

**Specifications
Volume 1 of 2
Exhibit C
Bid Set**

**City of Madison
Metro Transit Phase 3A – Maintenance and
Driver Facility Improvements**

Mead & Hunt, Inc.
4503500-190896.03

**Contract # 8981
Project # 11230
Munis # 11230-85-140-114403**

Prepared for:

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

Prepared by:

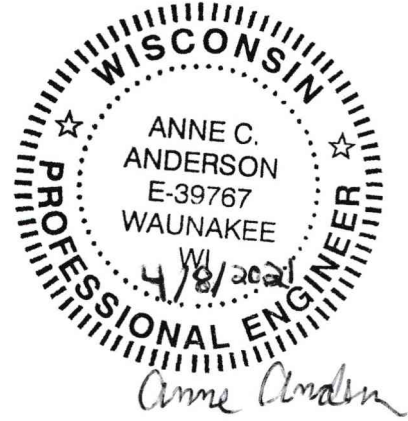


April 8, 2021

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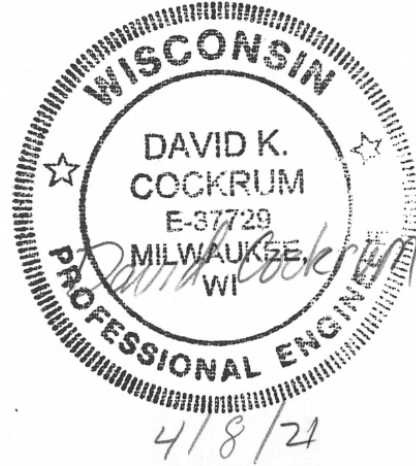
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ARCHITECT

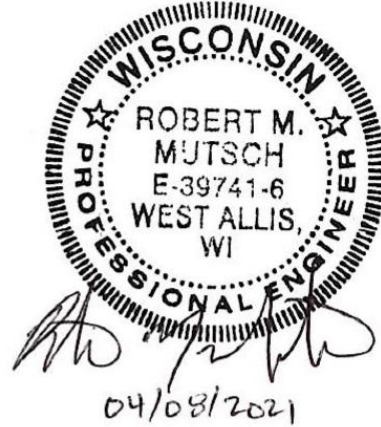
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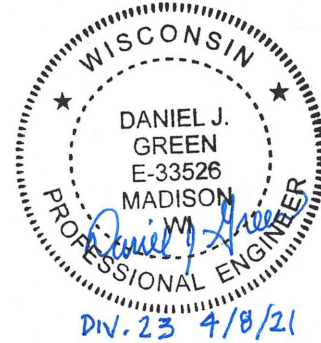
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 LIST OF DRAWING SHEETS**

PART 1 - GENERAL

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- A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set Exhibit A, titled City of Madison - Metro Transit Phase 3A – Maintenance and Driver Facility Improvements, dated March 19, 2021, 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:

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ED101E	FIRST FLOOR POWER DEMOLITION PLAN - AREA E
ED101F	FIRST FLOOR POWER DEMOLITION PLAN - AREA F
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ED102A	SECOND FLOOR POWER DEMOLITION PLAN - AREA A
ED102B	SECOND FLOOR POWER DEMOLITION PLAN - AREA B
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T-121G	FIRST FLOOR SECURITY AND AV PLAN - AREA G
T-121H	FIRST FLOOR SECURITY AND AV PLAN - AREA H
T-121J	FIRST FLOOR SECURITY AND AV PLAN - AREA J
T-121K	FIRST FLOOR SECURITY AND AV PLAN - AREA K
T-122A	SECOND FLOOR SECURITY AND AV PLAN - AREA A
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PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 00 01 15

**DOCUMENT 00 31 32
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.

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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.

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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 Silty/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
1	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.

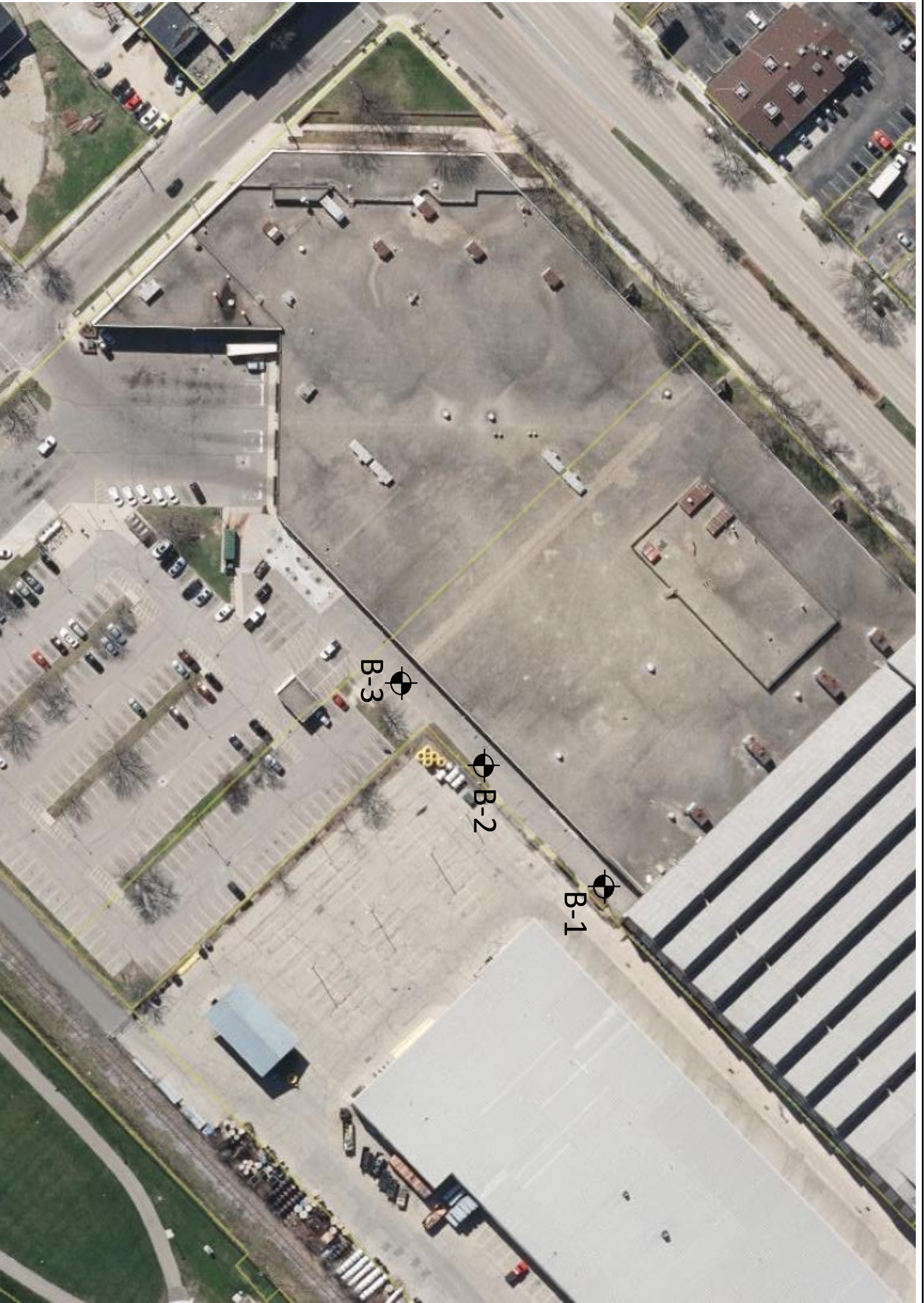
2. Standard Penetration Test and Split-Barrel Sampling of Soils
(ASTM Designation: D 1586)

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



Date: 05/2018		SOIL BORING LOCATION EXHIBIT Proposed Madison Metro Building Addition 1101 East Washington Avenue City of Madison, Dane Co., WI
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		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 (0-20'), 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±	4± in. Asphalt					
2	12	M	8	5	FILL: Dark Gray/Black Sand, Some Silt, Intermixed with Apparent Foundry Sand and Cinders					
3	16	M/W	8	5	Loose, Light Gray Silty Fine SAND (SM)					
4	14	W	11	10	Medium Dense, Yellow-Brown (Lightly Mottled) Sandy SILT, Trace Organics/Fine Roots (ML)					
5	12	W	29	10	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	15	Stiff, Gray Lean CLAY, Laminated with Silt Seams (CL)					
7	18	W	11	20	Loose, Light Gray Silty Fine SAND, Little Gravel (SM)	(1.75-2.0)	23.8			
8	12	W	7	25	Very Dense, Brown Silty Fine SAND, Little to Some Gravel, Trace Clay (SM)					
9	14	W	66	30	Very Dense, Light Gray Fine SAND, Some Gravel, Little to Some Silt (SP-SM/SM - Probable Weathered Sandstone Bedrock)					
10	10	W	88/10	35	Grades to Light Brown and Finer with Less Gravel Near 40 ft					
11	12	W	62	40	End of Boring at 40 ft					
				45	Borehole backfilled with bentonite slurry, chips and asphalt patch					

WATER LEVEL OBSERVATIONS	GENERAL NOTES
While Drilling ∇ 8.0' 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 (0-10'), 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±	4± in. Asphalt					
2	10	W	2	5	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	10	Medium Stiff, Gray/Brown (Mottled) Lean CLAY, Trace to Little Gravel (CL)	(0.75-1.0)	22.9			
4	4	M	5	10	Grades to Brown (Mottled) Near 10 ft	(1.0)	19.7			
5	8	W	24	15	Medium Dense, Brown Fine SAND, Little to Some Silt, Trace Gravel (SP-SM/SM)					
6	6	W	30	15	Medium Dense to Dense, Tan Silty Fine SAND to Sandy SILT (SM/ML)					
7	16	W	7	20	Stiff, Gray Lean CLAY, Laminated with Silt Seams (CL)	(1.0-1.25)	24.5			
8	12	W	22	25	Medium Dense, Gray Silty Fine SAND, Laminated with Thin Silt and Clay Seams (SM)					
9	10	W	24	30	Medium Dense, Olive Brown/Gray Fine SAND, Some Silt, Trace Gravel (SM)					
10	12	W	36	35	Medium Dense to Dense, Gray Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
11	8	W	24	40	End of Boring at 40 ft					
				45	Borehole backfilled with bentonite slurry, chips and asphalt patch					

WATER LEVEL OBSERVATIONS	GENERAL NOTES
While Drilling ∇ 10.0' Upon Completion of Drilling _____ Time After Drilling _____ Depth to Water _____ Depth to Cave in _____	Start 5/16/18 End 5/16/18 Driller BSD Chief KD Rig D-120 Logger CV Editor DAS 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.	

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

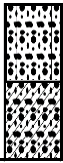
Well-graded gravels, gravel-sand mixtures, little or no fines



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

GRAVELS
More than 50% of coarse fraction larger than No. 4 sieve size

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

SANDS
50% or more of coarse fraction smaller than No. 4 sieve size

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

SILTS AND CLAYS
Liquid limit less than 50%

SILTS AND CLAYS
Liquid limit 50% or greater

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	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line or P.I. greater than 7	

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

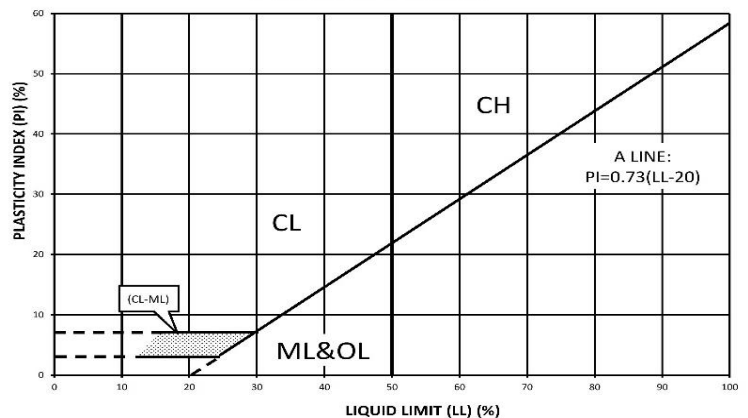
SP Not meeting all gradation requirements for GW

SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with P.I. greater than 7	

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_a – 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**

1
2
3
4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. REFERENCES 1
7 1.3. GENERAL CONTRACTORS REQUIREMENTS 1
8 PART 2 – PRODUCTS – THIS SECTION NOT USED 1
9 PART 3 – EXECUTION – THIS SECTION NOT USED 1
10

PART 1 – GENERAL

1.1. SUMMARY

- 14 A. Each project has varying requirements for permits, inspections, and fees based on the scope, size, and location
15 of the project.
16 B. The City of Madison (Owner) is subject to all permits, inspections and associated fees for construction,
17 demolition, utility connection, storm water management, and other similar requirements that may be required
18 to complete the scope of work associated with these contract documents.
19 C. The General Contractor (GC) shall be responsible for obtaining all permits, inspections and paying for all
20 associated fees unless specifically identified within this specification.
21

1.2. REFERENCES

- 23 A. The following references are not intended to be all inclusive. It shall be the GC's responsibility to determine all
24 requirements based on the scope of work in the contract documents.
25 B. City of Madison Ordinances: Review all ordinances that may require a permit or fee that may be connected with
26 a required permit. Contact the following City Agencies to determine the exact requirements during bidding
27 1. Building Inspection
28 2. Zoning
29 3. Engineering
30 4. Water Utility
31 5. Traffic Engineering
32 6. Others as may be specified by the contract documents.
33 B. State Statutes
34 C. Other Regulatory Regulations
35 D. Other Agencies or companies that may have related requirements
36 1. Madison Metropolitan Sewerage District
37 2. Local gas and electric utility companies
38 3. Other utility companies
39

1.3. GENERAL CONTRACTORS REQUIREMENTS

- 41 A. The GC shall be responsible for all of the following:
42 1. Execute application for all required permits as may be required by the scope of work described within the
43 contract documents.
44 2. Scheduling all required inspections that may be conditions of any required permits.
45 3. Paying for other permits not explicitly stated as excluded in this section.
46 B. The GC is not responsible for paying for the City Building, City HVAC, City Electrical, City Plumbing, Madison Fire
47 Department Sprinkler and Madison Fire Department Fire Alarm permits.
48 C. The GC shall provide high quality scanned images of all required permits and inspections and upload them to the
49 Contract Documents-Regulatory Documents Library on the Project Management Web Site.
50

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 00 43 25
SUBSTITUTION REQUEST FORM (DURING BIDDING)

1
2
3
4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATIONS 1
7 PART 2 – PRODUCTS – THIS SECTION NOT USED 1
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**

32
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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3

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 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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END OF SECTION

**SECTION 00 43 43
WAGE RATES FORM**

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4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
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.

1
 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.

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
5 1.1. SUMMARY 1
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**

12
13 **1.1. SUMMARY**

- 14 A. The City of Madison is a qualifying tax exempt entity in the State of Wisconsin.
15 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.
16 C. This project constructs or remodels facilities owned by the City of Madison in Madison, Wisconsin.
17
18

19 **1.2. RELATED SPECIFICATION SECTIONS**

- 20 A. Parts of this specification will reference articles within “The City of Madison Standard Specifications for Public
21 Works Construction”.
22 1. Use the following link to access the Standard Specifications web page:
23 <http://www.cityofmadison.com/business/pw/specs.cfm>
24 a. Click on the “Part” chapter identified in the specification text. For example if the specification
25 says “Refer to City of Madison Standard Specification 210.2” click the link for Part II, the Part II
26 PDF will open.
27 b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you
28 to the referenced text.
29

30 **1.3. TAX EXEMPT FORM**

- 31 A. The Contractor can access Wisconsin Sales and Use Tax Exemption Certificates (form S-211, Wisconsin
32 Department of Revenue) from the City of Madison Finance website.
33 1. City of Madison tax exempt information and signature by Purchasing Supervisor is already completed.
34 2. Website: <http://www.cityofmadison.com/employeeenet/finance/purchasing>
35 a. Under the title *Purchasing Forms*, scroll down to the form link titled *Sales Tax Exempt Form S-211*.
36

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

38
39 **PART 3 – EXECUTION – THIS SECTION NOT USED**

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44 **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 3A – Maintenance and Driver Facility Improvements, Contract No. 8981.

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.
 2. Interior Design: Destree Architecture & Design, Melissa Destree, AIA, IIDA, 222 West Washington Avenue, Suite 310, Madison, WI 53703, Telephone: 608-368-1499.
- 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. The existing facility comprises 277,877 sf. This project (Phase 3A) renovates half of the bus maintenance bay (27,326 sf) at the center interior of the building, provides interior renovations (8,955 sf) at the southwest corner of the building including maintenance replacements of the façade, and two small additions (785 sf) with all associated site work, utility work, and limited offsite work as identified in Drawings. The small additions are within the overhang roof area at the east side of the southwest projection. The renovation of this southwest corner provides a public conference/training room, break room, toilet facilities, supporting offices, parts room, tire room, loading dock, and a new public entry on Ingersoll.

Work includes phasing to allow for continuous Owner occupancy in existing business and maintenance garage occupancies with 24-hour operations. Exterior walls are clad with metal panels or exposed concrete base/grade beam. Low-slope EPDM roof patching 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 various flooring finishes. New openings include coiling overhead doors, wood and hollow metal doors with painted hollow metal frames, aluminum storefront entry and windows, and fiberglass-sandwich-panel exterior windows. Work includes building-wide infrastructure replacement of heating, ventilation, air conditioning, electrical, plumbing, fire protection and technology systems. Equipment is also included: vehicle lifts, fueling systems, lubrication systems, and compressed air.
- 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: Submittals, construct temporary offices, and coordinate move of staff, tire and paint shops.
 2. Phase 2:
 - a. Drive Lane Demo – South half/North half split
 - b. Construct new Service Bays
 - c. Infrastructure
 - 1) Water Service
 - 2) Electrical Service
 - 3) Boiler Room
 - 4) Comms
 - 5) 2nd Floor Maintenance B work
 - d. Maintenance B Toilet Rooms
 - e. Maintain access to Loading Dock
 3. Phase 3:
 - a. Loading Dock
 - b. Tire Shop/New Parts
 - c. Fuel Tank Removal
 - d. Break/Training/Lobby Area
 - e. Maintenance B Work/Lift Area
- 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. Roof Solar Panels

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 and camera monitoring system.

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. Contractor shall be responsible for securing the site and construction zones from occupant users and general public.

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 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: Area F – referred to as Maintenance “B,” first floor work.
1. Base Bid: Spaces on sheet AD101F are existing to remain.
 2. Alternate: Contractor to provide all work associated with demolition (AD101F) and construction of the Maintenance “B” ground level spaces (A-101F) in rooms 1301, 1302, 1303, 1304, 1305, 1306, 1308, 1309, 1311, along with all associated Structural, Equipment, Fire Protection, Plumbing, HVAC, Electrical, and Communications systems.

END OF SECTION 01 23 00

SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

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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.

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)**

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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
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43

44 **END OF SECTION**
45
46

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

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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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4 PART 1 – GENERAL 1
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18 3.4. EMERGENCY CHANGE ORDER REQUEST 5

19
20 **PART 1 – GENERAL**

21
22 **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.
22
23
24

25 **END OF SECTION**
26

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

1
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3
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**

7

8 **3.1. PREPARATION OF THE CHANGE ORDER**

9

- 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.

10

11 **3.2. EXECUTION OF THE CHANGE ORDER**

12

- 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.

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END OF SECTION

**SECTION 01 29 73
SCHEDULE OF VALUES**

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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

PART 1 – GENERAL

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

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

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

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 withheld 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	This is a recommendation to the GC and is not a requirement of this PP. <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	Contractor to determine the proper order of completion: <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
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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.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

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
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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)

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

3.2. PROJECT MANAGEMENT WEB SITE – TUTORIAL MEETING

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- A. The CPM shall schedule and conduct a tutorial presentation of the PMWS prior to the beginning of construction.
 - B. The CPM shall be responsible for the final agenda, there will be no minutes.
 - 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.
 - 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.

3.3. CONSTRUCTION PROGRESS MEETINGS

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- A. In general all of the following shall apply:
 1. Representatives of Contractors, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
 2. The attendance shall be from the required attendance list in 3.1.D. above.
 - B. The General Contractor Project Manager (GCPM) shall:
 1. Schedule and conduct all construction progress meetings biweekly or more frequently as required.
 2. Prepare agenda for meetings including, but not limited to the following:
 - a. Safety
 - b. Current Schedule, including review of the critical path and 6-week look ahead schedule
 - c. Status of project related documentation (Submittals, RFIs, CBs, etc.)
 - d. Quality Observation Log and status of correction of deficient items
 - e. Project questions and issues from meeting attendees
 - f. BPW Administration Check
 - g. Other as needed
 - h. Status of CORs and COs to be reviewed outside the standard progress meeting time.
 3. Make physical arrangements for meetings.
 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.
 5. Preside at meetings.
 6. Route a meeting attendance roster for attendees to sign-in on.
 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.

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

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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

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

1.2. SHAREPOINT PROCEDURE OVERVIEW

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

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

1
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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

17 **PART 1 – GENERAL**

18
19 **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

30 **1.2. RELATED SPECIFICATIONS**

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

36 **1.3. RELATED DOCUMENTS**

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

47 **1.4. SUBMITTAL DEFINITIONS**

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

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
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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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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**
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14

**SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION**

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7 1.3. SUBMITTALS 1
8 PART 2 – PRODUCTS 1
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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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8 PART 2 – PRODUCTS – THIS SECTION NOT USED 2
9 PART 3 - EXECUTION 2
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

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

- 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.
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23 **END OF SECTION**
24

**SECTION 01 41 00
REGULATORY REQUIREMENTS**

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7 1.3. NOTICES 1
8 1.4. PERMITS 2
9 PART 2 – PRODUCTS - THIS SECTION NOT USED 2
10 PART 3 – EXECUTION - THIS SECTION NOT USED 2
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**

34
35 **PART 3 – EXECUTION - THIS SECTION NOT USED**

36
37
38
39

END OF SECTION

SECTION 01 45 16
FIELD QUALITY CONTROL PROCEDURES

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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.
51
52
53

54 **END OF SECTION**

55

SECTION 01 45 29
TESTING LABORATORY SERVICES

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14

PART 1 – GENERAL

1.1. REQUIREMENTS INCLUDED

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

1.2. RELATED REQUIREMENTS

- 27 A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or
28 approvals of public authorities.
29 B. Related Requirements Specified in Other Sections:
30 1. Division 22 and 23: Testing of Mechanical Systems
31 2. Division 26: Testing of Electrical Systems
32

1.3. QUALIFICATION OF LABORATORY

- 34 A. Meet “Recommended Requirements of Independent Laboratory Qualification” published by American Council of
35 Independent Laboratories.
36 B. Meet basic requirements of ASTM E 329, “Standards of Recommended Practice for Inspection and Testing
37 Agencies for Concrete and Steel as Used in Construction.”
38 C. Authorized to operate in State in which the Project is located.
39

1.4. LABORATORY DUTIES

- 41 A. Cooperate with Owner, A/E and Contractor; provide qualified personnel after due notice.
42 B. Perform specified inspections, sampling and testing of materials and methods of construction:
43 1. Comply with specified standards.
44 2. Ascertain compliance of materials with requirements of Contract Documents.
45 C. Promptly notify the Owner, A/E and Contractor of observed irregularities or deficiencies of work or products.
46 D. Promptly submit written report of each test and inspection; one copy each to A/E, Consulting Engineer, Owner
47 and Contractor. Each report shall include:
48 1. Date issued.
49 2. Project Title and number.
50 3. Testing laboratory name, address and telephone number.
51 4. Name and signature of laboratory inspector.
52 5. Date and time of sampling or inspection.
53 6. Record of temperature and weather conditions.
54 7. Date of test.
55 8. Identification of product and specification section.
56 9. Location of sample or test in the Project.
57 10. Type of inspection or test.
58 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 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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16 3.7. DUCTWORK, PIPING, AND CONDUIT 3
17 3.8. OWNER PROVIDED, CONTRACTOR INSTALLED EQUIPMENT 4
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.

**SECTION 01 71 23
FIELD ENGINEERING**

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11	PART 3 – EXECUTION – THIS SECTION NOT USED	1

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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7 1.3. DEFINITIONS 1
8 1.4. QUALITY ASSURANCE 1
9 1.5. WARRANTY 2
10 PART 2 - MATERIALS 2
11 2.1. GENERAL 2
12 PART 3 - EXECUTION 2
13 3.1. EXAMINATION 2
14 3.2. PREPARATION 2
15 3.3. PERFORMANCE 2
16 3.4. CLEANUP AND RESTORATION 3
17

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
27
28

END OF SECTION

**SECTION 01 74 13
PROGRESS CLEANING**

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10 PART 3 - EXECUTION 1
11 3.1. SAFETY CLEANING 1
12 3.2. PROJECT SITE CLEANING 2
13 3.3. PROGRESS CLEANING 2
14 3.4. FINAL CLEANING 3
15 3.5. CALL BACK WORK 4
16

17 **PART 1 – GENERAL**

18
19 **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

29 **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

35 **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

44 **PART 2 - PRODUCTS**

45
46 **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

54 **PART 3 - EXECUTION**

55
56 **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.

**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 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.

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.

**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**

38
39 **PART 3 – EXECUTION – THIS SECTION NOT USED**

40
41
42
43
44

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.*

34 PART 2 – PRODUCTS – THIS SECTION NOT USED

36 PART 3 - EXECUTION

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 PHASE 3A - MAINTENANCE AND DRIVER**
- 50 **FACILITY IMPROVEMENTS_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 PHASE 3A - MAINTENANCE AND DRIVER FACILITY IMPROVEMENTS*
- 55 represents the title of the project or contract. A shortened version of the title may be
- 56 identified by the City Project Manager to 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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14 3.4. FINAL WARRANTY SUBMITTAL 4
15 3.5. WARRANTY NOTIFICATION, RESPONSE, EXECUTION AND FOLLOW-UP 4
16

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 **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 PHASE 3A - MAINTENANCE AND DRIVER FACILITY IMPROVEMENTS, contract
25 number, and contract address 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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15 3.3. MASTER AS-BUILT DOCUMENT SET 3
16 3.4. AS-BUILT REVIEW AND ACCEPTANCE 4
17 3.5. CHANGES AFTER ACCEPTANCE 5
18

PART 1 – GENERAL

1.1. SUMMARY

- 21
22 A. This specification is intended to provide clear guidelines and identify the responsibilities of all contractors as they
23 pertain to City of Madison contract procedures regarding the accurate recording of the Work associated with the
24 execution of this contract. This shall include but not be limited to work that will be hidden, concealed, or buried.
25 B. Each contractor shall be responsible for maintaining an accurate record of all installations, locations, and
26 changes to the contract documents during the execution of this contract as it may relate to their specific division
27 or trade.
28 C. The General Contractor (GC) shall be responsible for ensuring all contractors provide as-built record information
29 to the Master As-Built Document Set as described in this specification.
30

1.2. RELATED SPECIFICATIONS

- 31
32 A. 00 31 21 Survey Information
33 B. 01 26 13 Request for Information
34 C. 01 31 23 Construction Bulletin
35 D. 01 32 33 Photographic Documentation
36 E. 01 26 63 Change Orders
37 F. 01 29 76 Progress Payment Procedures
38 G. 01 31 23 Project Management Web Site
39 H. 01 33 23 Submittals
40 I. 01 77 00 Closeout Procedures
41 J. 01 91 00 Commissioning
42 K. Other Divisions and Specifications that may address more specifically the requirements for field recording the
43 installation of all items associated with the execution of this contract by Division or Trade.
44

1.3. RELATED DOCUMENTS

- 45
46 A. Other related documents shall include but not be limited to the following:
47 1. Bidding documents including drawings, specifications, and addenda.
48 2. Required regulatory documents of conditional approval.
49 3. Field orders, verbal or written by inspectors having regulatory jurisdiction.
50 4. Shop drawings and installation drawings.
51

1.4. PERFORMANCE REQUIREMENTS

- 52
53 A. The GC shall be responsible for maintaining the “Master As-Built Document Set” in the job trailer at all times
54 during the execution of this contract. This document set shall include all of the following:
55 1. Master As-Built Plan Set
56 2. Master As-Built Specification Set
57 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.

43
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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13 3.2. LABELING 2
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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

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

- 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

- 19
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

- 29
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

- 41
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.

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.

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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 at each Gate.
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 02 65 00 REMOVAL AND DISPOSAL OF STORAGE TANKS

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. The Contractor shall furnish all labor, material, tools, transportation and equipment necessary to remove and dispose of the existing Underground Storage Tanks (UST)s, associated electrical, structural, and product equipment, (e.g., dead men, anchor straps, piping, manways, piping, pumps, and dispenser(s), if present). This section specifies requirements for the environmental and tank assessment, permitting, removal and disposal of the UST(s) and is intended to supplement the construction/installation specifications. Generally, the work shall include, but not be limited to:

1. File all necessary notices, obtain all permits and licenses, and pay for all governmental taxes, fees, and other costs in connection with the work. Obtain all necessary approvals of all governmental departments having jurisdiction.
2. Characterize (any testing that may be required by a disposal facility), containerize, remove, and properly dispose of residual fuels from the designated tanks and appurtenant piping.
3. Clean, remove, and dispose of UST(s), and appurtenant piping for the tank(s). The work shall include the removal and proper disposal of fuel and residual in the tanks and associated piping between the tanks and the building. Removal of piping and associated contents within the building is addressed in the Mechanical drawings.
4. Perform all sampling and testing required to properly profile the material for waste disposal. This shall also include all testing required by the disposal or recycling facility.
5. All costs for the testing shall be borne by the Contractor.
6. Coordinate with the Licensed Site Professional (LSP) relative to the collection, sampling and analysis of impacted soils.
7. Coordinate with the Construction Manager, Licensed Site Professional to prepare all manifests and/or Bills of Lading for all contaminated materials removed from the Site. Original documents to be provided to the City of Madison Project Manager.
8. The contractor shall coordinate the activities for sampling and cleaning and analysis of soil sampling and agency submittals with SCS Engineers, 2830 Dairy Drive, Madison, WI. (608) 224-2830. SCS Engineers is the City of Madison approved vendor for these activities.
9. Comply with the Contractor's submitted Health and Safety Plan

1.3 DEFINITIONS

- A. LEL: Lower Explosive Limit

- B. LSP: Licensed Site Professional
- C. OSHA: Occupational, Health and Safety Administration
- D. PID: Photoionization Detector

1.4 REGULATORY REQUIREMENTS

- A. Tank closure shall be carried out in accordance with the Agriculture, Trade and Consumer Protection (DATCP), as well as any other applicable local, state and City of Madison regulations. Wherever there is a conflict or overlap of requirements, the most stringent provisions shall apply.
- B. The Contractor shall obtain and pay for all local and state permits and make necessary arrangements with the local Fire Department prior to the removal of tanks.
- C. The Contractor shall keep the local Fire Department informed of all activities throughout the performance of the work.
- D. The Contractor shall obtain all local, State, and Federal permits required for the transport and disposal of all waste materials resulting from the performance of this work.
- E. The Contractor shall document that the disposal facility(ies) proposed have all certifications and permits required by City of Madison, State, and Federal regulatory agencies to receive and recycle or dispose of the liquid and the solid wastes resulting from performance of the work.
- F. For work that will be sub-contracted, the Contractor is responsible to ensure that the Sub-contractor has reviewed and will strictly adhere to this specification, all reference documents, and with all local, state and federal regulations.
- G. All Contractors and/or Sub-contractors must have current, applicable licenses for all work performed.

1.5 SAFETY REQUIREMENTS

- A. Provide appropriate protective equipment for all personnel working in direct contact with vapors, liquids or sludge removed from the tanks. All personnel shall be trained in the proper use and maintenance of the appropriate protective equipment used on this project. Smoking will not be allowed in the work area or loading area during the course of the work.
- B. Personnel working inside and in the general vicinity of the tanks shall be trained and thoroughly familiar with the safety precautions, procedures, and equipment required for controlling the potential hazards associated with this work, including training for confined space entry. Personnel shall use proper protection and safety equipment during work in and around the tanks, including instruments to monitor air quality, explosive atmospheres and oxygen content.
- C. All provisions of the site Health and Safety Plan included shall be in force during tank removal activities, unless modified in writing by the Contractor's Site Safety Officer.

- D. Warning signs and devices shall be placed at regular intervals along the work area perimeter, and establish restricted work zones, support areas and decontamination areas as needed. Contractor shall furnish, install and maintain fencing or other appropriate barricades at open excavations, including illumination if left over night.
- E. Prior to ending operations on any working day or at any time the Contractor is not on site, the Contractor shall secure all areas of work by erecting temporary safety fencing in accordance with Section 01 50 00 – TEMPORARY FACILITIES AND CONTROLS.
- F. Cutting of steel or other metals by thermal methods shall, at all times, occur in a non-explosive environment. During such work, percent of lower explosive limit in the tanks, piping of the surrounding atmosphere shall be continuously monitored. The Contractor shall note that residual pockets of oils or residues may exist in some of the pipelines and the Contractor shall exercise care to prevent release to the environment and harm to workers, facility staff or the public resulting from potential explosive nature of the contained materials.
- G. The Contractor shall provide and maintain an adequate supply of fire extinguishers and other required safety equipment in close proximity to all tank cleaning and removal activities.

1.6 QUALITY ASSURANCE AND MEASUREMENT FOR CONTAMINATION

- A. The Contractor shall provide a designated representative available on site during the tank and pipe cleaning and removal to monitor for leaks. The designated representative will perform inspections and tests to ensure that the work is performed in compliance with the specification and with applicable Federal, State and local regulations, guidelines and policies. The Contractor's representative is to follow the Massachusetts Underground storage Tank Closure Assessment Manual for the proper protocols for compliance with this requirement.
- B. It is not intended that the presence or activities of the Owner's Representative shall relieve the Contractor in any way of his/her obligation to maintain an adequate inspection program of his/her own, or any other obligation under this specification.

1.7 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site prior to commencement of work at each Gate.
 - 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.

1.8 INFORMATIONAL SUBMITTALS

- A. The Contractor shall submit each item in this Article according to the Conditions of the Contract and the Submittals [Section 01 33 23], for information only, unless otherwise indicated.
- B. The Contractor shall submit a Waste Management Plan as specified in Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. The Plan shall include identification of the proposed waste hauler and disposal facility with copies of all applicable licenses, registrations and approvals.
- C. The Contractor shall provide copies of all worker certifications associated with OSHA 40 Hour Hazardous Waste Site Health and Safety Training in accordance with 29 CFR 1910.120.
- D. The Contractor shall provide the City of Madison Project Manager with all required documentation relating to the proper removal and disposal of any hazardous or regulated waste that leaves the site in accordance with the Waste Management Plan.
- E. After completion of the tank removal, provide a final report documenting removal, transportation and disposal activities. The document shall include the following:
 - 1. Complete original manifests and/or Bills of Lading for all hazardous or non-regulated materials disposed off-site, including but not limited to, discarded tank, waste liquid and sludge and associated debris from the Site.
 - 2. Permit for storage tank removal and transportation to approved tank disposal yard.
 - 3. Notice indicating a change in the registration information for the USTs.
 - 4. Original receipt of tank acceptance for a State approved tank yard.
 - 5. Generator's Copy of manifest to City of Madison for its disposal of waste materials.
- F. Payment for work related to this section will not be issued until all documentation required is submitted.

1.9 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.
- B. See Construction Sequencing Drawing G-101 for detailed sequencing requirements.

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.

- C. Standards: Comply with CH. ATCP 93 and any other state and federal tank laws.
- D. Reference Standards can be found at:
https://datcp.wi.gov/Pages/Programs_Services/PetroleumHazStorageTanksLawsRegulations.aspx

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide suitable personnel, material and equipment to clean and remove the fuel piping and tanks and all sludge and liquids that may be in the piping and tanks prior to removal. Take all necessary precautions during removal of the tanks to prevent damage to utilities adjacent to the area. All fuel fill, boiler supply and other fuel lines and vents shall be removed.

3.2 PERMITTING

- A. Prior to initiating storage tank removal activities, the Contractor shall notify the local fire department. The Contractor shall apply for and obtain a Permit for storage tank removal and transportation to approved tank disposal yard in accordance with the provisions of state, local and federal requirements.

3.3 TANK CLEANING

- A. Contract with:
 - 1. SCS Engineers, 2830 Dairy Drive, Madison, WI. (608) 224-2830. SCS Engineers is the City of Madison.
- B. The Contractor shall perform the following activities prior to closure of the tank:
 - 1. Notify the local fire department.
 - 2. Contact Digger's Hotline to obtain information on underground utilities, a minimum of 72 hours prior to excavation.
 - 3. Obtain all necessary permits, as previously detailed within this Section.
- C. Inspect the work area prior to excavation, decontamination and removal activities to the extent required to safely perform the work. Before the UST is uncovered check for stains around the fill pipes, free products, sheen and petroleum odors in nearby basements and storm sewers. If stained soil or petroleum odors are found, note these areas for future field screening and/or sampling during the UST removal.
- D. The Contractor shall protect existing site surfaces, materials, and structures from inadvertent Contamination from cleaning operations. Should such contamination occur, the Contractor shall not be reimbursed for costs associated with replacement or proper disposal of contaminated materials.

- E. Assure that any electrical power connected to the tanks or its ancillary equipment (pumps) has been deactivated and the actual wiring properly dismantled at the circuit breaker(s).
- F. Collect, containerize and dispose of all residual oils, other product, and sludge remaining in the tanks and piping prior to tank cleaning and removal.
- G. Tanks shall have interiors steam cleaned followed by three (3) rinses. The steam discharge nozzle and all conductive insulated objects subject to impingement or condensation should be bonded to the tank or be grounded. Surfaces shall be steam cleaned using a commercial-scale steam cleaner. The Contractor shall be required to use a detergent and provide a steam generator capable of supplying steam at 15 psig. Liquid waste generated as a result of steam cleaning and rinsing operations shall be collected and removed by the Contractor. The Contractor shall dispose of the liquids as per the method specified for the tank sludges and residues.
- H. After the above operations, all flammable vapors shall be removed from the tanks by displacement with inert gas. The vapors shall be made inert by adding solid carbon dioxide, (dry ice), in the amount of 1.5 pounds per 100 gallons of tank capacity. The dry ice shall be crushed and distributed evenly over the greatest possible area to ensure rapid sublimation. All available tank openings shall be open to the atmosphere during this procedure to ensure rapid dissipation of the dry ice.
- I. To evaluate the effectiveness of the dry ice procedure, the Contractor shall use a suitably calibrated instrument to determine if the resultant vapor mixture within the tanks exceeds ten percent of the Lower Explosive Limit (LEL). Readings shall be taken throughout the tanks depth wherever access is possible. If the vapors within the tanks exceed ten percent of the LEL, the displacement procedure shall be repeated followed by a recheck of the LEL until the vapors are less than 10 percent of the LEL.
- J. After acceptable LEL levels have been reached, excavation of tanks may begin after approval of the Owner's Representative.

3.4 TANK EXCAVATION

- A. The Contractor shall provide all labor, permitting, tools, material, services, and equipment necessary to properly demolish the concrete vault, excavate the tank(s), and associated mechanical piping and appurtenances, after pipe and tank cleaning and disposal activities.
- B. After the tank and mechanical piping have been purged, cleaned, and gas freed of vapors, but prior to removal, the Contractor shall plug all holes and inert the tanks and piping, as specified by the Board of Fire Prevention regulations.
- C. Once the tanks are cleaned and inert, the Contractor must be careful to excavate around the tank, exposing as much of the tank as possible, to allow for a visual inspection of the tank surface. The inspection is performed to identify possible holes, cracks, etc. and other evidence that a leak may have occurred. Remove the tank hold-down straps, if any, lift the tank out of the excavation, place on a level surface, and block the tank to prevent movement. The exterior of each tank and pipe shall be cleaned, and if contaminated soil or groundwater conditions exist, the cleaning wastes contained for

- proper disposal. Methods for removal shall be predetermined by Contractor and approved by the Owner or their representative.
- D. The LSP shall monitor the excavations and every 20 feet along pipe trenches for visual indications of the release of petroleum and shall use a PID for headspace screening of samples and to conduct ambient air readings during all excavation activities. The Contractor shall assist the LSP in collecting appropriate soil samples during post excavation from excavation graves. These samples will be submitted by the LSP for analysis at an analytical laboratory. Headspace screening performed by the LSP will be in accordance with the Underground Storage Tank Closure Assessment Manual. [Note that a reading exceeding 100 ppmv below 2 feet of the soil around the USTs is a Mass DEP 72-hour reportable condition and such findings shall immediately be conveyed to the City of Madison Project Manager. If this condition is encountered or any other condition that is a 2-hour or 72-hour reportable condition, all subsequent earthwork and/or groundwater handling work will be under the direction of a LSP retained by the City of Madison. The City of Madison will coordinate reporting obligations as well as any further environmental remediation. As a result, the Contractor may be required to perform additional excavation in the area(s).]
- E. If large areas of petroleum impacted soils are encountered in the UST excavation, or greater than one-half inch (1/2”) of free oil on a groundwater surface, work shall stop and the City of Madison Project Manager shall be immediately notified. Subsequent earthwork and/or groundwater handling work will be under the direction of a LSP retained by City of Madison.
- F. Incidental volumes of visually (or by field PID) contaminated soils may be expected during excavation of the USTs and piping. These soils shall be segregated and stored during characterization and preparation for offsite disposal by the Contractor. The maximum depth of all excavation areas shall be marked with caution tape or the like to aid potential future excavation. Apparently clean soils shall be stockpiled separately for future reuse at the site. Reuse of these soils will be directed by City of Madison or the project LSP, with results below applicable MCP standards.
- G. Where contaminated soil is present below the groundwater table, the Contractor, at the discretion of the Owner or their LSP representative shall discontinue excavation and shall line the excavation with 6 mil thick polyethylene sheeting prior to backfill.

3.5 TANK REMOVAL

- A. The tanks shall be removed from the excavation and the exterior cleaned to remove all soil and inspected for signs of corrosion, structural damage, or leakage. All materials coming into contact with the tanks, or in the vicinity of the excavation such as shovels, slings and tools shall be of the non-sparking type.
- B. Tank anchoring structures such as concrete deadmen or hold down slabs shall be removed, unless otherwise directed by the Owner.
- C. All piping including electrical conduit associated with the tanks shall be completely removed to the interior face of any associated building wall. Piping shall be reduced to appropriate lengths and cleaned of all contaminated materials. Sleeves and piping

passing through wall shall be flushed clean and then permanently capped and plugged on the outside in a manner approved by the Owner.

- D. All level monitoring and control equipment shall be completely removed to the interior face of any associated building wall. This includes transmitters, indicators, conduit, wiring, pumps and dispensers.
- E. The Contractor shall prominently label each UST tank with past product content and date of removal. The tanks shall be rendered unusable at the direction of the Fire Protection Officer. The tank shall be removed from the site the day it is excavated and transported to a certified tank salvage facility. Prior to removal from the site, the tank atmosphere must be tested to ensure the flammable vapors are no more than five (5) percent of the lower flammable limit; and not greater than eight (8) percent oxygen. Test results shall be provided to the Owner's Representative and the Fire Prevention Officer and subsequently documented, in writing, to the Owner's Representative and the Fire Prevention Officer.
- F. Each tank should be secured onto a truck or vehicle and transported to a certified tank salvage facility, in accordance with all applicable federal, state, and local regulations. The Contractor shall prepare the proper manifests or bills of lading. The certificates of receipt of proper disposal shall be submitted to the Fire Prevention Officer within 72 hours of tank removal, with copies provided to the City of Madison Project Manager and the Owner's Representative.

3.6 TANK DISPOSAL

- A. The Contractor shall dispose of all demolition related wastes as designated herein, in accordance with all applicable regulations.
- B. The Contractor shall characterize, containerize, transport, and dispose of all residue, sludges, cleaning materials, and fluids from the tanks at a City of Madison approved and permitted disposal/recycling facility.
- C. If evidence of soil or groundwater contamination is identified by the Owner's Representative or the LSP during the tank closure, then disposal of pumped groundwater shall be performed by the Contractor only as approved by the LSP.
- D. Tanks and piping shall be delivered for disposal in an acceptable manner to an approved disposal or recycling facility following decontamination.
- E. All concrete associated with existing buried tanks shall be broken up and re-used/disposed in accordance with Section 01 74 19 CONSTRUCTION AND WASTE MANAGEMENT AND DISPOSAL.
- F. UST Closure Report shall be prepared by SCS and submitted to DATCP.

END OF SECTION 02 65 00

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, ¾ by ¾ 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. Compression Test Specimens: ASTM C31/C31M.
 - a. Cast and laboratory cure (3) standard 6 inch diameter, 12 inch tall cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C39/C39M; test one cylinder at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from the same composite sample and tested at age indicated.
 - 7. 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).

8. 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.
9. 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.
10. 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.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. 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 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 $\frac{1}{4}$ 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. Prefomed 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 40 00 COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior non-load-bearing metal stud wall framing (Administration area).
2. Exterior metal stud wall framing for support of wall openings.
3. Bridging, bracing and attachments to structure, including provisions for deflections of adjacent construction.

1.2 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel (CFS) Framing, General: Design and provide in accordance with 2015 International Building Code (IBC), and AISI's "Standard for Cold-Formed Steel Framing - General Provisions".

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design for all Code required loads and load cases including Dead, Live, Wind, and Earthquake, for project design criteria indicated on the structural drawings and herein.
3. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
4. Design for support of openings and components that cover openings, including but not limited to: doors, windows, other glazing systems, and louvers. Reinforce opening framing, jambs, heads and sills, to resist tributary loads from components that cover openings, and to provide for attachment of doors, windows, louvers and other construction.
5. Provide framing with no punched opening at doors and openings.
6. Design attachments between system components.
7. Design attachments to structure.
8. Design wall bridging, bracing and attachments to structure.
9. Include elements indicated on drawings as load-bearing or 'structural' metal studs or framing or "Cold Formed Steel" or "CFS".

B. Delegated Design: System and component design and selection shall be performed by a qualified professional engineer licensed in the State of the project.

1.3 DEFINITIONS

A. CFS: Cold Formed Steel

1.4 COORDINATION

A. Coordinate and provide additional framing, blocking and backing to provide support for items attached to CFS system.

1.5 SUBMITTALS

- A. Shop Drawings. Include materials, sizes, dimensions, details, connections necessary to indicate and properly construct CFS system and interface with main structure and related components. Prepared under the supervision of CFS PE and signed and sealed by CFS PE.
- B. Structural Design Calculations. Performed, signed and sealed by the CFS PE.
- C. Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Clark Steel Framing.
 - 2. Dale/Incor.
 - 3. Dietrich Metal Framing; a Worthington Industries Company.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as required by structural performance.

2.3 WALL AND CEILING FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Flange width: Not less than 1-5/8 inch.
 - 2. Base metal thickness: As required by design, but not less than 0.033 inch.
 - 3. Base metal thickness, for stud backing at veneer, masonry veneer, and elements at risk for weather exposure: As required by design, but not less than 0.043 inch.
 - 4. Base metal thickness, for studs having components and backing for support of equipment, appurtenances, and architectural features: As required by design, but not less than 0.043 inch and not less than required for connections and load path.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.
- C. Screws: Self drilling, self tapping sheet metal screws; ASTM C 1513.
- D. Connections, General: Connection products shall be capable of providing load resistance required with appropriate performance qualification for use and project conditions, demonstrable by Code Evaluation Report or equivalent documentation.

Connections shall be appropriate and qualified for use in Project Seismic Design Category indicated on drawings.

- E. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. SCAFCO Corporation
 - c. The Steel Network, Inc.
- F. Single Deflection Track: Single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.
- G. Double Deflection Tracks: Double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.
 - 2. Inner Track: Of web depth indicated.
- H. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

- C. Use slip provisions at adjacent construction to accommodate the anticipated range of differential movement under design loads and conditions. Provide custom sizes and components as necessary.
- D. Install anchors in accordance with Section 05 50 00 Metal Fabrications.
- E. Coordinate the installation of related components of adjacent construction.

3.2 PROTECTION AND REPAIR

- A. Protect CFS elements from damage, including notching, bending, clipping, boring, punching, and unacceptable deformation of cross section.
- B. Repair damaged framing components and connections by a method approved in writing by the PE. Procedures, drawings and details provided for repair shall be stamped and signed by the PE and submitted to the Owner for approval prior to commencing repairs.

END OF SECTION 05 40 00

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 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.
 2. Stainless-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."

2. AWS D1.6/D1.6M, “Structural Welding Code – Stainless 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 1-1/2-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 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304.
- B. Pipe: ASTM A 312/A 312M, Grade TP 304.
- C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
- D. Plate and Sheet: ASTM A 240/A 204M or ASTM A 666, Type 304.

2.5 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. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 3. Stainless-steel Railings: Type 304 stainless-steel fasteners.
 4. 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. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. 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.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Intermediate Coats and Topcoats: Provide products that comply with Division 09 for "Exterior Painting" and "Interior Painting."
- G. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- I. Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- J. Anchoring Cement: Factory-packaged, non-shrink, non-staining, 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.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (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 1/4 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 1/2 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.

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize steel railings, including hardware, after fabrication.
 - 2. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 3. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.9 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines, or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches.
- C. Stainless Steel Tubing Finishes:
 - 1. 180-grit Polished Finish: Uniform, directionally textured finish.
- D. Stainless Steel Sheet and Plate Finishes:
 - 1. Directional Satin Finish: ASTM A 489 / A 480, No. 4.
- E. When polishing is complete, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (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 1/4 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 stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 - 2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

- A. 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 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Clean stainless-steel by washing thoroughly with clean water and soap and rinsing with clean water.

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

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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 (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 06 40 23 INTERIOR ARCHITECTURAL WOODWORK

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. Shop finishing of interior architectural woodwork.

- B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.
4. Wood-Preservative Treatment:
 - a. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 - b. Indicate type of preservative used and net amount of preservative retained.
 - c. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.

5. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 6. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Shop Drawings:
1. Include the following:
 - a. Dimensioned plans, elevations, and sections.
 - b. Attachment details.
 2. Show large-scale details.
 3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
 4. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each shop-applied color and finish specified.
1. Size:
 - a. Panel Products: 12 inches by 12 inches (300 mm by 300 mm).
- D. Samples for Initial Selection: For each type of shop-applied exposed finish.
1. Size:
 - a. Panel Products: 12 inches by 12 inches (300 mm by 300 mm).

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For architectural woodwork manufacturer and Installer.
- B. Product Certificates: For the following:
1. Adhesives.

1.7 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.8 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
2. Installer Qualifications: Manufacturer of products and Licensed participant in AWI's Quality Certification Program.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.
- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
 1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.
- C. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.11 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Urban Evolutions.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: Premium
- B. Hardwood Lumber:
1. Wood Species and Cut: Natural Elm Cladding – Prefinished, Tongue and Groove, Random length, $\frac{3}{4}$ " thick.
 2. Participation in the Wisconsin Urban Wood Program.
 3. Widths: Refer to Drawings.

2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.
 - a. Provide where indicated.
 - b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
 - c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.
 2. Fire-Retardant Treatment: Complying with requirements; provide where indicated.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
 2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.4 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
 - 1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
 - b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
 - 1. Disassemble components only as necessary for shipment and installation.
 - 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - 3. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
 - 4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.5 SHOP FINISHING

- A. Finish interior architectural woodwork indicated on Drawings at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: Custom.
 - 2. Finish: Manufacturer's standard natural finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
 - 1. Shim as required with concealed shims.
 - 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.
- F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
 - 1. Secure with countersunk, concealed fasteners and blind nailing.
 - 2. Use fine finishing nails for exposed fastening, countersunk and filled flush with interior architectural woodwork.
 - 3. For shop-finished items, use filler matching finish of items being installed.

3.3 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 - 1. Inspection entity shall prepare and submit report of inspection.

3.4 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective woodwork.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
 - 1. Fill nail holes with matching filler where exposed.
 - 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.5 CLEANING

- A. Clean interior architectural woodwork on exposed and semi-exposed surfaces.

END OF SECTION 06 40 23

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SECTION 06 41 16
PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

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. Plastic-laminate cabinets.
 2. Solid-surfacing-material countertops.
 3. Solid-surfacing material windowsills.
 4. Closet and utility shelving.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 2. Show locations and sizes of cutouts and holes for plumbing fixtures faucets soap dispensers and other items installed in architectural woodwork.
- C. Color Samples for Selection and Approval by Architect:
1. Provide manufacturer's color samples as indicated in the Architectural Finish Schedule (no substitutions) in minimum sizes of 50 mm (2-inches) x 100 mm (4-inches).
 - a. Plastic Laminate.
 - b. Solid-Surfacing Material.

1.5 QUALITY ASSURANCE

- A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
1. Hardboard: AHA A135.4.
 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

- C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi exposed edges.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
- E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish.
- B. Pulls:
 - 1. Wire pulls. Solid stainless steel wire pulls, fastened from back with two screws. Provide 2 pulls for drawers more than 600 mm (24 inches) wide.
 - 2. For sliding doors, provide recessed stainless steel flush pulls.
- C. Hinges: Fully concealed (European style) hinges for overlay doors with 110-degree opening. Hinges to be fully adjustable with nickel finish.
- D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or B05091.
- E. Electronic locks: Provide electronic, keyless lock, keypad, in stainless finish.
- F. Countertop Support Brackets:
 - 1. Standard Counter Supports (to 25-inches deep): 6063-T6 aluminum, TIG welded, all edges ground and deburred; black powder coated finish, for surface-mounting.
 - a. 18-inches x 18-inches Counter Support
 - b. Basis-of-Design Manufacturer and Product:
 - 1) Manufacturer: Rangine Corp.
 - 2) Product: Rakks Model EH-1818.
 - 2. Lavatory Counter Supports: 6063-T6 aluminum, TIG welded, all edges ground and deburred; black powder coated finish, for surface-mounting.
 - a. 21-1/2-inch horizontal leg x 18-inch vertical leg Counter Support.
 - b. Basis-of-Design Manufacturer and Product:
 - 1) Manufacturer: Rangine Corp.
 - 2) Product: Rakks Model EH-1818-LV.

- a) Include face panel mounting hardware.
- b) Delete privacy screen bracket.

- G. Grommets for Cable Passage through Countertops: 32 mm (1-1/4-inch) OD, black Insert color, molded-plastic grommets and matching plastic caps with slot for wire passage.
- H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.4 FABRICATION, GENERAL

- A. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 20 mm (3/4 Inch) Thick or Less: 1.6 mm (1/16 inch).

2.5 PLASTIC-LAMINATE CABINETS

- A. Grade: Custom.
- B. Regional Materials: Plastic-laminate cabinets shall be manufactured within 500 miles of Project site.
- C. AWI Type of Cabinet Construction: As indicated.
- D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: Grade HGL.
 - 2. Post-formed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade VGS.
 - 4. Edges: Grade VGS.
- E. Materials for Semi-exposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - 2. Drawer Sides and Backs: Thermoset decorative panels.
 - 3. Drawer Bottoms: Thermoset decorative panels.
- F. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated on the Architectural Finish Schedule, no substitutions.

2.6 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Grade: Custom.
- B. Solid-Surfacing-Material Thickness: 12 mm (nom. 1/2 inch).
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 - 1. As indicated on the Architectural Finish Schedule.
- D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
- E. Drill holes in countertops for plumbing fittings, stainless steel sink bowls, and soap dispensers in shop.

2.7 SOLID-SURFACING-MATERIAL WINDOWSILLS

- A. Grade: Custom.
- B. Solid-Surfacing-Material Thickness: 12 mm (nom. 1/2 inch).
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 - 1. As indicated on the Architectural Finish Schedule.
- D. Fabricate in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

2.8 CLOSET AND UTILITY SHELVING

- A. Shelf Material: 20-mm (3/4-inch) melamine-faced particleboard with applied-PVC exposed edges.
- B. Color: White.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to the extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 3.2 mm in 2420 mm (1/8 inch in 96 inches).
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 3.2 mm in 2420-mm (1/8 inch in 96-inch) sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 3.2 mm in 2420 mm (1/8 inch in 96-inch) sag, bow, or other variation from a straight line.
 - 3. Refer to drawings regarding backsplashes and endsplash requirements. Adhere applied splashes using standard color-matched silicone sealant.
 - 4. Adhere undermount sinks/bowls to countertops with color-matched silicone sealant.
 - 5. Caulk space between backsplash and wall with sealant suitable for application.
 - a. Caulk Color: Clear.
 - 6. Coordinate and make connections of plumbing fixtures and sinks with Division 22 Plumbing.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

- B. Clean, lubricate, and adjust hardware.
- C. Clean exposed and semi-exposed surfaces

END OF SECTION 06 41 16

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SECTION 06 42 19 PLASTIC-LAMINATE-FACED WOOD PANELING

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. Plastic-laminate-faced wood paneling.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced wood paneling that is not concealed within other construction.

- B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

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

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- B. Shop Drawings: For plastic-laminate-faced wood paneling.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
4. Apply AWI Quality Certification or WI Certified Compliance Program label to Shop Drawings.

- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.
- D. Samples for Initial Selection: For each type of plastic laminate.
- E. Samples for Verification: For each type of exposed laminate, 8 by 10 inches (200 by 250 mm).
 - 1. Provide one Sample applied to core material and with specified edge material applied to one edge.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For each type of product.
- C. Quality Standard Compliance Certificates: AWI Quality Certification Program or WI Certified Compliance Program.
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Shop Certification: AWI's Quality Certification Program accredited participant or WI's Certified Compliance Program licensee.
- B. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.

- C. Field Measurements: Where paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PANELING FABRICATORS

- A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Formica Corporation - (Basis of Design).

2.2 PANELING, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood paneling (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.
1. Provide inspections including installation together with labels and certificates from AWI or WI certification program indicating that woodwork complies with requirements of grades specified.
 2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.3 PLASTIC-LAMINATE-FACED WOOD PANELING

- A. Grade: Custom.
- B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3 and the following requirements:
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Formica Corporation.
 2. Panolam Surface Systems – Pionite brand.

3. Wilsonart LLC.
 4. Faces: Grade VGP.
 5. Backs: Grade BKV.
 6. Exposed Edges: Same as faces.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
1. As selected by Architect from laminate manufacturer's full range in the following categories:
 - a. Wood grains, matte finish.
 2. Grain Direction: Refer to Drawings.
- E. Panel Core: Particleboard or MDF.
1. Thickness: As indicated on Drawings.
- F. Fire-Retardant-Treated Paneling: Panels shall consist of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. Assemble panels by gluing and concealed fastening.

2.4 MATERIALS

- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Moisture Content: 5 to 10 percent.
- C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
1. MDF: ANSI A208.2, Grade 130.
 2. Particleboard: ANSI A208.1, Grade M-2.
 3. Straw-Based Particleboard: ANSI A208.1, Grade M-2, except for density.

2.5 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.

2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
 4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of paneling.
- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E84.
1. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi (11 MPa); modulus of elasticity, 300,000 psi (2070 MPa); internal bond, 80 psi (550 kPa); and screw-holding capacity on face and edge, 250 and 225 lbf (1100 and 1000 N), respectively.
 2. For panels 13/16 to 1-1/4 inches (20 to 32 mm) thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi (9 MPa); modulus of elasticity, 250,000 psi (1720 MPa); linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf (1100 and 780 N), respectively.
- D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.

2.6 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.
- C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.

2.7 FABRICATION

- A. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.
- B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition paneling to humidity conditions in installation areas.
- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.
- B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.
 - 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch (0.8 mm).
- C. Anchor paneling to supporting substrate with blind nailing. Do not use face fastening unless otherwise indicated.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 42 19

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SECTION 07 01 53 ROOF MEMBRANE PATCHING AND REPAIR

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 SCOPE

- A. This Section includes the following:
1. Patching and repair of existing warrantied EPDM roofing system at new plumbing, mechanical, and electrical penetrations.

1.3 RELATED WORK

- A. Applicable provisions of Division 1 govern work under this Section.
- B. Related work specified elsewhere:
1. Section 06 10 53 - Miscellaneous Rough Carpentry
 2. Section 07 62 00 – Sheet Metal Flashing and Trim
 3. Division 23 for equipment curbs.

1.4 GUARANTEE AND WARRANTIES

- A. Contractor shall work with roofing manufacturer to maintain and not void the current warranty of the existing roof: Firestone Building Products.
- B. Roof System Guarantee: Provide written two (2) year guarantee warranting all roofing and flashing required under contract, to be watertight and free from defects in materials or workmanship for period of time, as stipulated in guarantee form.
- C. It is recommended that the Contractor take digital photos of the finished work for their files and future reference.

1.5 ACTION SUBMITTALS

- A. Product Data: Catalog sheets, specifications, installation instructions for each material specified.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Material Safety Data Sheets (MSDS): Include the MSDS in the Submittals Package.
- D. Submit all action items, except contract closeout submittals and MSDS, at one time as a complete package. Partial submittals will not be considered.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire Hazard Classification: The sheet membrane roof system shall have an Underwriters Laboratories Class A External Fire Resistance rating, as determined by tests conducted in conformity with UL-790 “Tests for Fire Resistance of Roof Covering Materials”.
- C. Material Classification Identification: Materials delivered to the site that are a component of the roofing system shall bear the UL Classification mark.

1.7 QUALIFICATIONS

- A. Contractor/Installer: Installer of roof membrane patching approved by warrantor of existing roofing system to work on existing roofing.
 - 1. Additional Requirement for Field Labor: The supervisor or crew chief and at least one other member of the roofing crew shall have installed at least 3 EPDM sheet membrane roof systems and shall be thoroughly familiar with all aspects of the installation.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to the site in the manufacturer’s labeled, unbroken containers.
- B. Storage and Handling: Store materials in a dry, well-ventilated place protected from the weather.
 - 1. Do not store materials so as to overload the deck or structural assembly.
 - 2. Store all materials on raised platforms covered with properly secured breathable water-resistant covers. Slit shrink wrapping to not permit condensation and cover with breathable tarp.
 - 3. Store volatile liquids in a separate storage building or trailer or removed from the site at the end of each workday.
 - 4. Store volatile liquids at temperatures recommended by the manufacturer.
 - 5. Do not remove materials from factory packaging until ready for use.
 - 6. Store adhesives, and sealants at temperatures between 60 degrees F and 80 degrees F.

1.9 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner’s operations will not be disrupted. Provide Owner with not less than 7 days notice of activities that may affect Owner’s operations.
 - 1. Coordinate work activities daily with Owner so Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down

- HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area.
2. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated before proceeding with work over the impaired deck area.
- B. Protect building to receive roof patching, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
 - C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
 - D. Unless otherwise directed, do not execute the work of this Section if the Owner's/Architects Representative is not present.
 - E. Do not execute the work of this Section unless the repair area substrate is dry and free of dirt and debris.
 - F. Moisture Protection:
 1. Cover, seal or otherwise protect the roof and flashings so that water cannot accumulate or flow under completed portions. When and where necessary to accomplish this, provide temporary water cut-offs in accordance with the membrane manufacturer's written specifications.
 - a. Limit the removal of existing materials to areas that can be completely repaired or temporarily protected within the same day. At the discretion of the Owner's Representative, a watertight built-up vapor barrier may be acceptable temporary protection for a maximum of 48 hours.
 - G. Do not use open flames near volatile materials.
 - H. Limit construction loads on roof and for uniformly distributed loads.
 - I. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

PART 2 - PRODUCTS

2.1 EPDM SHEET MEMBRANE, SHEET FLASHING, AND RELATED PRODUCTS

- A. The EPDM sheet membrane shall be visually free of streaks, particles of foreign matter, undispersed raw material, pinholes, cracks, tears, and shall be uniform in thickness. When unrolled in a relaxed position, the membrane shall be free of wrinkles, distortions, and blisters.
- B. EPDM (Ethylene, Propylene, Diene, Monomer) Sheet Membrane:

1. 60 mil, unreinforced, EPDM membrane.
- C. Sheet Flashing: Membrane manufacturer's cured and uncured EPDM as specified.
- D. Inseam Tape: Membrane manufacturer's minimum 3 inch wide self-adhering tape consisting of cured butyl double sided adhesive tape, for inseam splicing of rubber to rubber.
- E. Cured EPDM Cover Tape: Membrane manufacturer's minimum 5 inch wide self-adhering tape consisting of cured butyl adhesive laminated to cured EPDM, for installation over EPDM seams, cuts in field membrane, and for stripping in metal work.
- F. Uncured EPDM Cover Tape: Membrane manufacturer's minimum 5 inch wide self-adhesive tape, consisting of, cured butyl adhesive laminated to uncured EPDM, for installation over base flashing corners, inside and outside corners, pipe flashings and other detail work.
- G. Related Products: Membrane manufacturer's bonding adhesive, splicing cement, lap sealant, water cut-off mastic, seal, pourable sealer, splice joint cleaning agent and primer, insulation adhesive, and all other products related to the sheet membrane system.

2.2 INSULATION

- A. Uniform Thickness polyisocyanurate insulation and Tapered polyisocyanurate insulation: Approved closed cell polyisocyanurate foam core insulation skinned on both sides with factory applied fiberglass facers suitable for installation with hot asphalt and cold adhesive. ASTM C1289-02, Type II, Class 1, Grade 2. UL Classified and Factory Mutual Approved for direct application over steel deck. Minimum LTTR: 5.0 per inch thickness. Match existing thickness.
- B. Tapered Insulation System: Membrane manufacturer's approved factory tapered polyisocyanurate insulation to match existing taper.
- C. Coverboard Insulation: Match existing thickness with membrane manufacturer's approved gypsum roof board.
- D. Tapered Cricket System: Membrane manufacturer's approved 1/2 inch per foot factory tapered polyisocyanurate insulation.
- E. Tapered Edge Strips: Membrane manufacturer's approved 1/2 inch per foot factory tapered polyisocyanurate insulation.
- F. Deckboard (if required): Match existing thickness with membrane manufacturer's approved gypsum roof board.
- G. Flashing: Comply with Section 07 62 00.
- H. Termination Bar and Fasteners: As recommended by membrane manufacturer.
- I. EPDM Anchor Strips: 6-inch-wide reinforced EPDM.

2.3 INSULATION ADHESIVE

- A. Insulation Adhesive: Two-Part, Lowrise polyurethane foam adhesive, or the manufacturer's recommended insulation adhesive.

2.4 MISCELLANEOUS MATERIALS

- A. Pipe Flashing: Cured premolded EPDM pipe boot.
- B. Mechanical Pipe Supports: Flashing and pre-molded boot with stainless steel draw-band clamp shall be approved and supplied by the membrane supplier.
- C. Compression Clamp: Stainless steel or cadmium plated steel worm drive clamp.
- D. Sealant: One-part, low modulus, silicone sealant: Dow Corning's 790, General Electric's Silpruf, Pecora's 864, or Tremco's TremPro 646.

2.5 MATERIALS FOR VAPOR BARRIER REPAIR

- A. Vapor Barrier: Match existing materials with membrane manufacturer's approved equivalent.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Protect existing membrane roofing system that is indicated not to be reroofed.
- B. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- C. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- D. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
- E. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing membrane roofing system components that are to remain.
- F. Verify that rooftop utilities and service piping have been shut off before beginning the Work.

3.2 INSTALLING INFILL INSULATION

- A. Keep insulation absolutely dry at all times. Discard insulation that contains moisture.

1. Install only as much insulation as can be covered with roofing membrane the same day.
 2. Discard all units with broken corners or similar defects.
 3. At roof drains, terminate the insulation with tapered edge strips so that all flashing and coverstrip joint laps can be made within the tapered portion.
- B. Cut back the membrane at affected area to expose the insulation. Remove fasteners holding the insulation, if present. Cut the insulation and discard properly, taking care not to damage vapor barrier, if present.
- C. Installing Adhesively Secured Insulation: Set each board in insulation adhesive applied in accordance with manufacturer's printed instructions. Press insulation into the adhesive immediately and as necessary thereafter to assure proper bonding. Maintain pressure on the adhesive until the adhesive has completely set (20 to 45 minutes).
- D. Installing Insulation Board: Install each layer of insulation with joints staggered. Butt edges and ends snugly so there are no gaps between the insulation boards. Discard boards with broken corners and boards that are warped.
- E. Installing Tapered Insulation System: Install the tapered insulation to match the existing tapered insulation system. Install each layer of insulation with joints staggered. Butt edges and ends snugly so that there are no gaps between the insulation boards.
- F. Install coverboard insulation over the polyisocyanurate insulation.

3.3 MEMBRANE PREPARATION

- A. Preparing Existing Roof Membrane for patching: Cut the membrane a short distance from and parallel with the perimeter, base of the wall, curb or termination point to relieve the tension. Allow the membrane to relax for a minimum of 30 minutes.

3.4 INSTALLING EPDM REPAIR MEMBRANE

- A. Cut a piece of like membrane large enough to extend 4 inches beyond any part of the cut and to provide an expansion fold of 4 to 6 inches. Round the corners of the patch to prevent peeling of square corners.
1. Apply primer to both surfaces to be mated and allow to dry.
 2. If the existing membrane surface is excessively degraded, insert the new patch material under the existing membrane so that adhering of the patch may be accomplished to the underside of the existing membrane.

3.5 PHASING OF MEMBRANE INSTALLATION

- A. Limit the removal of existing materials and repairs to areas that can be completely repaired within the same day.

3.6 FIELD QUALITY CONTROL

- A. As the repairs are completed or at the end of each workday, in the presence of the Owner's Representative closely examine joints in the membrane and repairs. Cut out

and repair areas of the joints that are not fully bonded or that contain “fishmouths” or “wrinkles”. Repair the membrane so it is restored to its full waterproof integrity. Lap patches a minimum of 6 inches beyond cuts.

END OF SECTION 07 01 53

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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.
 - a. At perimeter foundation wall and below slabs.
 - b. At exterior cavity walls.
 2. Blanket/batt insulation.
 3. Fire-safing insulation.
 4. Vapor retarders.
 5. Attic ventilation troughs at roof eaves.

1.3 REFERENCES

- A. ASTM C578 - Preformed, Cellular Polystyrene Thermal Insulation.
- B. ASTM E84 - Surface Burning Characteristics of Building Materials.
- C. ASTM C665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM C764 - Mineral Fiber Loose Fill Insulation.
- E. UL 723 - Surface Burning Characteristics of Building Materials.

1.4 SYSTEM DESCRIPTION

- A. Materials of this Section shall provide a continuous thermal, vapor and air barrier where required, at building enclosure elements.

1.5 ACTION SUBMITTALS

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

1.6 REQUIREMENTS OF REGULATORY AGENCIES

- A. Surface Burning Characteristics:

1. Comply with applicable codes for Class I (Class A) flame/smoke ratings of 25 or less/450 or less for insulation types and accessories other than foamed plastic when tested according to ASTM E84 (UL 723).
2. Comply with applicable codes for Class II (Class B) flame/smoke ratings of 75 or less/450 or less for foamed plastic insulation types when tested according to ASTM E84 (UL 723).

1.7 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 INSULATION MATERIALS

- A. INSUL-1: Extruded Polystyrene Board Insulation; ASTM C578, Type IV, extruded cellular polystyrene; 1.6 pcf density minimum; 25 psi minimum compressive strength; 0.1 percent maximum water absorption by volume; "k" factor of 0.20 at 75 deg. F; shiplap/square edges, manufacturer's standard board size, thickness indicated. Provide minimum "R" value as indicated on drawings.
 1. Use: Rigid board insulation at foundation walls and below concrete floor slabs at the exterior perimeter of the building.
 2. 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. DiversiFoam Products, CertiFoam SL.
 - b. Dow Chemical Company, Styrofoam SM.
 - c. Owens Corning Industries, Foamular 250.
 - d. Pactiv Corporation., Green-Guard XPS Type IV 25 PSI.
- B. INSUL-2: Extruded Polystyrene Board Insulation; ASTM C578, Type IV, extruded cellular polystyrene; 1.55 pcf density minimum; 25 psi minimum compressive strength; 0.1 percent maximum water absorption by volume; "k" factor of 0.20 at 75 deg. F; square edges, manufacturer's standard board size, thickness indicated. Provide minimum thickness as indicated on drawings.

1. Use: Rigid board insulation at exterior cavity wall construction.
 2. 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. DiversiFoam Products, CertiFoam SE.
 - b. Dow Chemical Company, Styrofoam CavityMate Plus.
 - c. Owens Corning Industries, Hi-R CW Plus.
 - d. Pactiv Corporation., Green-Guard XPS Type IV 25 PSI.
- C. INSUL-3: A. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.
1. Use: Blow-in batt attic insulation.
 2. 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. CertainTeed Corporation. www.CertainTeed.com; InsulSafe SP Fiber Glass Blowing Insulation.
 - b. Guardian Building Products, Inc. www.GuardianFiberglass.com; Attic Guard Plus Loose Fill Fiberglass Insulation.
 - c. Johns Manville. www.JM.com; Climate Pro® Loose Fill Blow-In Fiber Glass Insulation.
 - d. Knauf Insulation. www.KnaufInsulation.com; JET STREAM 73.3.
 - e. Owens Corning. www.OwensCorning.com; AttiCat® Expanding Blown-In PINK Fiberglas™ Insulation.
 3. Minimum R-Value (RSI-Value): 30 (5.3).
 4. Minimum Installed Thickness: 12.4-inches.
 5. Accessories:
 - a. Eave Ventilation Troughs: Preformed, rigid foam or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves, cardboard troughs not acceptable.
 - 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) Ado Products www.AdoProducts.com; Durovent Foam Rafter Vent.
- D. INSUL-4: Sound Attenuation Fiber Blanket/Batt Insulation (Unfaced); ASTM C665, Type I, preformed glass fiber blanket without facers. Thickness – match stud depth.
1. Use: Sound attenuation batt insulation at stud wall construction where indicated on the drawings.

2. 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. CertainTeed Corporation, Noise Reducer.
 - b. Johns Manville, Sound Control Batts.
 - c. Owens-Corning Fiberglass Corp, Sound Attenuation Batts Fiber Glass.
- E. INSUL-5: Fire Safing Insulation; FS HH-I-558, Form A, Class 1; preformed, semi-rigid mineral felt, 4.0 pcf density.
 1. Use: Install fire safing insulation (INSUL-7) in required thicknesses to fill voids and cavity spaces as indicated on Drawings.
 2. 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. Manville Corporation, Pyro-Fiber Safing Insulation.
 - b. United States Gypsum, Thermafiber Safing Insulation.

2.2 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.

2.3 ACCESSORIES

- A. Adhesive for Bonding Board 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. 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 CAVITY WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
 - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00, "Unit Masonry Assemblies."

3.6 INSTALLATION OF ATTIC INSULATION

- A. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
- B. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves per manufacturer's installation instructions.

3.7 INSTALLATION OF SOUND ATTENUATION BLANKET INSULATION

- 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. 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.
5. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
6. 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).

3.8 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 retarder.

3.9 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 07 27 26 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 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 airtight 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. Grace, W. R., & Co. - Conn.; 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 fish mouths 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 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 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 1-1/2-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 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" and an applied membrane that provides air, moisture, and water vapor control specified in Division 07 Section "Fluid-Applied Membrane Air Barriers." Metal wall panel installation specified in this Section includes secondary metal sub girt framing for panel attachment.

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 CONCEALED FASTENER PROFILE METAL WALL PANELS

A. Metal Wall Panels, General: Factory-formed, concealed fastener panels with interconnecting side joints, concealed clip and fastener design, 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-4**:

1. Basis of Design Product: Morin, Concealed A-12
2. Panel Coverage: 12 inches (305 mm).
3. Panel Height: 1.50 inches (38 mm).
4. Perforated: No
5. Installation: Soffit Installation
6. Finish: Smooth
7. Color: Custom Color to match Existing Metal Panel Cream

C. 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.

2.6 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.

2.7 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. 1/4-inch in 20 feet (6.4 mm in 6 m) vertically or horizontally from face plane of framing.
 - b. 1/2-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

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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. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed wall sheet metal fabrications.
5. Formed equipment support flashing.
6. Formed overhead-piping safety pans.

- B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 04 20 00 "Unit Masonry Assemblies" for materials and installation of manufactured sheet metal through-wall flashing and trim integral with masonry.
3. Section 07 42 13 "Metal Wall Panels for sheet metal flashing and trim integral with metal wall panels.
4. Section 07 95 00 "Expansion Control" for manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
5. Section 07 95 13 "Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for interior and exterior building walls, soffits, and parapets.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

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

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counter-flashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long by actual width.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is FM Approvals approved.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure

to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- E. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A755/A755M.
 - 1. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.
 - 2. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to

exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color:
 - a. Adjacent to Metal wall panels: Custom color to match panels.
 - 1) Metro Navy Blue - Pantone 540.
 - 2) Match Existing Metal Panel Cream.
 - b. General: As selected by Architect from manufacturer's full range.
 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).
- C. Zinc Sheet: Zinc, 99 percent pure, alloyed with 0.08 to 1.00 percent copper, 0.06 to 0.20 percent titanium, and up to 0.015 percent aluminum; with manufacturer's standard factory-applied, flexible, protective back coating.
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. Artazn LLC.
 - b. Rheinzink America.
 - c. Umicore Building Products USA, Inc.
 2. Source Limitations: Obtain sheet from single source from single manufacturer.
 3. Finish: Pre-weathered gray.
- D. Lead Sheet: ASTM B749 lead sheet.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F (111 deg C); and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
1. Source Limitations: Obtain underlayment from single source from single manufacturer.
- C. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

1. Source Limitations: Obtain underlayment from single source from single manufacturer.
2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C) or lower.

D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

3. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn60, 60 percent tin and 40 percent lead.
2. For Zinc: ASTM B32, 40 percent tin and 60 percent lead with low antimony, as recommended by zinc manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.
- I. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.
- J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.
 - 1. Source Limitations: Obtain reglets from single source from single manufacturer.
 - 2. Material: Galvanized steel, 0.022 inch (0.56 mm) thick.
 - 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 - 5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 - 6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 - 7. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
 - 8. Finish: With manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 2. 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.

3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 4. 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.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 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.
 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. 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.
- D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. 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.
- G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates.
1. Joint Style: Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate.
 2. Fabricate with scuppers as located in the drawings, to dimensions required with 4-inch- (100-mm-) wide flanges and base extending 8 inches (200 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
- B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.
1. Coping Profile: See drawings and in accordance with SMACNA's "Architectural Sheet Metal Manual."
 2. Joint Style: Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate.
 3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.040 inch (1.02 mm) thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch (1.02 mm) thick.
- C. Roof and Expansion-Joint Cover: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.034 inch (0.86 mm) thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.034 inch (0.86 mm) thick.
- D. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
- E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
- F. Flashing Receivers: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch (0.56 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

H. Roof-Drain Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch (0.396 mm) thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings; and form with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Zinc: 0.032 inch (0.80 mm) thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch (0.56 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

C. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

B. Overhead-Piping Safety Pans: Fabricate from the following materials:

1. Stainless Steel: 0.0250 inch (0.635 mm) thick.
2. Galvanized Steel: 0.040 inch (1.02 mm) thick.
3. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch (1.02 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lap joints not less than 2 inches (50 mm).
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
 - 1. Lap horizontal joints not less than 4 inches (100 mm).
 - 2. Lap end joints not less than 12 inches (300 mm).
- C. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses.
 - 5. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.
- D. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lap joints not less than 4 inches (100 mm).

3.3 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder. Welds and sealant.
 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than 12 inches (300 mm) o.c.
 6. Space individual cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch.
 9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
 - b. Form joints to completely conceal sealant.

- c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
- 1. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 2. Do not solder metallic-coated steel and aluminum sheet.
 - 3. Do not pre-tin zinc-tin alloy-coated copper.
 - 4. Do not use torches for soldering.
 - 5. Heat surfaces to receive solder, and flow solder into joint.
 - a. Fill joint completely.
 - b. Completely remove flux and spatter from exposed surfaces.
 - 6. Stainless Steel Soldering:
 - a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
 - b. Promptly remove acid-flux residue from metal after tinning and soldering.
 - c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - 7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
 - 8. Copper-Clad Stainless Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.
- H. Rivets: Rivet joints in uncoated aluminum and zinc where necessary for strength.

3.4 INSTALLATION OF ROOF-DRAINAGE SYSTEM

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Parapet Scuppers:
 - 1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 2. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.

3. Loosely lock front edge of scupper with conductor head.
 4. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- C. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch (25 mm) below scupper discharge.
- D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

3.5 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.
 3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- C. Copings:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch (400-mm) centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch (600-mm) centers.
 3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.

- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 2. Extend counterflashing 4 inches (100 mm) over base flashing.
 3. Lap counterflashing joints minimum of 4 inches (100 mm).
 4. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.
- C. Reglets: Installation of reglets is specified in Section 04 20 00 "Unit Masonry Assemblies."

3.7 INSTALLATION OF MISCELLANEOUS FLASHING

- A. Equipment Support Flashing:
1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 2. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans:
1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
 2. Pipe and install drain line to plumbing waste or drainage system.

3.8 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 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.

3.9 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

3.10 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 84 13 PENETRATION 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. Penetration firestopping systems for the following applications:
 - a. Penetrations in fire-resistance-rated walls.
 - b. Penetrations in horizontal assemblies.
 - c. Penetrations in smoke barriers.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 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."

1.8 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.

1.9 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. Everkem Diversified Products, Inc.
 - b. HoldRite; Reliance Worldwide Company.
 - c. RectorSeal Firestop; a CSW Industrials Company.
 - d. Specified Technologies, Inc.
 - e. STC Sound Control.
 - f. 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. Penetrations in Horizontal Assemblies: 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: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- F. Manufactured Piping Penetration Firestopping System: 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. 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. ProVent Systems, Inc.

- b. RectorSeal Firestop; a CSW Industrials Company.
 - 2. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 - 3. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - 4. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
 - 5. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - 6. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 - 7. Special Coating: Corrosion resistant on interior of fittings.
- G. 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 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 non-shrinking, 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, non-shrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 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 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.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

- B. 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.
- C. 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

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 Architect 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 Architect 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 Architect 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 Architect 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 Architect 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 Architect 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 Government'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 Government 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 Government.

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 Division 1.

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 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. Government will not preapprove bidders.
- 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 Contracting Officer's Representative 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 Contracting Officer's Representative 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 SUMMARY

- A. This Section includes standard hollow-metal steel doors and frames.

1.2 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.

1.3 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 non-vented 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. Manufacturers and Products: Subject to compliance with requirements, available manufacturers and products that may be incorporated into the Work include, but are not limited to the following.
1. Amweld Building Products, LLC.
 2. Ceco Door Products.
 3. Curries Company.
 4. Steelcraft.

2.2 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. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.
- E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- G. 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.
- H. Grout: Comply with Division 4 Section "Unit Masonry Assemblies."
- I. Grout: Comply with ASTM C 476, with a slump of 4 inches for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.
- J. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.
- K. Glazing: Comply with requirements in Section 08 81 00 "Glazing."

2.3 STANDARD STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces. Comply with ANSI A250.8.
 - 1. Core Construction: Manufacturer's standard kraft-paper honeycomb core that produces doors complying with ANSI A250.8.
 - 2. Vertical Edges for Single-Acting Doors: Square edge.
 - 3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.
 - 4. STC-32 minimum.
- B. Exterior 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:
 - 1. Level 4 and Physical Performance Level A, (Maximum Duty), Model 2 (Seamless).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A, (Extra Heavy Duty), Model 2 (Seamless).

2.4 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
 1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
 2. Frames for Level 4 Steel Doors: 0.053-inch- thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
 1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
- D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.
- E. Jamb Anchors: Masonry, stud-wall, compression, or post installed expansion type; not less than 0.042-inch-thick.

2.5 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.

2.6 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. Standard Steel Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Glazed Lites: Factory cut openings in doors.
- C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Jamb Anchors: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c.

3. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
- D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 "Door Hardware."
 1. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.7 STEEL FINISHES

- A. Factory priming:
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria.
- B. Field-Applied Paint Finish: Field paint all hollow metal doors and frames in accordance with architectural finish schedule in Sections 09 91 13 "Exterior Painting" and 09 91 23 "Interior Painting" of the specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. 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.
- C. Standard Steel Frames: Install standard steel frames for doors sidelights borrowed lights and 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. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.
 2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."

4. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
- D. Standard Steel Doors: Fit hollow-metal doors accurately in frames. Shim as necessary.
 - E. Glazing: Comply with installation requirements in Section 08 81 00 "Glazing" and with standard steel door and frame manufacturer's written instructions.
 - F. 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 standard steel doors or frames that are warped, bowed, or otherwise unacceptable.
 - G. 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 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 "Glazing" for glass view panels in doors.
2. Division 08 Section "Hollow Metal Doors and Frames" for hollow metal frames.
3. Division 08 Section "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 1/4-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, "Glazing."

2.3 FIBERGLASS REINFORCED POLYESTER DOORS

- A. General: Provide 1-3/4 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. Jams 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 "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 081613

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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 access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.
- C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing and inspecting agency.
1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
 2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.5 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.6 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges

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. ACUDOR Products, Inc.
 - b. Babcock-Davis.
 - c. Cendrex Inc.
 - d. Milcor; a division of Hart & Cooley, Inc.
 - e. Nystrom.
2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Refer to Drawings.
4. Door Size: Refer to Drawings.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Cam latch, key operated.

B. Exterior Flush Access Doors:

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. Babcock-Davis.
 - b. Nystrom.
2. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2-inch-thick (50-mm-thick) fiberglass insulation.
3. Locations: Refer to Drawings.
4. Door Size: Refer to Drawings.
5. Stainless Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage, ASTM A480/A480M No. 4 finish.
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: as indicated in schedule.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges:

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. ACUDOR Products, Inc.
 - b. Babcock-Davis.
 - c. Cendrex Inc.
 - d. Milcor; a division of Hart & Cooley, Inc.
 - e. Nystrom.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
3. Locations: Refer to Drawings.
4. Door Size: Refer to Drawings.
5. Fire-Resistance Rating: Not less than that indicated.
6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
7. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-latching door hardware, operated by key.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 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 in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latch and Lock Hardware:
1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 2. Keys: Furnish two keys per lock and key all locks alike.
 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 08 71 00 "Door Hardware."

2.6 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. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
 2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.
 - a. Color: Match adjacent wall color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80.

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

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SECTION 08 33 23 OVERHEAD COILING DOORS

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. Electric-motor-operated overhead coiling Insulated service doors.

1.3 DEFINITIONS

- A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.4 PERFORMANCE REQUIREMENTS (EXTERIOR DOORS)

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
1. Wind Load: Uniform pressure (velocity pressure) of 80 lbf/sq. ft., acting inward and outward.
 2. Impact Test for Flying Debris: Comply with ASTM E 1996, tested according to ASTM E 1886.
 - a. Level of Protection: Basic Protection.
 - b. Wind Velocity: 110 mph, pressure test to 1/2 and 1-1/2 x design pressure (positive and negative).
- B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.
- C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available for units with factory-applied finishes.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Exterior Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
 - a. Minimum Base-Metal (Uncoated) Thickness: 20 gage.
 - b. Flat profile slats.
 - 2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
 - 3. Inside Curtain Slat Face: To match material of outside metal curtain slat.
 - a. Minimum Base-Metal (Uncoated) Thickness: 24 gage.
- B. Interior Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - a. Minimum Base-Metal (Uncoated) Thickness: 22 gage.
 - b. Flat profile slats.
- C. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon.

Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

- D. Bottom Bar for Service Doors: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; galvanized, stainless-steel, or aluminum extrusions to suit type of curtain slats.
- E. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch- thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.2 HOODS AND ACCESSORIES

- A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
 - 1. Fabricate hoods for steel doors of minimum 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
 - 2. Shape: Round.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weatherstripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
 - 1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 - 2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.
- C. Push/Pull Handles: For emergency-operated doors, provide galvanized steel lifting handles on each side of door.
- D. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
 - 1. Locking Bars: Single-jamb side operable from inside only.
 - 2. Keyed Lock cylinder: Provide keyed lock cylinder that is controlled by the building's master key. Coordinate with door hardware supplier.
- E. Chain Lock Keeper: Suitable for padlock.

2.3 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.4 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-rewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- B. Comply with NFPA 70.
- C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
- F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, worm gear running-in-oil drive, and chain and sprocket secondary drive.
- G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to

start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.

1. Type: Polyphase, medium-induction type.
 2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
 4. Provide open drip proof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
- H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
 2. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Provide pneumatically actuated automatic bottom bar.
 - 1) Self-Monitoring Type: Four-wire configured device.
- J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

2.5 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved selection from color chart. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved selected color and are assembled or installed to minimize contrast.

2.6 STEEL FINISHES

- A. Baked Finish: Manufacturer's standard baked finish consisting of primer and topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23

SECTION 08 33 30 HIGH SPEED RUBBER ROLL-UP 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 rubber 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 (5) 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

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Rubber Roll-up Doors: Basis of Design TNR Doors Model HDC-DD

1. **Curtain:**
 - a. Two (2) layers of Styrene Butadiene Rubber (SBR) each 3.2mm (1/8") thick, 70 durometer, reinforced with 1-ply, 50 kg (110 lb) polyester cord centre. Material provides normal resiliency and flexibility at temperatures ranging from -40F to +180F (-40C to 85C)
 - b. Complete with molded NEWGEN® Curtain Loks™ that are mechanically attached to the vertical edges of the curtain material. This retention system maintains and holds the curtain in guides under heavy windload conditions. Continuous glued SBR windlock or molded in place Teflon windlock designs will not be accepted.
 - c. Standard Color: Black

2. **Guides:**
 - a. Side curtain retention: Guides shall be one-piece extruded aluminum to form a slot of sufficient depth to allow the Curtain Lok to move freely in the guides at all times. Aluminum members are to be of sufficient thickness and rigidity to maintain the Curtain Lok within the guides during normal operation while enabling the Curtain Lok to release during accidental impacts.
 - b. Steel guides (bolted or spring-loaded) will not be accepted.
 - c. Side frame: Mounting angle is provided for installation directly onto concrete or steel door framing. Additional customization of door frame is not required.

3. **Bottom Rail**
 - a. Bottom bar shall extend the full width of the curtain, sufficient to maintain the bottom edge of the curtain parallel to the door threshold at all times. The bottom bar shall be constructed of two steel angles bolted together and shall have a knock-away section to reduce risk of damage during accidental impacts.
 - b. Knock-away bottom bar to be reset without the need to open side frames. Single angle design will not be accepted. Side Frames: Galvanized steel side frames with full height weather seal on both sides to seal against door panel.

4. **Roll-Up Door System**
 - a. The curtain is to be rolled on a barrel of sufficient size to carry the door load with a deflection of not more than 2.5 mm/m (.03 in/ft) of opening width. Drive shaft in the barrel is to be constructed of minimum 50.8 mm (2") C1018 cold rolled steel shafts.

- b. Door shall be designed to operate safely without the use of a counterbalance system (i.e. – springless design).
 - c. The Idler Barrel shall be constructed of 102 mm (4") OD round HSS structural tubing with a minimum wall thickness of 3.4 mm (0.134") and supported by 32 mm (1¼") C1018 cold rolled steel shafts at either end. Idler must be guide mounted not end bracket mounted for proper tracking of curtain into Guides.
 - d. End brackets are constructed of 6 mm (¼") hot rolled steel plate c/w sealed heavy-duty, self-aligning bearings with cast iron housings to support the drive barrel. Drive shaft bearing shall be load rated at 3405 kg (7490 lb) dynamic and 2555 kg (5620 lb) static.
 - e. Welded Truss shall brace endplates together at the top and bottom with C3 x 4.1 channel and 2" x ¼" flatbar diagonal bracing.
5. Reversing Edge
- a. Door to be equipped with reversing sensing edge to stop and reverse door to manufacturer's standard. A ⅛" thick EPDM rubber loop shall wrap the reversing edge. Both the reversing edge and rubber loop must be replaceable without removing the bottom bar from the curtain.
6. Accessories:
- a. Various accessories are available, for example: radio controls, motion sensors, loop detectors, pull cords, traffic lights, etc.
 - b. Provide dual horizontal and angular photo eye sensors.
7. Construction
- a. Doors: constructed of steel, aluminum and SBR rubber/woven curtain.
 - b. Structural elements: assembled by welding or by mechanical fasteners.
8. Operation of Door: Doors shall be equipped for operation by electric operator, with emergency manual chain hoist.
- a. Manual Operation:
 - 1) Emergency manual chain hoist shall be provided to allow manual door operation.
 - 2) Chain hoist shall be of sufficient capacity to operate a door at a maximum pull requirement of 9 to 14 kg (20 to 30 lb). The static load on the hand chain to hold the door in any position must not exceed 5 kg (11 lb).
 - b. Electrical Operation:
 - 1) Electric door operators shall be CSA/UL approved, high RPM, heavy-duty worm gear type complete with pre-wired, number coded control cabinet as required, to manufacturer's standard. Panel enclosure to be NEMA 4 rating.

- 2) Motor to be NEMA 4, high starting torque, direct drive, hoist type, operating through a worm gear reducer mechanism. Sprockets and chains will not be accepted.
 - 3) Motor to be of capacity to open door at maximum speeds of up to 48" per second, depending on door size to manufacturer's standard, rated for X horsepower, X voltage, X phase, X frequency.
 - 4) Operator shall be equipped with digital encoder limit switches to control open and close door positions as well as an electro-mechanical brake system to stop and hold door in any position to manufacturer's standards. Rotary cam limit switches optional.
 - 5) Operator shall be equipped with built-in manual emergency chain hoist. Built-in electrical interlock shall prevent motor operation during use of manual chain hoist.
 - 6) Control Panel: Panel enclosure shall be NEMA 4 and wiring shall be completed by manufacturer and shall be UL listed. Drive system shall be controlled by programmable logic controller (PLC) complete with inverter drive for soft start and soft stop door operation. Motor control by a reversing contactor is not acceptable. Control panel shall have fused primary power, adjustable closing timer, three (3) push buttons for open, close and stop functions, push/pull mushroom button E-stop and a cycle counter.
 - 7) Control panel without inverter drive will not be accepted.
9. 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.

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

SECTION 08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Exterior storefront framing systems.
 2. Exterior manual-swing entrance doors and door-frame units.
 3. Door Hardware.

1.3 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 REFERENCES

- A. ASTM International.
1. ASTM F 1642: Standard Method for Glazing and Glazing Systems Subjected to Airblast Loadings.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 2. Dimensional tolerances of building frame and other adjacent construction.
 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Noise or vibration created by wind and by thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.

- f. Sealant failure.
 - g. Failure of operating units.
- B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Wind Loads: As indicated on the Structural Drawings.
- D. Deflection of Framing Members: Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
- E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
- 1. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 2. Test Durations: 10 seconds.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
- G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

1.6 ACTION SUBMITTALS

- A. General: Provide action submittals for all items in this specification section for review.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
- 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - 2. Hardware for entrance doors: Submit entrance door hardware as part of Hardware Schedule and submittal requirements specified in Section 08 71 00 "Door Hardware."

- D. Samples for Selection: Manufacturer’s standard color samples for each type of exposed finish with factory-applied color finish for selection by the Architect.
- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames and related work to ensure proper size, thickness, hand, function and finish of entrance door hardware.
- F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional structural engineer responsible for their preparation.
- G. Installer’s Qualification: Letter from manufacturer stating the installer is an approved installer of products listed in this section.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- B. Warranties: Completed manufacturer’s special warranties as described in the “Warranties” Article of this specification section.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Delegated Design Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for systems’ aesthetics effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profile of components and assemblies as they related to sightlines, to one another, and to adjoining construction. Performance Characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Aluminum Frame Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Water penetration through fixed glazing and framing areas.
 - d. Failure of operating components.
 2. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Aluminum Frame Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling or failure of paint to adhere to bare metal.
 2. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Wausau Window and Wall System; 14650 Deep Flush Series (Basis-of-Design)
 2. Kawneer, an ALCOA Company; Trifab 601 Series
 3. Oldcastle Building Envelope; 6000 Series

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 4. Structural Profiles: ASTM B 308/B 308M.

- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Front
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
- F. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding flashing compatible with adjacent materials.
- G. Framing System Gaskets and Sealants: Manufacturer's standard for each joint type.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 08 81 00 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.
 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

- A. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products complying with BHMA standard referenced.
 2. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- B. Designations: Requirements for design, grade, function, finish, size and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
1. Named Manufacturer's Products: Manufacturer and product designations are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.7 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in "Door Hardware Schedule" Article.
1. Door Hardware Sets: Provide quantity, item, size, finish, or color indicated, and named manufacturers' products complying with BHMA designations when referenced.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Warranty Period: Three (3) years from date of Substantial Completion, unless otherwise indicated.
1. Exit Devices: Two (2) years from date of Substantial Completion.
 2. Electrified Door Hardware Two (2) Years from date of Substantial Completion.
 3. Manual Closers: Ten (10) years from date of Substantial Completion
- C. Designations: Requirements for design, grade, function, finish, size and other distinctive qualities of each type of door hardware are indicated in "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Door Hardware Schedule" Article.
- D. Continuous Hinges:
1. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Roton Hinges 780-112HD
 - 2) PEMKO CFM-HD
 - b. Finish BHMA color to match new aluminum frame.
- E. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Best Access Systems; Div. of Stanley Security Solutions, Inc. 40H Series Lever 15 Rose H.
 - b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company. ML 2000 Newport Lever and trim.

- c. SARGENT Manufacturing Company; an ASSA ABLOY Group company. 8200 Series Centro MJ Lever and Rose CO.
 2. Finish BHMA 626 (US26D).
- F. Lock Cylinders:
 1. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - a. Manufacturer: Same manufacturer as for locking devices.
 2. All Cylinders and locking devices shall accept the 7 pin “Best” brand small format interchangeable core.
 3. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.
 4. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 2 construction master keys.
 5. All permanent cores will be owner supplied.
 6. Cylinder Change Keys: Three
 7. Finish BHMA 626 (US26D)
- G. Exit Devices and Auxiliary Items: BHMA A156.3.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company. ED 5000 N900 series trim.
 - b. Sargent 80 series FW-ETL Trim.
 - c. Von Duprin; an Ingersoll-Rand company. 7000 Series AU600 Trim.
 2. Provide cylinder dogging at all non-fire rated doors. Cylinder in rail to hold latch retracted to allow door to function as push pull.
 3. Pull Trim with through-bolt mounting.
 4. Use standard 4 7/8” standard strike prep at exterior doors.
 5. Finish BHMA 630 (US 32D).
- H. Door Push/Pulls:
 1. Storefront Manufacturer Standard 1-inch (25-mm) round bent bar with a 90-degree design.
 - a. Pull: 12-inch (305-mm) high.
 2. All mounting methods to be concealed type:
 3. Finish BHMA 630 (US32D):
- I. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size

of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LCN Closers; an Ingersoll-Rand company. 4040 Adjustable Series.
 - b. Norton 7500 Series.
 - c. Sargent 351 Series.
2. All Closers shall be non-handed.
3. Closers shall have non-ferrous covers and separate valves for adjusting backcheck, delayed action, closing and latching cycles and adjustable spring to provide sizes 1 through 6.
4. Provide non-sized closers adjustable to meet maximum opening force requirements of ADA.
5. Provide drop plates, brackets or adapters for arms as required to suit details.
6. Mount closers on inside of exterior doors.
7. Provide forged heavy duty forged steel arms.
8. Finish BHMA 689 (ALUM).

J. Door Gasketing:

1. Door Gasketing and Sweeps: BHMA A156.22; air leakage not to exceed 0.5C cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stock maintained by manufacturer.
 - a. Door Manufacturer's Standard Gasketing and Door Sweeps.
 - b. Finish: BMMH to match new aluminum frame.

K. Thresholds:

1. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pemko Manufacturing Co.; an ASSA ABLOY Group company 2005AT
 - b. NGB 425 AL
 - c. Zero
 - d. Finish BHMA 628 (US28)

L. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

M. Silencers: BHMA A156.16, Grade 1

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
- B. Anchors:
1. Concrete and Masonry Inserts: Stainless steel requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 6. Provisions for field replacement of glazing from interior.
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Storefront Framing: Fabricate components for assembly using head-and-sill-receptor system with shear blocks at intermediate horizontal members.
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Three coat finish complying with AAMA 2605. With 70% PVDF kynar 500 resin. Prepare, pretreat and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: To be selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine 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 INSTALLATION

- A. General:
1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure non-movement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as recommended by manufacturer to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing as specified in Section 08 81 00 "Glazing."
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet
 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2-inch-wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.
- B. Replace components damage, including scarring of finish on exposed aluminum, during installation, glazing, or cleaning. Field touch up with applied materials will not be accepted.

END OF SECTION 08 41 13

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. 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.
- D. 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 ACTION SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access-controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.5 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 Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. 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.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. 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.
- G. 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.
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.6 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".

1.7 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.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. Twenty-five years for manual surface door closer bodies.
 - 4. Five years for motorized electric latch retraction exit devices.
 - 5. Two years for electromechanical door hardware.

1.9 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, Product Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:
 - a. Bommer Industries (BO) - LB Series.
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
 - c. Stanley Hardware (ST) - CB Series.

- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 1. Manufacturers:
 - a. Bommer Industries (BO).
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
 - c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
 1. Manufacturers:
 - a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.

- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
 1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:
 - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.
 - b. Stanley Hardware (ST) – WH Series.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
 1. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 1. Push/Pull Plates: Minimum .050-inch-thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 5. Manufacturers:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 5. Keyway: Manufacturer's Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.
1. 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. 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. Manufacturers:
 - a. Yale Locks and Hardware (YA) – 8800FL Series.
 - b. Corbin Russwin Hardware (RU) – ML2000 Series.
 - c. Sargent Manufacturing (SA) – 8200 Series.
- B. Multi-Point Locksets: Vertical rod locking devices designed for openings requiring multiple latching points within one locking mechanism. Rods are retracted by dual mounted outside lever trim controls available in a variety of ANSI/BHMA operational functions. Option for single top latching only eliminates the need for bottom strikes.
 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DL4100 Series.
 - b. Sargent Manufacturing (SA) - 4870 Series.
 - c. Yale Locks and Hardware (YA) - 350 Series.

2.7 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
 1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 2. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor configuration which is compatible with the access control system.
 3. Manufacturers:

- a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
- b. Sargent Manufacturing (SA) - 80 Series.
- c. Von Duprin (VD) - 35A/98/99 Series.

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
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 A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.9 ELECTRIC STRIKES

- A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike where specified.
1. Manufacturers:
 - a. Folger Adam EDC (FO).
 - b. HES (HS).
- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.10 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the push bar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 5. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
 6. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
 7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy-duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 11. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 12. 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. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Yale – 6000 Series

- b. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
- c. Sargent Manufacturing (SA) - 80 Series.
- d. 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. Yale – 6000ED Series
 - b. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - c. Sargent Manufacturing (SA) - 80 Series.
 - d. 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 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
- 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 - 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 - 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 6. Closers shall not be installed on exterior or corridor side of doors, where possible install closers on door for optimum aesthetics.
 - 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the 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. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Sargent Manufacturing (SA) - 351 Series.
 - c. Norton Door Controls (NO) - 7500 Series.

2.13 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.
 - c. Tormax – TTX II Low Energy Swing Door Operator

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

2.15 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm, and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

- a. Rixson Door Controls (RF).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Sargent Manufacturing (SA).

2.16 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 NPFA 252, Standard Methods of 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.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko Products; (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.17 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.

2.18 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 SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware, and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Manufacturer's Abbreviations:
 - 1. MK - McKinney
 - 2. PE - Pemko
 - 3. RO - Rockwood

- 4. SA - Sargent
- 5. RF - Rixson
- 6. NO - Norton
- 7. BE – Stanley Best
- 8. YA - Yale
- 9. BEA – BEA Americas
- 10. HS - HES

Hardware Schedule

Set: 1.0 – Exterior Alum Door – Auto Operator – 1101B

1 Continuous Hinge	MCK-14HD	BZ	MK
1 Exit Device	6203 428F	630	YA
1 Removeable Core	7Pin	626	BE
1 Electric Strike	9600 Fail Secure	626	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Door Pull	RM201	626	RO
1 Wall Stop	400	626	RO
2 Door Actuator	LPR36		BEA
1 Bollard	10BOLLARDSLV W/ Cap, Bracket, & Wireless transmitter	SLV	BEA
1 Automatic Operator	6060	626	NO
1 Gasketing	312CR LAR		PE
1 Threshold	171A		PE
1 Sweep	18100DNB		PE
1 Concealed Position Switch	By Access Control Contractor		
1 Motion Detector	By Access Control Contractor		
2 Reader Interface	By Access Control Contractor		
1 Multi-Technology Reader	By Access Control Contractor		
1 Power Supply	By Access Control Contractor		

Set: 2.0 – Exterior Alum Secure Door – 1101A

1 Continuous Electric Hinge	MCK-14HD-PT	BZ	MK
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1 Electric Exit Device	6203ED(BP) 428F	630	YA
1 Removeable Core	7Pin	626	BE
1 Door Closer	CPS7500	689	NO
1 Gasketing	312CR LAR		PE
1 Threshold	171A		PE
1 Sweep	18100DNB		PE
1 Concealed Position Switch	By Access Control Contractor		
1 Power Supply	By Access Control Contractor		

Set: 3.0 – Vestibule Alum Door – Auto Operator – 1101D

1 Continuous Hinge	MCK-14HD	BZ	MK
1 Exit Device	6203 428F	630	YA
1 Removeable Core	7Pin	626	BE
1 Electric Strike	9600 Fail Secure	626	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Door Pull	RM201	626	RO
1 Wall Stop	400	626	RO
2 Door Actuator	LPR36		BEA
1 Automatic Operator	6060	626	NO
1 Gasketing	312CR LAR		PE

Set: 4.0 – Vestibule Alum Door – Closer – 1101C

1 Continuous Hinge	MCK-14HD	BZ	MK
1 Exit Device	6203 428F	630	YA
1 Removeable Core	7Pin	626	BE
1 Door Closer w/ Integral Stop	CPS7500	689	NO
1 Door Pull	RM201	626	RO
1 Gasketing	312CR LAR		PE

Set: 5.0 – Exterior HM Door - Closer/Card Reader – 1230B, 1232C

3 Hinge	TA2314 4-1/2" x 4-1/2"	US26	MK
1 Storeroom Lock	8805 AUR LC	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 Access Control Contractor		
1 Power Supply	By Access Control Contractor		
1 Door Position Switch	By Access Control Contractor		
1 Motion Detector	By Access Control Contractor		
1 Reader Interface	By Access Control Contractor		

Set: 6.0 – Exterior HM Door – Panic/Card Reader – 1221A

3 BB Hinge NRP	TA2314 4-1/2" x 4-1/2" NRP	US26D	MK
1 Exit Device	6103 428F	630	YA
1 Removeable Core	7Pin	626	BE
1 Electric Strike	9600 Fail Secure	626	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Door Closer	CPS7500	689	NO
1 Gasketing	312CR LAR		PE
1 Threshold	171A		PE
1 Sweep	18100DNB		PE
1 Concealed Position Switch	By Access Control Contractor		
1 Motion Detector	By Access Control Contractor		
2 Reader Interface	By Access Control Contractor		

- 1 Multi-Technology Reader By Access Control Contractor
- 1 Power Supply By Access Control Contractor

Set: 7.0 – INTERIOR Door – Classroom/Panic – 1104A, 1104B

- 3 BB Hinge NRP TA2314 4-1/2" x 4-1/2" NRP US26D MK
- 1 Exit Device Rim (EO) 6108 428F 630 YA
- 1 Electric Strike 9600 Fail Secure 626 HS
- 1 SMART Pac Bridge Rectifier 2005M3 HS
- 1 Door Closer/Hold Open CPS7500 689 NO
- 1 Motion Detector By Access Control Contractor
- 2 Reader Interface By Access Control Contractor
- 1 Multi-Technology Reader By Access Control Contractor
- 1 Power Supply By Access Control Contractor
- 3 Silencer 608 PE

Set: 8.0 – INTERIOR Door – Passage/Panic – Fire Rated/Pressurized Vestibule – 1104C, 1236, 1107B

- 3 BB Hinge NRP TA2314 4-1/2" x 4-1/2" NRP US26D MK
- 1 Exit Device Rim (EO) 6100 428F 630 YA
- 1 Door Closer CPS7500 689 NO
- 1 Kickplate K1050 24" x 2" LDW 4BE CSK 630 RO
- 1 Gasketing S88BL LAR PE
- 1 Sweep 315CN x Width PE

Set: 9.0 – INTERIOR Double Door – Passage/Panic – Fire Rated/Pressurized Vestibule – 1112, 1120A, 1120B,

6	BB Hinge NRP	TA2314 4-1/2" x 4-1/2" NRP	US26D	MK
1	Exit Device Rim (EO)	6100 428F	630	YA
1	Automatic Flush Bolt	2842/2942 to suit dr mtl	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Coordinator	2672	US28	RO
2	Door Closer	CPS7500	689	NO
2	Kickplate	K1050 24" x 2" LDW 4BE CSK	630	RO
2	Gasketing	S88BL LAR		PE
1	Sweep	315CN x Width		PE

Set: 10.0 – PASSAGE – 1109, 1118, 1119, 1232A, 1309B, 1309D, 1311A

3	BB Hinge NRP	TA2314 4-1/2" x 4-1/2" NRP	US26D	MK
1	Passage Set	8801 AUR LC	US32D	YA
1	Wall Stop	406/409 to suit	US32D	RO
3	Silencer	608		PE

Set: 11.0 – Card Reader Office – 1105, 1108, 1117, 1228, 1231,1238A, 1238B, 1229, 1701, 2121, 2301

3	BB Hinge NRP	TA2314 4-1/2" x 4-1/2" NRP	US26D	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	Wall Stop	400	626	RO
3	Silencer	608		PE
1	Multi-Technology Reader	By Access Control Contractor		

- 1 Door Position Switch By Access Control Contractor
- 1 Motion Detector By Access Control Contractor
- 1 Reader Interface By Access Control Contractor
- 1 Power Supply By Access Control Contractor

Set: 11.1 – Card Reader – Rated, 1107A, 1235

- | | | | |
|------------------------------|------------------------------------|-------|----|
| 3 BB Hinge NRP | TA2314 4-1/2" x 4-1/2" NRP | US26D | 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 Wall Stop | 400 | 626 | RO |
| 1 Set Gasketing | S88BL LAR | | PE |
| 1 Multi-Technology Reader | By Access Control Contractor | | |
| 1 Door Position Switch | By Access Control Contractor | | |
| 1 Motion Detector | By Access Control Contractor | | |
| 1 Reader Interface | By Access Control Contractor | | |
| 1 Power Supply | By Access Control Contractor | | |

Set: 12.0 – Classroom lock – E134

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|-------------------|----------------------------|-------|----|
| 3 BB Hinge NRP | TA2314 4-1/2" x 4-1/2" NRP | US26D | MK |
| 1 Classroom Set | 8808 AUR LC | US32D | YA |
| 1 Removeable Core | 7Pin | 626 | BE |
| 1 Wall Stop | 406/409 to suit | US32D | RO |
| 3 Silencer | 608 | | PE |

Set: 13.0 – DOUBLE STOREROOM - 2201

6 BB Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Set	8805 AUR LC	US32D	YA
1 Removeable Core	7Pin	626	BE
1 Automatic Flush Bolt	2842/2942 to suit dr mtl	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Coordinator	2672	US28	RO
2 Door Closer	7500 provide arm as required	689	NO
1 Kickplate	K1050 24" x 2" LDW 4BE CSK	630	RO
2 Wall Stop	406/409 to suit	US32D	RO
6 Silencer	608		PE

Set: 14.0 – Multi-Stall Toilet Doors – 1302, 1303

3 BB Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Pull Plate - 4" x 16"	107x70C	US32D	RO
1 Push Plate - 4" x 16"	70C	US32D	RO
1 Door Closer	7500 provide arm as required	689	NO
1 Wall Stop	406/409 to suit	US32D	RO
1 Sweep	315CN x Width		PE
3 Silencer - Metal Frame	608		RO

Set: 15.0 – DOUBLE WORKROOM Card Reader – 1305, 1306

2 Continuous Electric Hinge	MCK-14HD-PT	BZ	MK
1 Classroom/Office Set	8891ED REX AUR LC	US32D	YA
1 Removeable Core	7Pin	626	BE
1 Automatic Flush Bolt	2842/2942 to suit dr mtl	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Coordinator	2672	US28	RO
2 Door Closer	7500 provide arm as required	689	NO
1 Kickplate	K1050 24" x 2" LDW 4BE CSK	630	RO
2 Wall Stop	406/409 to suit	US32D	RO
6 Silencer	608		PE

- 1 Multi-Technology Reader By Access Control Contractor
- 1 Door Position Switch By Access Control Contractor
- 1 Reader Interface By Access Control Contractor
- 1 Power Supply By Access Control Contractor

Set: 15.1 – DOUBLE Storeroom Card Reader – 2303, 2305A, 2306

6 BB Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom/Office Set	8891ED REX AUR LC	US32D	YA
1 Removeable Core	7Pin	626	BE
1 Automatic Flush Bolt	2842/2942 to suit dr mtl	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Coordinator	2672	US28	RO
2 Door Closer	7500 provide arm as required	689	NO
1 Kickplate	K1050 24" x 2" LDW 4BE CSK	630	RO
2 Wall Stop	406/409 to suit	US32D	RO
6 Silencer	608		PE
1 Multi-Technology Reader	By Access Control Contractor		
1 Door Position Switch	By Access Control Contractor		
1 Reader Interface	By Access Control Contractor		
1 Power Supply	By Access Control Contractor		

Set: 16.0 – Other – 1230A, 1232B, 1232D, 1238C, 1238D, 1309A, 1309C, 1310E, 1311B, 2305B

1 All hardware	by door manufacturer		00
1 Removeable Core	7Pin	626	BE

END OF SECTION 08 71 00

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SECTION 08 81 00 GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Steel doors and frames.
 - 2. Glazed aluminum storefronts and entrances.

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 any insulating glass unit that contains dehydrated air or a specified gas.
- C. Deterioration of Coated Glass. Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking and other indications of deterioration in metallic coating.
- D. Deterioration of Insulating Glass. Failure of the hermetic seal under normal use that is 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.
- E. Deterioration of Laminated Glass. Defects developed from normal use that are 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 material obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standards.

1.4 DESIGN REQUIREMENTS

- A. General. Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass

breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Glass Design. Provide glass lites in the thickness and strengths (annealed or heat-treated) to meet or exceed the following criteria based on analysis of Project loads and in-service conditions.
1. Minimum glass thickness of lites composed of annealed or heat-treated glass are selected so the worst-case probability of failure does not exceed the following:
 - a. Eight (8) lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action.
 - b. One (1) lite per 1000 for lites set over 15 degrees off vertical and under action of wind or snow.
 2. Specified Design Wind Loads. As indicated on the Structural Drawings.
 3. Specified Design Snow Loads. As indicated on the Structural Drawings, but not less than snow loads applicable to Project, required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures: Section 7, Snow Loads."
 4. Minimum Glass Thickness for Exterior Lites. Not less than 6mm.
 5. Thickness of Tinted and Heat-Absorbing glass. Provide the same thickness of each tint color indicated throughout Project.
- 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- C. Product Certificates. Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

1.6 INFORMATIONAL SUBMITTALS

- A. Glazing Contractor to submit written compatibility and adhesion test reports from sealant manufacturers indicating that glazing materials were tested for compatibility and adhesion with glazing sealants and other glazing requirements.

1.7 CLOSEOUT SUBMITTALS

- A. Warranties: Provide manufacturer's special warranties with requirements specified in "Warranties" article with submission of O&M Manuals.

1.8 QUALITY ASSURANCE

- A. Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
- B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Source Limitations for Glazing Accessories. Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- D. Glass Product Testing. Obtain glass test results for product test reports in "Submittals" Articles from a qualified testing agency based on testing glass products.
1. Glass Testing Agency Qualifications. An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- E. Safety Glazing Products. Comply with testing requirements in 16 CFR 1201.
- F. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction. All areas described in Section 2406 in the International Building Code, shall be tempered.
- G. 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. GANA Publications: GANA's "Glazing Manual."
 2. IGMA Publication for Insulating Glass. SIGMA TM-3000, "Glazing Guidelines for Sealed.
- H. GANA Publications
1. GANA Glazing Manual.

2. Tempering Division – Engineering Standards Manual.
 3. Laminating Division – Laminated Glass Design Guide.
 4. LSGA Publications.
- I. Safety glass products shall comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.
1. Subject to Compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
- J. Insulating glass products shall be permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
- K. Insulating glass certification Council (IGCC).
1. Single Source Fabrication Responsibility. Fabrication processes, including Low E and reflective coatings, insulating, laminating, silkscreen, and tempering, shall be fabricated by a single Fabricator.
 2. Glass Fabricator shall have 10 years of experience and meet ANSI/ASQC Q9002 1994.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For Insulating-Glass Units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations. Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the glazing material manufacturers and when glazing channel substrates are wet from rain, frost condensation, or other causes.
- B. Do Not Install Liquid Glazing Sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.11 WARRANTY

- A. Manufacturers' Warranty for Vertical Glazing: Provide written manufacturers' warranties for replacement of deteriorated glass, associated glazing product accessories and units, including coated, heat-strengthened and insulating glass units, due to normal conditions of use and not to handling, installation, protection, and maintenance practices contrary to the glass manufacturers' published instructions. Defects shall include edge seal

separation, material obstructing vision through glass, cracks, and blemishes. Should any defect develop during warranty period, such defects shall, upon request, be repaired or replaced at no additional cost to the Owner. Costs of such Work shall be borne by the defective product manufacturer. Provide written warranties for a ten (10) year warranty period from the date of final Substantial Completion.

- B. **Manufacturers' Warranty for Laminated Glass and Heat-Soaked Tempered Safety Glass:** Provide written manufacturers' warranties for replacement of deteriorated laminated glass and heat-soaked tempered safety glass, associated glazing product accessories and units, due to normal conditions of use and not to handling, installation, protection, and maintenance practices contrary to the glass manufacturers' published instructions. Defects shall include edge seal separation, delamination, material obstructing vision through glass, shall include spontaneous breakage of the tempered glass due to inclusions, particularly nickel sulfide. Should any defect develop during warranty period, such defects shall, upon request, be repaired or replaced at no additional cost to the Owner. Costs of such Work shall be borne by the defective product manufacturer. Provide written warranties for a five (5) year warranty period from the date of final Substantial Completion.
- C. If there are separate manufacturers for each of the different glass types, then a separate warranty shall be provided by each manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Basis-of Design Manufacturer and Product:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. **Basis-of-Design Manufacturer:** Viracon Glass.

2.2 GLASS PRODUCTS

- A. **Annealed Float Glass.** ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
- B. **Heat-Treated Float Glass.** ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article. HS glass shall have a surface compression of 5500 psi +/- 1500 psi.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 4. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat- strengthened) float glass where safety glass is indicated. All glass within

24 inches of doorways shall be tempered. In addition, all areas described in Section 2406 in the International Building Code, shall be tempered. Provide FT glass in all doors and sidelites except for fire rated openings. All tempered glass shall be heat soaked tested by manufacturer a minimum of two hours to minimize the potential of spontaneous breakage due to nickel sulfide inclusions.

- C. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent flat glass), Quality-Q3, and complying with other requirements specified.
1. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048.
- D. Laminated Glass:
1. ASTM C1172. Laminated Architectural Flat Glass.
 2. Laminated Process. Autoclave with heat plus pressure.
 3. Interlayer Material. Polyvinyl butyral sheets.
- E. Insulating-Glass Units, General. Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. ASTM E773 Seal Durability of Sealed Insulating Glass Units.
 2. ASTM E774 Sealed Insulating Glass Units.
 3. Sealed insulating glass units shall be double sealed with a primary seal of black (or gray) polyisobutylene and a secondary seal of black (or gray) silicone.
 4. Lites shall be separated by an aluminum spacer with three bent corners and one keyed- soldered corner, or four bent corners and a straight butyl injected zinc plated steel straight key joint, to provide a hermetically sealed and dehydrated air space.
 5. Units shall be certified for compliance with seal classification "CBA" by the Insulating Glass Certification Council (IGCC) and tested in accordance with the above ASTM Test Methods.

2.3 GLAZING GASKETS

- A. Dense Compression Gaskets. Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Neoprene.
 2. EPDM, ASTM C 864.
 3. Silicone, ASTM C 1115.
 4. Thermoplastic polyolefin rubber, ASTM C 1115.

2.4 GLAZING TAPES (for interior windows in hollow metal frames)

- A. Back-Bedding Mastic Glazing Tapes. Preformed, butyl-based elastomeric tape with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass

manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes. Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
1. Type 1, for glazing applications in which tape acts as the primary sealant.
 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 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).

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges and corners.

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 written 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 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 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 days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.9 MONOLITHIC FLOAT-GLASS TYPES

- A. Uncoated Clear Float-Glass Units: Class 1 (clear), annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements.
- B. GL-1: Float Glass, Clear:
 - 1. Kind HS (heat-strengthened) float glass.
 - 2. Thickness: 1/4 inch, 6.0 mm.
 - 3. Application: Interior.
- C. GL-2: Safety-Glass, Clear:
 - 1. Kind FT (fully tempered) labeled safety glass.
 - 2. Thickness: 3/8 inch, 9.5 mm, unless indicated otherwise.
 - 3. Application: Interior.
 - 4. At all-glass doors and sidelight panels. Monolithic tempered safety glass, 1/2 inch 12.7 mm, thick.

3.10 INSULATING-LAMINATED-GLASS TYPES

- A. Insulating-Glass Units, General. Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
- B. GL-3: Laminated Glass, Low-E, Clear Insulating-Glass Units with Argon Gas:
 - 1. Basis of Design Manufacturer and Product:
 - a. Basis of Design Manufacturer name and product is given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.
 - 1) Product: Viracon VE-1-2M.
 - 2. Overall Unit Thickness 1 1/8 inch total.
 - 3. Thickness of Each Lite
 - a. Outdoor Lite - 1/4 inch.
 - b. Indoor Lite – Laminated Glass overall thickness 1/2 inch.
 - 4. Interspace Content: Argon Gas

5. Outdoor Lite. Class 2 (clear) float glass.
 - a. Clear w/ low-E coating on No.2 surface.
 - b. Kind HS (heat strengthened).

6. Indoor Lite. Class 1 (clear) laminated glass.
 - a. Kind HS (heat strengthened).
 - b. Laminated Glass Composition:
 - 1) 1/4 inch clear glass.
 - 2) 0.060 inch PVB.
 - 3) 1/4 inch clear glass.

7. Visible Light Transmittance. 70 percent minimum.
8. Winter NFRC U-Value. 0.29 Btu/(hr x sqft x F).
9. Summer NFRC U-Value. 0.26 Btu/(hr x sqft x F).
10. Shading Coefficient: 0.44.
11. Solar Factor (SHGC): 0.25.

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 01 90.52 MAINTENANCE REPAINTING

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 maintenance repainting as follows:
1. Removing existing paint.
 2. Patching substrates.
- B. Related Requirements:
1. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for Paint materials and systems.

1.3 DEFINITIONS

- A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- B. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.4 PREINSTALLATION MEETINGS

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

1.5 SEQUENCING AND SCHEDULING

- A. Perform maintenance repainting in the following sequence, which includes work specified in this and other Sections:
1. Dismantle existing surface-mounted objects and hardware except items indicated to remain in place. Tag items with location identification and protect.
 2. Verify that temporary protections have been installed.
 3. Examine condition of surfaces to be painted.
 4. Remove existing paint to the degree required for each substrate and surface condition of existing paint.
 5. Apply paint system.
 6. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.6 ACTION SUBMITTALS

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

1. Include recommendations for product application and use.
2. Include test data substantiating that products comply with requirements.

B. Product List: For each paint product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each MPI-product category specified in paint systems, with the proposed product highlighted.
3. VOC content.

1.7 QUALITY ASSURANCE

A. Mockups: Prepare mockups of maintenance repainting processes for each type of coating system and substrate indicated and each color and finish required to demonstrate aesthetic effects and to set quality standards for materials and execution. Duplicate appearance of approved Sample submittals.

1. Locate mockups on existing surfaces where directed by Architect.
2. Surface-Preparation Mockups: On existing surfaces using applicable specified methods of cleaning and other surface preparation, provide mockup sample of at least 10 sq. ft.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing of cleaning materials, paint removers and compatibility of paint coatings and systems for each type of painted surface.

1. Use test areas as indicated and representative of proposed materials and existing construction.
2. Propose changes to materials and methods to suit Project.

1.9 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 daily.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with maintenance repainting only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 PREPARATORY CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).
- C. Detergent Solution: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent that contains no ammonia, 5 quarts (5 L) of 5 percent sodium hypochlorite bleach, and 15 quarts (15 L) of warm water for every 5 gal. (20 L) of solution required.
- D. Mildewcide: Commercial proprietary mildewcide or a job-mixed solution prepared by mixing 1/3 cup (80 mL) of household detergent that contains no ammonia, 1 quart (1 L) of 5 percent sodium hypochlorite bleach, and 3 quarts (3 L) of warm water.
- E. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.
- F. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.
- G. High Pressure Cryogenic Liquid-Nitrogen Jet Cleaning: for surface ablation and cleaning.

2.2 PATCHING MATERIALS

- A. Metal-Patching Compound: Two-part, polyester-resin, metal-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of metal repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be produced for filling metal that has deteriorated from corrosion. Filler shall be capable of filling deep holes and spreading to feather edge.
- B. Cementitious Patching Compounds: Cementitious patching compounds and repair materials specifically manufactured for filling cementitious substrates and for sanding or tooling prior to repainting; formulation as recommended in writing by manufacturer for type of cementitious substrate indicated, exposure to weather and traffic, the detail of work, and site conditions.
- C. Gypsum-Plaster Patching Compound: Finish coat plaster and bonding compound according to ASTM C842 and manufacturer's written instructions.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist chemical solutions being used unless the solutions will not damage adjacent surfaces. Use protective materials that are UV resistant and waterproof. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
2. Do not apply chemical solutions during winds of sufficient force to spread them to unprotected surfaces.
3. Neutralize and collect alkaline and acid wastes before disposal.
4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

3.2 MAINTENANCE REPAINTING, GENERAL

- A. Maintenance Repainting Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from the building at 15 feet away from painted surface.
- B. Execution of the Work: In repainting surfaces, disturb them as minimally as possible and as follows:
 1. Remove failed coatings and corrosion and repaint.
 2. Verify that substrate surface conditions are suitable for repainting.
 3. Allow other trades to repair items in place before repainting.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail.
- D. Heat Processes: Do not use torches, heat guns, or heat plates.

3.3 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of painting work. Comply with paint manufacturer's written instructions for inspection.
- B. Maximum Moisture Content of Substrates: Do not begin application of coatings unless moisture content of exposed surface is below the maximum value recommended in writing by paint manufacturer and not greater than the following maximum values when measured with an electronic moisture meter appropriate to the substrate material:
 1. Concrete: 12 percent.
 2. Gypsum Board: 12 percent.
 3. Gypsum Plaster: 12 percent.
 4. Masonry (Clay and CMU): 12 percent.
 5. Portland Cement Plaster: 12 percent.
 6. Wood: 15 percent.

- C. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer. Conduct alkali testing with litmus paper on exposed plaster, cementitious, and masonry surfaces.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
 - 1. If existing surfaces cannot be prepared to an acceptable condition for proper finishing by using specified surface-preparation methods, notify Architect in writing.
- E. 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.

3.4 PREPARATORY CLEANING

- A. General: Use the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.
- B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.
- C. Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine, that leave residue.
- D. Mildew: Clean off existing mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. Rinse with water applied by clean rags or sponges.
- E. Chemical Rust Removal:
 - 1. Remove loose rust scale with specified abrasives for ferrous-metal cleaning.
 - 2. Apply rust remover with brushes or as recommended in writing by manufacturer.
 - 3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
 - 4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
 - 5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.

6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.
- F. Mechanical Rust Removal:
1. Remove rust with specified abrasives for ferrous-metal cleaning. Clean to bright metal.
 2. Wipe off residue with mineral spirits and either steel wool or soft rags.
 3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
 4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.
- G. High Pressure Cryogenic Liquid-Nitrogen Jet Cleaning: for surface ablation and cleaning.
1. The treatment consists in impacting the surface with a high pressure (up to 3500 bar) cryogenic nitrogen jet (down to -160°C).
 2. The pressurized cryogenic nitrogen exits from a nozzle - having generally a 0.2 to 0.5 mm diameter outlet - to form the high velocity (supersonic) nitrogen jet.

3.5 PAINT REMOVAL

- A. General: Remove paint where indicated. Where cleaning methods have been attempted and further removal of the paint is required because of incompatible or unsatisfactory surfaces for repainting, remove paint to extent required by conditions.
1. Application: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
 - a. Apply materials to all surfaces, corners, contours, and interstices, to provide a uniform final appearance without streaks.
 - b. After work is complete, remove protection no longer required. Remove tape and adhesive marks.
 2. Brushes: Use brushes that are resistant to chemicals being used.
 - a. Metal Substrates: If using wire brushes on metal, use brushes of same metal composition as metal being treated.
 - b. Wood Substrates: Do not use wire brushes.
 3. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.
 - a. Equip units with pressure gages.
 - b. Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from surface and apply material in horizontal, back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

- c. For chemical spray application, use low-pressure tank or chemical pump suitable for chemical indicated, equipped with nozzle having a cone-shaped spray.
- d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
- e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.

B. Paint Removal with Hand Tools: Remove paint manually using hand-held scrapers, wire brushes, sandpaper, and metallic wool as appropriate for the substrate material.

3.6 SUBSTRATE REPAIR

A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.

B. Cementitious Material Substrate:

- 1. General: Repair defects including dents and chips more than 1/4 inch (6 mm) in size and all holes and cracks by filling with cementitious patching compound and sanding smooth. Remove protruding fasteners.
- 2. New and Bare Plaster: Neutralize surface of plaster with mild acid solution as recommended in writing by paint manufacturer. In lieu of acid neutralization, follow manufacturer's written instruction for primer or transition coat over alkaline plaster surfaces.
- 3. Concrete, Cement Plaster, and Other Cementitious Products: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. If surfaces are too alkaline to paint, correct this condition before painting.

C. Gypsum-Plaster and Gypsum-Board Substrates:

- 1. Repair defects including dents and chips more than 1/8 inch (3 mm) in size and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners.
- 2. Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.

D. Metal Substrate:

- 1. Preparation: Treat repair locations by wire-brushing and solvent cleaning. Use chemical or mechanical rust removal method to clean off rust.
- 2. Defects in Metal Surfaces: Repair non-load-bearing defects in existing metal surfaces, including dents and gouges more than 1/16 inch (6 mm) deep or 1/2 inch (13 mm) across and all holes and cracks by filling with metal-patching compound and sanding smooth. Remove burrs and protruding fasteners.
- 3. Priming: Prime iron and steel surfaces immediately after repair to prevent flash rusting. Stripe paint corners, crevices, bolts, welds, and sharp edges. Apply two coats to surfaces that are inaccessible after completion of the Work.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage paint-remover manufacturer's factory-authorized service representative for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.
- B. Paint Material Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for composition and dry film thickness.
 - 1. Paint Composition: The following procedure may be performed at any time and as often as Owner deems necessary during the period when paints are being applied:
 - a. Testing agency will sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance of paint materials with product requirements.
 - c. 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. Remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.
 - 2. Dry Film Thickness:
 - a. Contractor shall touch up and restore painted surfaces damaged by testing.
 - b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.8 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.

END OF SECTION 09 01 90.52

SECTION 09 05 61.13 MOISTURE VAPOR EMISSION 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. Fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

1.3 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Product Test Reports: For each MVE-control system, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Preinstallation testing reports.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F (18 deg C) and not more than 85 deg F (29.4 deg C) at least 48 hours before use.
 2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29.4 deg C) and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
 3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F (3 deg C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
1. MVER: Maximum 15 lb of water/1000 sq. ft. (6.80 kg of water/92.9 sq. m) when tested according to ASTM F1869.
 2. Relative Humidity: Maximum 100 percent when tested according to ASTM F2170 using in situ probes.
- B. Water-Vapor Transmission: Through MVE-control system, maximum 0.10 perm (5.75 ng/Pa x s x sq. m) when tested according to ASTM E96/E96M.
- C. Tensile Bond Strength: For MVE-control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D7234.

2.2 MVE-CONTROL SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ARDEX Americas.
 2. Custom Building Products.
 3. Laticrete International, Inc.
 4. Schönox; HPS North America, Inc.
- B. MVE-Control System: ASTM F3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce

MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.

1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

2.3 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi (20.68-MPa) compressive strength after 28 days when tested according to ASTM C109/C109M.
- B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.
- C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's gypsum or hydraulic cement-based underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Preinstallation Testing:
 1. Testing Agency: Engage a qualified testing agency to perform tests.
 2. Alkalinity Testing: Perform pH testing according to ASTM F710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
 3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Install MVE-control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Internal Relative Humidity Test: Using in situ probes, ASTM F2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.

4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE-control system to prepared concrete substrate and test according to ASTM D7234.
 - a. Proceed with installation only where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.
- B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.
 1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
 2. Provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
 4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
 5. Fill surface depressions and irregularities with patching and leveling material.
 6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
 7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
 8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.
- C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

- A. Install MVE-control system according to ASTM F3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
 1. Install primers as required to comply with manufacturer's written instructions.
- B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.
- C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.
- D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.

- E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.
- F. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform installation inspections.
- B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.
 - 1. Verify that surface preparation meets requirements.
 - 2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
 - 3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.
- C. MVE-control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

- A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.
- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION 09 05 61.13

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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 2-1/2 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: 1/2-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 non-slotted 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.
 2. Isolation Strip at Exterior Walls: Provide one of the following:
 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 2. 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, counter-splaying, 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. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
2. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

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, or 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. Locations: Restrooms, plumbing rooms, janitor's closet, break room break room walls between base and wall cabinets where sinks are located, and walls to which drinking fountains are attached and adjacent within 1'-0".
 - a. Not to be used in shower areas at floors, walls, or ceilings.
 - 2. Core: 5/8 inch (15.9 mm), Type X.
 - 3. Long Edges: Tapered.
 - 4. 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 non-sag, paintable, non-staining 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 1/4-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 30 13 CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Ceramic wall tile.
 2. Ceramic floor tile.
 3. Waterproof membrane.
 4. Metal edge strips.

1.2 ACTION SUBMITTALS

- A. Samples: For tile, grout and accessories.

1.3 QUALITY ASSURANCE

- A. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
1. Waterproof membrane.
 2. Metal edge strips.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.6 EXTRA MATERIALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Tile and Trim Units: Furnish 2 boxes of each type of tile noted in the Architectural Finish Schedule.
 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type of tile noted in the Architectural Finish Schedule.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

- A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. Manufacturers and Products:
1. Composition: Glazed Ceramic.
 2. Module Size: As indicated in the Architectural Finishes Schedule.
 3. Thickness: Manufacturers standard.
 4. Finish: Manufacturer's standard glaze.
 5. Tile Color and Pattern: As indicated in the Architectural Finishes Schedule and in the drawings.
 6. Grout Color: As selected by Architect from manufacturer's full range of standard colors.
 7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

2.2 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
1. All door thresholds: Schluter-RENO-black brushed anodized aluminum floor transition.

2.3 SETTING MATERIALS

- A. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
1. Manufacturers: Per manufacturers' recommendations.

2. For wall applications, provide nonsagging mortar.

2.4 GROUT MATERIALS

- A. High Performance Cement Grout: ANSI A118.7.

1. Polymer Type: Unsanded, dry, redispersible form, prepackaged with other dry ingredients.

2.5 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

- B. Polyethylene Sheet: Uncoupling polyethylene membrane with a grid structure of square cavities, each cut back in a dovetail configuration, and an anchoring fleece laminated to the underside.

- C. Manufacturers: 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. Basis-of-Design: Schluter Systems.

- D. Waterproof Membrane Product:

1. Basis-of-Design: DITRA for 1/8 inch (3 mm) mat.
DITRA-XL for 5/16 inch (7 mm) mat.

2.6 MISCELLANEOUS MATERIALS

- A. Metal Edge Strips:

1. Outside corners: Schluter-RONDEC brushed nickel, anodized aluminum corner bead.
2. Cove and inside corners: Schluter-DILEX-AHK brushed nickel, anodized aluminum.
3. Top edges: Schluter-JOLLY brushed nickel, anodized aluminum.

- B. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.
- C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Refer to drawing for tile pattern. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
 2. Glazed Wall Tile: 1/16 inch (1.6 mm).
- G. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- H. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- I. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 13

SECTION 09 51 13 ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated including physical characteristics and performance criteria.
- B. Evaluation Reports: For each suspension system, submit ICC ES-1222 report showing compliance.

1.4 CLOSEOUT SUBMITTALS

- A. Provide manufacturer's requirement for maintenance of washable acoustical ceiling panels as part of the Operation and Maintenance Manual as specified in Division 1.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS

- A. Manufacturer and Product: (No Substitution)
1. Manufacturer: USG.
 2. Product: Mars High-NRC/High CAC with plant-based binder, complying with ASTM E 1264.
- B. Physical Characteristics:
1. Type and Form: Type IV, mineral base with membrane-faced overlay.
 2. Form 1&2, nodular and water felted.
 3. Pattern: E & C (smooth and light texture).
 4. Size: per Architectural Finish Schedule and as indicated on drawings.
 5. Thickness: 22mm (7/8-inch).
 6. Edge: Angled Tegular (SLT).
 7. Surface Finish: Factory-applied latex paint.
 8. Surface Finish Color: White.
- C. Performance Criteria:

1. Noise Reduction Coefficient (NRC): 0.90.
2. Ceiling Attenuation Class (CAC): 35.
3. Fire Rating: Class A (per ASTM E84).
4. Flame Spread Index: 25 or less.
5. Smoke Developed Index: 50 or less.
6. Light Reflectance: 0.90.
7. Sag Resistance: Warranted to withstand relative humidity of up to 95% at 49° C (120°F) without sagging, warping, or delaminating for 30 years.

2.2 CEILING SUSPENSION SYSTEM

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Manufacturer and Product: (No Substitution)
 1. USG Donn Centricitee DXLT 9/16" Acoustical Suspension System, Intermediate duty, narrow faced, capped, double web cold-rolled suspension system.
 2. Color: White.
- C. Attachment Devices: Sized for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 1. Size: Provide yield strength at least 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung), but not less than 2.69-mm- (0.106-inch-) diameter wire.
- E. Hold-Down Clips: Manufacturer's standard product; spaced 610 mm (24 inches) o.c. on all cross tees where required by fire Codes or in entrance vestibule(s).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Measure each ceiling area and center panels in space.
- C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
 2. Do not attach hangers to steel deck tabs or to steel roof deck.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 406 mm (16 inches) o.c. and not more than 76 mm (3 inches) from ends, leveling with ceiling suspension system to a tolerance of 3 mm (1/8 inch) in 3658 mm (12 feet). Miter corners accurately and connect securely.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 09 51 13

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SECTION 09 54 23 LINEAR METAL CEILINGS

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 strip, linear metal pans and suspension systems for ceilings.

1.3 DEFINITIONS

- A. LR: Light Reflectance coefficient.
- B. NRC: Noise Reduction Coefficient.

1.4 COORDINATION

- A. Coordinate layout and installation of linear metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For components with factory-applied color and other decorative finishes.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below:
 - 1. Linear Metal Pan: Set of 12-inch- (300-mm-) long Samples of each type and color and a 12-inch- (300-mm-) long spliced section.
 - 2. Suspension System Members: 12-inch- (300-mm-) long Sample of each type.
 - 3. Exposed Molding and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
 - 4. Filler Strips: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
 - 5. Sound Absorber: 12 inches (300 mm) long.
 - 6. End Cap: Full size.

1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Linear pattern.
 2. Joint pattern.
 3. Ceiling suspension members.
 4. Method of attaching hangers to building structure.
 5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
 6. Ceiling perimeter and penetrations through ceiling; trim and moldings.
 7. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each linear metal ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For linear metal ceiling and components and anchor and fastener type.
- E. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Linear Metal Ceiling Components: Quantity of each pan, carrier, accessory, and exposed molding and trim equal to 5 percent of quantity installed.
- B. Deliver linear metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- C. Handle linear metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install linear metal ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Exterior linear metal ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling pans; or permanent damage to fasteners and anchors:
1. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa), acting inward or outward.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.
- C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.
 2. Smoke-Developed Index: 50 or less.

2.2 LINEAR METAL CEILING PANS

- A. Acoustical Metal Pan Standard: Provide manufacturer's standard linear metal pans of configuration indicated that comply with ASTM E1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E795.
- B. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
1. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C635/C635M.
 - a. Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A879/A879M, 04Z (12G) coating; surface treatment as recommended by finish manufacturer for type of use and finish indicated.
 - b. Chemical/Mechanical Finishes: Uncoated steel sheet complying with ASTM A1008/A1008M with luster or bright finish as required by finisher for applying electroplating or other metallic-finishing processes.

- C. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated to snap on and be securely retained on carriers without separate fasteners, and finished to comply with requirements indicated.
- D. Pan Splices: Construction same as pans, in lengths 6 inches (150 mm); with manufacturer's standard finish.
- E. End Caps: Manufacturer's standard material; fabricated to fit and conceal exposed ends of pans.
- F. Filler Strips: Manufacturer's standard material; fabricated to uninterruptedly close voids between pans.
- G. Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same metal and finish as linear metal ceiling pans.
- H. Sound-Absorbent Pads: Provide width and length to completely fill between carriers, joined at center of panel, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E84, and to comply with the following requirements:
 - 1. Unwrapped, Glass-Fiber Insulation: Black-coated, unfaced, glass-fiber insulation complying with ASTM C553, Type I, II, or III, not less than 1-lb/cu. ft. (16-kg/cu. m) density, treated to be nondusting, and as follows:
 - a. Thickness: 1 inch (25 mm).

2.3 METAL SUSPENSION SYSTEMS

- A. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C635/C635M requirements.
- B. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.
 - 1. Cast-in-Place and Post-installed Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Post-installed expansion anchors.

- J. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.
- K. Edge Moldings and Trim: Provide exposed members as indicated or required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic unless otherwise indicated.
 - 1. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

2.4 STEEL PANS AND SUSPENSION SYSTEM FOR LINEAR METAL CEILING

- A. Steel Pans and Suspension System:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Armstrong "Metalworks Linear-Synchro system
- B. Classification: Units complying with ASTM E1264 for Type XX, other types described as perforated steel strips with sound-absorbent fabric backing.
 - 1. Pattern: Manufacturer's standard micro-perforated panels.
- C. Pan Thickness: Not less than 0.024 inch (0.6 mm).
- D. Pan Edge Detail: Manufacturer's standard edge detail.
- E. Linear Module Width and Pan Face Width: As indicated on Drawings.
- F. Pan Depth: Not less than 1 to 1-1/2 inches (25 to 38 mm) deep.
- G. Pan Face Finish: Electroplated finish selected from manufacturer's full range.
- H. End Cap, Finish of Exposed Portions: Manufacturer's standard finish.
- I. Filler Strip Design: An integral extension of pan profile.
- J. Filler Strip, Finish of Exposed Portions: To match pan.
- K. NRC: Not less than 0.75.
- L. Suspension-System Main-Carrier Material: Manufacturer's standard material and protective finish.

2.5 ACCESSORIES

- A. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors of required size, permitting upward or downward opening.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. High-Humidity Finish: Comply with ASTM C635/C635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

2.7 STEEL SHEET FINISHES

- A. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
- B. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical, bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.
 - 1. For wood-grained finishes (if used): Run grain of directional finishes with long dimension of each piece.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which linear metal ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of linear metal ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of linear metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and on Coordination Drawings.

3.3 INSTALLATION

- A. Comply with ASTM C636/C636M and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers but without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- D. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- F. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- G. Install linear metal pans in coordination with suspension system and exposed moldings and trim.
1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
 2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
 3. Install pans with butt joints using internal pan splices and in the following joint configuration:
 - a. As indicated on the drawings.
 4. Where metal pan ends are visible, install end caps unless trim is indicated.
 5. Install filler strips where indicated.
 6. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.
- H. Install hold-down clips where indicated.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
1. Suspended ceiling system.
 2. Hangers, anchors, and fasteners.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections: Testing and inspecting of completed installations of linear metal ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of linear metal ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - a. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select 1 of every 2 post-installed anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

- D. Linear metal ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 54 23

**SECTION 09 65 13
RESILIENT AND METAL BASE AND 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. Resilient wall base.
 2. Metal wall base
 3. Rigid vinyl corner guard

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of product indicated, in manufacturer's standard-size.

1.4 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

- A. Resilient Base (WB-1):
1. Manufacturer and Product: (No Substitution)
 - a. Mannington Commercial: Edge Effects Collection, Etched
- B. Resilient Base Standard: ASTM F 1861.
1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
 2. Style: Non-Cove, flat.

- C. Minimum Thickness: 0.25 inch.
- D. Height: 4.25 inches.
- E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- F. Outside Corners: Job formed or pre-formed.
- G. Inside Corners: Job formed or pre-formed.
- H. Colors and Patterns: As indicated in the Architectural Finishes Schedule.

2.2 METAL WALL BASE

- A. Metal Wall Base (WB-2):
 - 1. Manufacturer and Product basis of design:
 - a. Stylmark, Inc.: TrimMaker,
 - b. Style/Profile – refer to Drawings,
 - c. Color/finish – Black anodized
 - d. Base Mounting – Standard aluminum base option

2.3 RIGID VINYL CORNER GUARDS

- A. Rigid Vinyl corner guard system: Extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added.
 - 1. Manufacturer and Product basis of design:
 - a. InPro Corporation Tape-On Corner Guards.
 - b. Size: ¾" wing size x 12'-0" height x 90 degrees.
 - c. Install: Tape-on.
 - d. Color: See finish schedule.
 - e. Thickness: .080" (2mm).

2.4 INSTALLATION MATERIALS

- A. Resilient Base: Adhesives - Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
- B. Metal Base: Manufacturer's standard clip system for the profile(s) selected.
- C. Rigid Vinyl Corner Guards:
 - 1. Factory applied double faced foam tape.
 - 2. Field applied heavy duty adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Do not install resilient products until they are same temperature as the space where they are to be installed.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.

3.3 METAL BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing metal wall base.

3.4 RIGID VINYL CORNER GUARDS

- A. General: Locate the corner guard as indicated on the approved detail drawing for the appropriate substrate and in compliance with the IPC installation instructions. Install corner guard level and plumb at the height indicated on the drawings.
- B. Installation of Tape-on Corner Guards:
 - 1. Surface must be clean, dry and properly sealed.
 - 2. Installation with factory applied foam tape - Remove release paper from the foam tape.
 - 3. Installation with Heavy Duty Adhesive - Cut the smallest opening possible in the spout. Apply a continuous bead of adhesive on each wing of the corner guard.
 - 4. Position the corner guard on the substrate corner.
 - 5. Starting at the bottom, press into place, working upward until entire corner guard is in place.
 - 6. Roll surface with IPC Extension Roller.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient and metal products.

END OF SECTION 09 65 13

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SECTION 09 65 19 RESILIENT TILE 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. Rubber floor tile.

1.3 ACTION 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. Samples: Units not less than 6-by-6 inch of each color and pattern of floor tile required.
- C. Installer's Qualifications: Provide letter from tile manufacturer confirming the tile installer meets the requirements provided in the "Quality Assurance" Article.

1.4 CLOSEOUT SUBMITTALS

- A. Provide manufacturer's requirement for maintenance of resilient sheet flooring as part of the Operation and Maintenance Manual as specified in Section 01 78 23.
- B. Provide manufacturer's standard warranty for requirements listed in the "Warranty" article of this section for carpeting as part of the Operation and Maintenance Manual as specified in Section 01 78 23.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Provide resilient flooring manufactured by a firm with a minimum of 10 years' experience with resilient flooring of types specified.
1. Color Matching: Provide resilient flooring products, including wall base and accessories, from one manufacturer to ensure color matching.
 2. Manufacturer capable of providing technical training and field service representation.
- B. Installer Qualifications: Installer shall be manufacturer approved for the requirements of the project or INSTALL (International Standards & Training Alliance) resilient certified for the requirements of the project.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.
- B. Deliver materials sufficiently in advance of installation to condition materials to the required temperature prior to installation.

1.7 PROJECT CONDITIONS

- A. Maintain temperature and humidity at service levels or 20° C (68° F), ± 3° C (5° F), and 50% RH ± 10% in areas to receive resilient flooring. Specified temperature shall be maintained at least 48 hours before, during, and 72 hours after installation.

1.8 WARRANTY

- A. Provide manufacturer's standard five-year warranty against defects in manufacturing and workmanship of all flooring products. Provide manufacturer's warranty as specified under each product as applicable, including limited wear, defect and conductivity.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Performance Requirements:
 - 1. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore Standard.

2.2 RUBBER FLOOR TILE FOR COMMERCIAL TRAFFIC

- A. Manufacturer and Products: (No Substitution):
 - 1. Nora Systems, Inc.: Grano 3.5 mm tile Article 1880, color – refer to Drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate required by the resilient floor manufacturer in a 24 hour time period.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level percentage required by the resilient floor manufacturer.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis.

- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply number of coats recommended by manufacturer.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 68 13 TILE CARPETING

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 modular, tufted carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.
- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.
 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.
- B. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."

1.7 PROJECT CONDITIONS

- A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
- B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.8 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, and delamination.
 - 3. Warranty Period: Lifetime.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT-1)

- A. Manufacturer and Products: (No Substitution)
 - 1. Mohawk, Inc.: GT154 Faculty Remix carpet tile.
- B. Size: 24 by 24 inches (610 by 610 mm).
- C. Color: Refer to Architectural Finishes Schedule.

2.2 WALK OFF CARPET (WOCPT)

- A. Manufacturer and Products: (No Substitution)
 - 1. Bentley Mills: Rough Idea Shear Entryway Tile
- B. Size: 24 by 24 inches (610 by 610 mm).
- C. Color: Refer to Architectural Finishes Schedule.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 72 00 WALL COVERINGS

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. Vinyl wall covering.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36-inch- (914-mm-) long in size.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.
- B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 Wall Covering Materials

- A. Manufacturer and Products

1. Manufacturer: Carnegie
2. Product: Arcade+

- B. Description: Provide products in rolls from same production run and complying with the following:

- C. Total Weight: 18 oz/lineal yd.

- D. Width: 52 inches (132 cm).
- E. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 - 2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 3. Metals: If not factory primed, clean and apply primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 4. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 5. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 WALL-COVERING INSTALLATION

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

- C. Install strips in same order as cut from roll.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.
- E. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- F. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

- A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 00

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SECTION 09 77 23 FABRIC-WRAPPED 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 shop-fabricated, fabric-wrapped wall panels.
- B. Related Sections:
1. Section 09 72 00 "Wall Coverings" for adhesively applied textile wall coverings.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include fabric facing, panel edge, core material, and mounting indicated.
 2. Include plans, elevations, sections, and mounting devices and details.
 3. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 4. Include details at cutouts and penetrations for other work.
 5. Include direction of fabric weave and pattern matching.
- B. Samples for Initial Selection: For each type of fabric facing.
1. Include Samples of hardware and accessories involving color or finish selection.
- C. Samples for Verification: For the following products:
1. Fabric: Full-width by approximately 36-inch- (900-mm-) long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
 2. Panel Edge: 12-inch- (300-mm-) long Sample(s) showing each edge profile, corner, and finish.
 3. Core Material: 12-inch- (300-mm-) square Sample at corner.
 4. Mounting Devices: Full-size Samples.
 5. Assembled Panels: Approximately 36 by 36 inches (900 by 900 mm), including joints and mounting methods.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Electrical outlets, switches, and thermostats.
 2. Items penetrating or covered by panels including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Alarms.
 - e. Sprinklers.
 - f. Access panels.
 3. Show operation of hinged and sliding components covered by or adjacent to panels.
- B. Product Certificates: For each type of panel.
- C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of panel to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd. (9 sq. m), full width of bolt.
 2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.8 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.
1. Build mockup of typical wall area 48 inches (1200 mm) wide by full height. Include intersection of wall and ceiling, corners, and perimeters.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install panels until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install panels until a permanent level of lighting is provided on surfaces to receive the panels.
- C. Air-Quality Limitations: Protect panels from exposure to airborne odors such as tobacco smoke and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify panel locations and actual dimensions of openings and penetrations by field measurements before fabrication and indicate them on Shop Drawings.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace panels and components that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Fabric sagging, distorting, or releasing from panel edge.
 - b. Warping of core.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as

determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 FABRIC-WRAPPED WALL PANELS

- A. Fabric-Wrapped Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
 1. Fliz Felt
 2. Thickness: 3 mm
 3. Panel Shape: As indicated on Drawings.
 4. Mounting: Edge mounted with splines secured to substrate.
 - a. Finish Color at Exposed Edges: Match color of facing material.
 5. Mounting: Back mounted with manufacturer's standard adhesive, secured to substrate.
 6. Panel Width: As indicated on Drawings.
 7. Panel Height: As indicated on Drawings.

2.4 MATERIALS

- A. Core Materials: Manufacturer's standard.
 1. Glass-Fiber Board: ASTM C612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m), unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
 2. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of panel and the other part to substrate, designed to permit unit removal.

2.5 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch (1.6 mm) for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated panels, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting panel performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.
- C. Align fabric pattern and grain as indicated on Drawings.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm) in 48 inches (1200 mm), noncumulative.
- B. Variation of Joint Width: Not more than 1/16 inch (1.6 mm) wide from reveal line in 48 inches (1200 mm), noncumulative.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 77 23

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SECTION 09 80 00 ACOUSTIC TREATMENT

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 acoustical baffles.

1.3 REFERENCES

- A. The following is a list of standards which may be referenced in this section: ASTM International (ASTM):
1. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 2. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For sound-absorbing ceiling hung units provide layout and dimensions of panels indicating work. Include mounting devices and details.
- C. Samples: for each exposed product and for each fabric, color and texture specified.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
1. Upon delivery to Site, inspect materials for damage, dampness, and wet storage stains.
 2. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 3. Do not uncrate materials until ready for use.
- B. Storage:

1. Store panels on edge, positioned to allow moisture to run off rather than accumulate on the faces.
2. Separate so air can circulate around every surface.
3. Protect products from weather, abuse, defacement, and damage.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CLOUDS

A. Manufacturers and Products:

1. Lucid Textiles: Ecocore - Colours

B. Manufactured Units:

1. Configuration: Custom cut by CNC or waterjet machines per Architect's design.
2. Material: 100% Polyester.
3. Thickness: .47 inches (12 mm).
4. Sheet Size: 48.32 inches x 110 inches max. - As indicated on the Drawings.
5. Colors: selected from manufacturer's standard color range, as indicated on Drawings.
6. Mounting Accessories: As recommended by manufacturer for installation and in conformance with applicable anchorage and bracing requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF ACOUSTICAL CLOUDS

- A. Install in accordance with manufacturer's current printed instructions.
- B. Provide acoustical clouds in sizes and at locations shown on Drawings. Follow manufacturer's recommended installation and anchorage methods.

3.2 INSTALLATION OF WALL PANELS

- A. Install in accordance with manufacturer's current printed instructions.
- B. Provide acoustical wall panels in sizes and at locations shown on Drawings. Follow manufacturer's recommended installation and anchorage methods.

3.3 CLEANING

- A. Follow manufacturer's instructions for cleaning panels soiled during installation. Replace panels that cannot be cleaned to as new condition.

3.4 FINISHES

- A. Exposed Surfaces: Free of dents, scratches, abrasions, or other visible defects.

END OF SECTION 09 80 00

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 Masonry Units.
 3. Galvanized metal.
 4. Wood and PVC foam (Fypon).
 5. 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).
- 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 14 00 INTERIOR SIGNAGE

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. Interior Building Signage

1.3 DEFINITIONS

- A. Retain this Article if term in paragraph below remains after this Section has been edited.
- B. ABA Accessibility Guidelines: Architectural Barriers Act (ABA) Accessibility Guidelines."

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 Literature and Product Data: For each type of product indicated.
- C. Shop Drawings: Show fabrication and installation details for signs that comply with requirements on Drawings.
1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 2. Provide message list, timesteps, graphic elements, including tactile characters and Braille, and layout for each sign.
- D. Color Charts for 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. Sign Schedule: Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

- A. Warranties: Provide manufacturer and installer warranties with requirements specified in "Warranties" article with submission of O&M manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- B. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines

1.7 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors and sign lamination.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INTERIOR BUILDING SIGNAGE

- A. Products:
 - 1. Reference the architectural drawings pertaining to interior building signage.
- B. Material: Colored opaque acrylic sheet, matt finish.
- C. Sign and Frame Profiles: As indicated on the drawings.
- D. Graphic Content and Style: Provide sign copy that complies with requirements indicated on drawings for size, style, spacing, mounting height and location, material, finishes, and colors of signage.
- E. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of slide-in inserts.
- F. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ABA Accessibility Guidelines. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
- G. Mounting Height: As indicated on the drawings.

2.2 ACCESSORIES

- A. Mounting Methods: Use silicone adhesive fabricated from materials that are not corrosive to sign material and mounting surface.

2.3 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items including anchor inserts are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 75 mm (3 inches) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
 - 2. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Government.

END OF SECTION 10 14 00

SECTION 10 21 13.19 PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for blocking.
2. Section 09 22 16 "Non-Structural Metal Framing" for blocking.
3. Section 10 28 13 "Toilet and Shower Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

- A. Coordinate requirements for blocking, reinforcing, and other supports concealed within walls.**

1.3 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For solid-plastic toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: Actual sample of finished products for each type of toilet compartment indicated.

1. Size: Manufacturers standard size.
2. Include each type of hardware and accessory.

- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates:

1. Product Certificates: For each type of toilet compartment by manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: 5 hinge(s) with associated fasteners.
2. Latch and Keeper: 5 latch(es) and keeper(s) with associated fasteners.
3. Door Bumper: 2 bumper(s) with associated fasteners.
4. Door Pull: 2 door pull(s) with associated fasteners.
5. Fasteners: 10 fasteners of each size and type.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Department of Justice "2010 ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Bradley Corp.: Bradmar Solid Plastic (HDPE) Series 400 - Sentinel
- B. Toilet-Enclosure Style: Floor Mounted - Refer to drawings.

- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
 - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 - 2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 3. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.
- E. Pilaster Shoes: Manufacturer's standard design; stainless steel.
- F. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, clear-anodized aluminum.
 - 2. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories, Standard Duty: Manufacturer's standard operating hardware and accessories.
 - 1. Material: Clear-anodized aluminum.
 - 2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit, designed for emergency access, and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.

- B. Aluminum Extrusions: ASTM B221 (ASTM B221M).
- C. Brass Castings: ASTM B584.
- D. Brass Extrusions: ASTM B455.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- F. Stainless Steel Castings: ASTM A743/A743M.
- G. Zamac: ASTM B86, commercial zinc-alloy die castings.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts. Provide shoes at posts to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PLASTIC TOILET COMPARTMENTS

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:

- a. Pilasters and Panels: 1/2 inch (13 mm).
 - b. Panels and Walls: 1 inch (25 mm).
 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.
 - a. Locate wall brackets, so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust, so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust, so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- E. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust, so doors are level and aligned with panels, when doors are in closed position.
- F. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.19

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SECTION 10 22 39 FOLDING PANEL PARTITIONS

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. Electrically operated, acoustical panel partitions.

- B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
2. Section 09 29 00 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.
3. Electrical and communications Sections for electrical service and connections for motor operators, controls, and limit switches and for system disconnect switches.

1.3 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Class.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

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

1. Include plans, elevations, sections, attachment details.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
3. Include diagrams for power, signal, and control wiring.

- B. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

- C. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
1. Textile Facing Material: Full width by not less than 36-inch- (914-mm-) long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 2. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches (75 mm) square.
 3. Panel Edge Material: Not less than 3 inches (75 mm) long.
 4. Hardware: One of each exposed door-operating device.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 2. Suspended ceiling components.
 3. Structural members to which suspension systems will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Smoke detectors.
 - f. Access panels.
 6. Plenum –fire, smoke, and acoustical barriers.
- B. Setting Drawings: For embedded items and cutouts required in other work.
- C. Qualification Data: For Installer.
- D. Product Certificates: For each type of operable panel partition.
- E. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.
- F. Field quality-control reports.
- G. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.
 - c. Electric operator and controls.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design seismic bracing of tracks to structure above.

- B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
 2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C423, and rated for not less than the NRC indicated.
 3. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E336, determined by ASTM E413, and rated for 10 dB less than STC value indicated.
- C. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
1. Basis of Design:
 - a. North Wall of 1104: Skyfold, Zenith Premium Model C.
 - b. Dividing Wall of 1104: Skyfold, Zenith Model B
- B. Panel Operation: Electrically operated, vertical lift panels.
- C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: As indicated in the Drawings.
- E. STC: Not less than 51.
- F. Panel Weight: 11 lb/sq. ft. (55 kg/sq. m) maximum.
- G. Panel Thickness: Nominal dimension of 4 inches (102 mm).
- H. Panel Materials: Manufacturer's standard, unless otherwise indicated in the Drawings.
- I. Panel Closure: Manufacturer's standard unless otherwise indicated.
- J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
- K. Finish Facing: as indicated in the Drawings.

2.3 SEALS

- A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:
 1. Manufacturer's standard seals unless otherwise indicated.
 2. Seals made from materials and in profiles that minimize sound leakage.
 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
- B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous, resilient acoustical seal.
- C. Horizontal Top Seals: resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.
- D. Horizontal Bottom Seals: Manufacturer's standard continuous-contact seal exerting uniform constant pressure on floor.
- E. Horizontal Bottom Seals: Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

2.4 PANEL FINISH FACINGS

- A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant non-staining adhesive as recommended by facing manufacturer's written instructions.
- B. Fabric Wall Covering: Manufacturer's standard fabric, from same dye lot, treated to resist stains.
 1. Color/Pattern: As selected by Architect from manufacturer's full range.

- C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum mounted directly to overhead structural support, with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch (2.54 mm) between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

2.6 ELECTRIC OPERATORS

- A. Factory-assembled electric operation system of size and capacity recommended and provided by operable panel partition manufacturer for partition specified; with electric motor and factory-prewired motor controls, speed reducer, chain drive, control stations, control devices, and accessories required for operation. Include wiring from control stations to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
- B. Comply with NFPA 70.
- C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
- D. Motor Electrical Characteristics:
1. Horsepower: Manufacturer's standard.
 2. Volts: 230.
 3. Phase: Polyphase.
 4. Hertz: 60.
- E. Control Stations: Two single-key-operated, constant-pressure control stations located remotely from each other on opposite sides and opposite ends of partition run. Wire in series to require simultaneous activation of both key stations to operate partition. Each three-position control station labeled "Open," "Close," and " Stop." Furnish two keys per station.
- F. Obstruction-Detection Devices: Equip each motorized operable panel partition with indicated automatic safety sensor that causes operator to immediately stop and reverse direction.
1. Sensor Edge: Contact-pressure-sensitive safety edge along partition's leading edge.
 2. Sensor Mat: Electrically operated, contact-weight-sensitive safety mat in storage pocket area.
 3. Infrared Sensor System: Designed to detect an obstruction in partition's path and sound an audible alarm, without obstruction contacting partition.

G. Safety Requirements:

1. System shall have primary and secondary safety systems in the event a single safety system would fail.
2. System must contain a certified load arrestor to stop a free fall occurrence. Motor brakes that simply reduce the downward fall speed are unacceptable.
3. System must contain an entrapment backup system on the lead edge of the panel that automatically reverses downward movement when lead edge makes contact with an obstruction within the path of the system.
4. System must contain certified Type B2 safety monitoring relay switches that can sense any failures between each limit switch and the control box as the partition is operated during every cycle. The safety monitor switches must automatically shut off power to the motor drives if a failure occurs.
5. System must contain a constant contact finger switch as the lead panel operates within the guide rail and immediately shut off the motor drive power in the event of a free fall detection or an obstruction on the lead edge.
6. Single key station with continuous pressure actuation.
7. Additional push button switch located at opposite end of the partition for full view of the opening on both sides during operation.
8. Option: Non-contact optical beams must be installed to detect objects that may inadvertently move under the partition during operation.
 - a. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop operable panel partition at fully extended and fully stacked positions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, floor levelness, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- B. Install panels in numbered sequence indicated on Shop Drawings.
- C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

- E. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 FIELD QUALITY CONTROL

- A. NIC Testing: Engage a qualified testing agency to perform tests and inspections.
 - 1. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing.
 - 2. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E336, determined by ASTM E413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- B. An operable panel partition installation will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust panels to operate smoothly and easily, without binding or warping.
- C. Verify that safety devices are properly functioning.

3.5 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 10 22 39

SECTION 10 28 13 TOILET AND SHOWER ACCESSORIES

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. Public-use washroom accessories.
 2. Underlavatory guards.
 3. Custodial accessories.

1.3 ACTION SUBMITTALS

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

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 Contracting Officer.
1. Source limitations does not apply to toilet accessories noted as sole sourced.

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 to prevent delay in Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) 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.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers and Products: Subject to compliance with requirements, available manufacturers and products that may be incorporated into the Work include but are not limited to the following. The Government will not preapprove bidders.
 - 1. Bobrick Washroom Equipment, Inc. (Basis-of-Design)
 - 2. American Specialties, Inc.
 - 3. Bradley Corporation.
- B. Toilet Paper Dispenser (TPD): OFCI
- C. Electric Hand Dryers (EHD): Excel HO-BL Hands On, Surface Mounted, LEXAN Cover, White, 30 second time cycle, 120V.
- D. Sanitary Napkin Disposal (SND): B-270
- E. Rolled Paper Towel Dispenser (PTD): OFCI
- F. Soap Dispensers (SD): OFCI
- G. Waste Receptacle (WR): B-2260
 - 1. Floor-Standing Waste Receptacle with Open Top 21 Gallon).
- H. Grab Bars:
 - 1. (GB1): B-6806.99 x 42
 - 2. (GB2): B-6806.99 x 36
 - 3. (GB3): B-6806.99 x 18

2.3 UNDERLAVATORY GUARDS

- A. Manufacturers and Products: Subject to compliance with requirements, available manufacturers and products that may be incorporated into the Work include, but are not limited to the following. The Government will not preapprove bidders.
 - 1. Plumberex Specialty Products, Inc.
 - 2. Truebro by IPS Corporation.
 - 3. TCI Products.

B. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded-plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Manufacturers and Products: Subject to compliance with requirements, available manufacturers and products that may be incorporated into the Work include but are not limited to the following.

1. Bobrick Washroom Equipment, Inc. (Basis-of-Design)
2. American Specialties, Inc.
3. Bradley Corporation.

B. Mop Strip: (MS) B-223 x 24.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of four keys to Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 13

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SECTION 10 44 11
FIRE PROTECTION CABINET – KNOX BOX

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. Fireman's lock box – Knox Box.

1.3 ACTION SUBMITTALS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Product provided shall be sole sourced in compliance with local fire department's requirements.
1. Product: Knox Company 3200 Series KNOX-BOX with tamper switch.
 - a. Exterior Dimensions: Surface Mount – 4" H X 5" W x 3-3/4" D.
 - b. Lock: Manufacturer's standard. Key cylinder to fire department's master.
 - c. Color: Factory coated, color Black.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fireman's lockbox unit surface mounted to post at vehicle entrance gate as indicated on the civil drawings.

END OF SECTION 10 44 11

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SECTION 10 44 13 FIRE EXTINGUISHER CABINETS

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. Prefinished semi-recessed wall-mounted fire extinguisher cabinets.

1.3 ACTION SUBMITTALS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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.

1. Basis-of-Design Manufacturer: Larsen.

2.2 FIRE-PROTECTION CABINETS

- A. Basis-of-Design Product: MP10 (10 lb. multi-purpose fire extinguisher).

- B. Characteristics:

1. Enameled-steel, semi-recessed cabinets for fire extinguisher.
2. Color: Red.
3. Trim Style: Square trim semi-recessed.
4. Door and Trim Material: Enameled steel.
5. Door Glazing: Tempered float glass.
6. Door Style: Vertical duo.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cabinets such that the vertical distance to fire extinguisher handle within the cabinet does not exceed 48 inches above finished floor.

- B. Identification: Apply decal(s) in white lettering to door with letters reading “FIRE EXTINGUISHER” vertically top to bottom.

END OF SECTION 10 44 13

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
1. Fire Extinguishers: NFPA 10 listed and labeled for the type, rating, and classification of extinguisher.

1.3 ACTION SUBMITTALS

- A. Submittals: Product Data.

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, 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 54 inches above finished floor to top of fire extinguisher.
- B. Install fire extinguishers in mounting brackets and 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. Division 22
B. Division 26

1.3 DESCRIPTION

- A. Furnish and install a complete inside "lubrication system" as herein described and shown on drawings. The system is an extension of the existing system. 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 (existing to be reused)
 7. Installation
 8. Adapters
 9. Emergency Shut Off
 10. Vehicle Oil Pump (Waste Oil System)
 11. 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.
- #### **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 16' above the floor in the repair shop and on the supports in the vehicle parking area. One portion of the procedure is being emphasized as follows, but in no way minimizes the remaining manufacturers' installation instructions.
- 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.

B. Equipment by Lincoln, Graco, 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 year limited parts and labor warranty, and have metal product identification tags.
2. Bulk Fluid #1, Bulk Fluid #2, Bulk Fluid #3, Bulk Fluid #4 and Anti Freeze.
 - a. #83464-50 Lincoln 50' x 1/2" 2250 psi WP hose
 - b. Lincoln Hose Inlet Kit
 - c. #769 Lincoln Control valve
 - d. #768 Lincoln Control valve
 - e. #Lincoln Solenoid valve with ready lights at all reels
 - f. #Lincoln Medium pressure inlet hose kit (comes with hose Reel)
 - g. #Lincoln Lubricant Filter
 - h. #66084 Lincoln 2,000 psi shut-off ball valve
 - i. #Lincoln Non-metered dispensing valve
 - j. #3867 Lincoln metering control valve, 60 quart, preset countdown.(to be used at each Stations, 30 reels)

D. Emergency Shut off for Each Set of Hose Reels, Lube Dispensing Station and Waste Oil Tank:

1. This contractor shall add normally open air solenoid valves, panic push button for shut off and wiring from push button to solenoid valves to shut off supply air to air pumps. Connect solenoid to nearest power circuit.
2. System shall operate by closing air solenoid valves at air pump inlets when panic button is pushed.
3. Include sign indicating "emergency shut off for lubrication reels." (d)
4. Locations: Mount panic button on wall or support at 4' above floor near lube areas as described below:
5. The waste oil tank should have an auto shout off when it reaches 95% full. This should be done by interrupting the air supply only to the waste oil tank via an air solenoid at the tank and each pump station.

E. Pumps

1. At EACH group of lube reels (7 locations)
2. All pumps shall have a minimum 4" diameter air motor size and the lubrication pumps shall have a limited parts and labor warranty.

3. General Lubrication: Fluid #1, Bulk Fluid #2, Bulk Fluid #3, Bulk #4 and Anti Freeze

Quantity	Part #	Description
35	2014	Lincoln Powermaster 3, 10:1 ratio stub pump with 4" diameter air motor and 6" stroke and built-in air muffler with remote wall mount brackets/supports
35	74024	Lincoln 2' air connect hose
35	1230060	Lincoln 5' x 3/4" product hose
35	83132	Lincoln Bung adapter
35	82439	Lincoln low-level cut off
35		Thermal relief valves
35	Local	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.

4. Miscellaneous Pump Accessories

Quantity	Part #	Description
35	83168	Lincoln 1/2" air regulator and gauge
35	70332	Lincoln 3/4" product shut off ball valve
35	66084	Lincoln 1/2" pump air shut off ball valve
35	6600112	Lincoln 3/4" airline filter
35	600212	Lincoln 3/4" airline lubricator
35	70332	Lincoln 3/4" shut-off ball valve for main airline

F. Above Ground Tanks (existing Tank will be reused)

G. Vehicle Oil Pump (Waste Oil pump), 2 Stations,

1. A UL listed evacuation pump is to be mounted on wall 48" above the floor and include air filter, regulator, oiler, 6' x 3/4" suction hose, quick disconnect couplers, shut off valves and back check valves.

Quantity	Part #	Description
2	4100	Lincoln UL evacuation kit. Includes: a 1" inlet UL double
2	256200	Lincoln 1/4" air valve
2	84824	Lincoln overfill warning valve for double wall Tank or
2	72060	Lincoln 5' air connecting hose
2	Local	Local Y-strainer
2	241408	Lincoln 1" fluid coupler
2	613	Lincoln portable waste oil receiver
2	66493	Lincoln 16 gallon drum with threaded hole base
2	84714	Lincoln 20 gallon portable waste oil truck cart

2	241409	Lincoln 1" fluid nipple
2		Air shut off valves

- a. Other miscellaneous items required for proper system function

H. Piping:

1. Vehicle Oil Piping: Black steel ASTM A53 threaded pipe
2. All piping shall be as required for intended use and per industry standards.
3. Piping:
 - a. Oil, etc.: 1" OD steel tubing with a wall thickness of 0.083" with matching joint systems is the minimum piping size – final size by this contractor.

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.
 6. 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.
 7. Holes through exterior walls shall be waterproofed and made watertight.
 8. The Contractor shall patch and return to original condition all areas damaged, sawcut, core drilled, etc. on this project and site.

9. 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.
10. 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. 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.
11. 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 1/2 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.
12. This contractor shall protect existing/New building, structure, drives, walks, equipment, etc. and furnishings when sawcutting, 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.
2. Where walls are not available, provide steel sandwich panels mounted on pipe legs and floor flange.
3. 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.
4. 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:
 - a. Check existing locations, elevations and pitches of present piping before making connections to same;
 - b. Report immediately to Architect in writing any existing conditions which will prohibit the installation of new work;
 - c. Await Architect's decision on approximate adjustment of line locations and elevations before proceeding.
 5. 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.
 6. 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 1 1/4" plastic or brass tags with 1/4" 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

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. Relocate the existing fuel dispenser that is located in the old service lane. Run a new temporary fuel line to the existing building generator. Once the new natural gas generator the temporary line will be removed. Furnish, deliver, unload, store, protect and install all equipment and piping so as to provide a complete operating system.

1.3 SHOP DRAWINGS

- A. 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 for the dispenser will required to be installed 1” fiberglass with .016 aluminum outer jacket (not required at the temporary generator fuel piping)..
- B. Dispenser: Existing Unit to be relocated
- C. Existing Fuel Master Fuel Management System will be relocated by this contractor. Unit will be cleaned and repainted by this contractor.
- D. Generator Fuel pump: Supply a self-contained, automatic fuel oil transfer and monitoring system to ensure a reliable supply of fuel oil to the existing emergency generator. The system shall include automatic pump set lead/ lag, storage tank and day tank level monitoring, leak monitoring, LCD operator display, manual back-up stations, time and date stamped alarm and event summary. The control system shall be microprocessor-based and can be expanded by adding additional FSC modules. The Automatic Fuel Oil Transfer Pump Set and monitoring system shall be Preferred Utilities Mfg. Corp. Danbury, CT Model ATPSF-101 rated at 23/24 GPH of (No. 2), (No. 4), (Diesel) oil against a discharge pressure of 15 PSIG.

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 existing dispenser should be relocated and all the old none used Fuel lines should be removed.
- 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.

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 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 13 19 STATIONARY LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Recessed adjustable loading dock levelers.
2. Truck restraints.
3. Light communication systems.

- B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for curb angles at edges of recessed pits and loading dock platform edge channels.
2. Section 11 13 13 "Loading Dock Bumpers" for loading dock bumpers that are not integral with loading dock levelers.

1.3 DEFINITIONS

- A. Operating Range: Maximum amount of travel above and below the loading dock level.
- B. Working Range: Recommended amount of travel above and below the loading dock level for which loading and unloading operations can take place.

1.4 COORDINATION

- A. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.
- B. Coordinate installation of cast-in-place items. Furnish setting drawings and templates.
- C. Electrical System Roughing-in: Coordinate layout and installation of loading dock equipment with connections to power supplies and interlocked equipment.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of loading dock equipment.

3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for stationary loading dock equipment.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For stationary loading dock equipment.
1. Include plans, elevations, sections, and attachment details.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of anchors and each field connection.
 3. Include diagrams for power, signal, and control wiring.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Welding certificates.
- C. Product Test Reports: For each dock leveler, for tests performed by manufacturer and witnessed by a qualified testing agency.
1. Indicate compliance of dock levelers with requirements in MH 30.1 for determining rated capacity based on comprehensive testing within last two years of current products.
 2. Submittal Form: According to MH 30.1.
- D. Sample Warranty: For manufacturer's special warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For stationary loading dock equipment to include in operation and maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
1. Maintenance Proximity: Not more than one hours' normal travel time from Installer's place of business to Project site.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.10 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of construction contiguous with stationary loading dock equipment, including recessed pit dimensions, slopes of driveways, and heights of loading docks, by field measurements before fabrication.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace dock levelers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracked or broken structural support members, load-bearing welds, and front and rear hinges.
 - b. Faulty operation of operators, control system, or hardware.
 - c. Deck plate failures including cracked plate or permanent deformation in excess of 1/4 inch (6 mm) between deck supports.
 - d. Hydraulic system failures including failure of hydraulic seals and cylinders.
 2. Warranty Period for Structural Assembly: 10 years from date of Substantial Completion.
 3. Warranty Period for Hydraulic System: Five years from date of Substantial Completion.
 4. Warranty shall be for unlimited usage of leveler for the specified rated capacity over the term of the warranty.

PART 2 - PRODUCTS

2.1 RECESSED LOADING DOCK LEVELERS

- A. General: Recessed, hinged-lip-type dock levelers designed for permanent installation in concrete pits preformed in the edge of loading platform; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.
1. Basis of Design: Rite Hite, RHH-4000 Hydraulic Dock Leveler or comparable product by one of the following:
 - a. McGuire; a division of Systems, Inc.
 - b. Poweramp, a division of Systems, Inc.
 - c. Serco; 4Front Engineered Solutions, Inc.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. 208/230/460/575V, 60 Hz, three phase
- C. Standard: Comply with MH 30.1.
- D. Rated Capacity: Capable of supporting total gross load of 30,000 (13 608) lb (kg) without permanent deflection or distortion.
- E. Platform: Not less than 5/8- (16-) inch- (mm-) thick, nonskid steel plate.
1. Platform Width: 7'-0"
 2. Platform Length: 8'-0"
 3. Frame: Manufacturer's standard.
 4. Toe Guards: Equip open sides of dock leveler over range indicated with steel toe guards.
 - a. Toe-Guard Range: Entire upper operating range.
- F. Hinged Lip: Not less than 5/8- (16-) inch- (mm-) thick, nonskid steel plate.
1. Hinge: Full-width, piano-type hinge with heavy-wall hinge tube and grease fittings, with gussets on lip and ramp for support.
 2. Safety Barrier Lip: Designed to protect material-handling equipment from an accidental fall from loading platform edge of the dock leveler when the leveler is not in use.
- G. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform.
1. Vertical Travel: Operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact with the following minimum working range:
 - a. Above Adjoining Platform: 12 inches (305 mm).
 - b. Below Adjoining Platform: 12 inches (305 mm).
 2. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed shall compensate automatically for upward or downward movement of truck bed during loading and unloading.
 3. Automatic Lateral Compensation: Tilting of ramp with lip extended and resting on truck bed shall compensate automatically for canted truck beds of up to 4 inches (102 mm) over width of ramp.
 4. Lip Operation: Manufacturer's standard mechanism, which automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck and automatically retracts lip when truck departs.
 - a. Length of Lip Extension: Not less than 12 inches (305 mm) from face of dock bumpers and not less than) measured from ramp edge.
 5. Automatic Ramp Return: Automatic return of unloaded ramp, from raised or lowered positions to stored position, level with platform, as truck departs.

6. Interlock: Leveler does not operate while leveler night lock is engaged.
- H. Hydraulic Operating System: Electric control from a remote-control station; fully hydraulic operation. Electric-powered hydraulic raising and hydraulic lowering of ramp. Equip leveler with a packaged unit including a unitized, totally enclosed, nonventilated electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity of leveler indicated. Include means for lowering ramp below platform level with lip retracted behind dock bumpers. Provide a hydraulic velocity fuse connected to main hydraulic cylinder to limit loaded ramp's free fall to not more than 3 inches (76 mm).
1. Remote-Control Station with Emergency Stop: Weatherproof multibutton control station with an UP button of the constant-pressure type and an emergency STOP button of the momentary-contact type, enclosed in NEMA ICS 6, Type 4 box. Ramp raises by depressing and holding UP button; ramp lowers at a controlled rate by releasing UP button. Ramp movement stops, regardless of position of ramp or lip, by depressing STOP button. Normal operation resumes by engaging a manual reset button or by pulling out STOP button.
 - a. Dual-Panel Control Station: Remote-control station for operating side-by-side dock levelers.
 - b. Master Panel: Control panel with integral fused disconnecting means for operating dock leveler, dock door, and truck restraints.
 2. Independent Lip Operation: Electric-powered hydraulic raising and hydraulic lowering of lip, controlled independent of raising and lowering of ramp.
- I. Construction: Fabricate dock-leveler frame, platform supports, and lip supports from structural- or formed-steel shapes. Weld platform and hinged lip to supports. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles.
1. Cross-Traffic Support: Manufacturer's standard method of supporting ramp at platform level in stored position with lip retracted. Provide a means to release supports to allow ramp to descend below platform level.
 2. Maintenance Strut: Integral strut to positively support ramp in up position during maintenance of dock leveler.
- J. Integral Laminated-Tread Dock Bumpers: Fabricated from 4- (112-) inch- (mm-) thick, multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch- (19-mm-) diameter, steel supporting rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles.
- K. Materials:
1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 2. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from steel plate complying with ASTM A572/A572M, Grade 55 (380).
 3. Steel Tubing: ASTM A500/A500M, cold formed.

4. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- L. Dock-Leveler Finish: Manufacturer's standard baked-on factory finish.
1. Toe Guards: Baked-on factory finish.
- M. Accessories:
1. Curb Angles: 3-by-3-by-1/4-inch (76-by-76-by-6-mm) galvanized-steel curb angles for edge of recessed leveler pit, with 1/2-inch- (13-mm-) diameter by 6-inch- (152-mm-) long concrete anchors welded to angle at 6 inches (152 mm) o.c.
 2. Night Locks: Manufacturer's standard means to prevent extending lip and lowering ramp when overhead doors are locked.
 3. Abrasive skid-resistant surface.

2.2 TRUCK RESTRAINT DEVICE

- A. General: Manufacturer's standard device designed to engage truck's rear-impact guard and hold truck at loading dock. Vertical, face-of-dock mounting type hydraulic restraint mechanism with light communication system and instructional signs, compatible with dock control station, as follows. Arm shall move vertically, automatically adjusting to varying height of truck due to loading and unloading operations.
1. Basis of Design: Rite Hite "Dok-Lok SHR 5000" or Architect approved comparable product.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
1. 208/230/460/575V, 60 Hz, three phase
- C. Standard: Comply with MH 30.3.
- D. Rated Capacity: Capable of supporting total gross load of 30,000 (13 608) lb (kg) without permanent deflection or distortion.
- E. Operating Range: Capable of restraining rear-impact guards within a range from:
1. Vertical Range: Minimum of 9 inches (229 mm) to maximum of 30 inches (762 mm) above driveway.
 2. Horizontal Range: Zero to 12 inches (305 mm) in front of dock bumpers.
- F. Power Operating System: Manufacturer's standard electromechanical or hydraulic unit.
1. Dock Leveler Remote-Control Station: Single-button station of the constant-pressure type, enclosed in NEMA ICS 6, Type 12 box. Restraint is engaged by depressing and holding button; restraint is released by releasing button.
 2. Interlock: Leveler does not operate while truck restraint is not engaged.

- G. Rear-Impact-Guard Sensor: Detects presence of rear-impact guard and automatically returns to stored position if rear-impact guard is not engaged. If hook loses engagement during operation, restraint will automatically re-fire to re-establish engagement.
- H. Caution Signs: Exterior, surface mounted; designed to inform both dock attendant and truck driver; with sign copy as follows. Provide one sign at each truck-restraint location.
1. Sign Copy in Forward and Reverse Text: Manufacturer's standard text permitting truck movement with green light.
 2. Interior Sign Copy: Manufacturer's standard text permitting truck movement with green light.
- I. Light Communication System: Red and green illuminated signal-light sets, with lens approximately 4 inches (102 mm) in diameter, designed to indicate status to both dock attendant and truck driver. Equip system with steel control panel located at interior of dock that includes illuminated lights indicating status of exterior signal lights. Provide signal-light set and control panel at each location indicated for light communication system. Enclose exterior signal-light sets in steel or plastic housing with sunshade.
1. Manual Operation: System is activated by push button or switch located on truck-restraint control panel.
 2. Automatic Operation: System is activated automatically when device engages rear-impact guard. Provide on-off switch located on truck-restraint control panel.
 3. Mounting: Wall.
- J. Alarm: Audible and visual system indicating that rear-impact guard is not engaged, with manual reset.
- K. Materials:
1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 2. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from steel plate complying with ASTM A572/A572M, Grade 55 (380).
 3. Steel Tubing: ASTM A500/A500M, cold formed.
 4. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- L. Truck-Restraint Finish: Manufacturer's standard electrodeposited zinc coating.
- M. Accessories: Interlock to dock leveler.
- 2.3 LIGHT COMMUNICATION SYSTEMS**
- A. General: Communication system consisting of signal-light sets, caution signs, alarms, and controls for each location indicated.
1. Basis of design: Rite Hite
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Caution Signs: Surface mounted; designed to inform both dock attendant and truck driver; with sign copy as follows:
1. Exterior Sign Copy in Forward and Reverse Text: Manufacturer's standard text permitting truck movement with green light.
 2. Interior Sign Copy: Manufacturer's standard text permitting truck movement with green light.
 3. Mounting: Wall
- D. Signal-Light Sets: Red and green illuminated signal-light sets, with lens approximately 4 inches (102 mm) in diameter, designed to indicate status to both dock attendant and truck driver. Equip system with steel control panel that includes illuminated lights indicating status of exterior signal lights; locate control panel at interior of dock. Provide signal-light set and control panel at each location indicated for light communication system. Enclose signal lights in steel or plastic housing, with exterior signal-light sets equipped with sunshade.
1. Automatic Operation: Lights are activated automatically by photoelectric sensor mounted on overhead door track. Provide on-off switch located on control panel.
 2. Mounting: Wall
- E. Materials:
1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 2. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from steel plate complying with ASTM A572/A572M, Grade 55 (380).
 3. Steel Tubing: ASTM A500/A500M, cold formed.
 4. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.4 FINISH REQUIREMENTS

- A. Finish loading dock equipment after assembly and testing.
- B. Hot-Dip Galvanizing: Comply with the following:
1. ASTM A123/A123M for iron and steel loading dock equipment.
 2. ASTM A153/A153M or ASTM F2329/F2329M for iron and steel hardware for loading dock equipment.
- C. Spray Zinc Metallizing: ASTM B833.
- D. Electrodeposited Zinc Coatings: ASTM B633.
- E. Steel Prime Paint Finish: Clean, pretreat, and apply manufacturer's standard primer.
- F. Baked-on Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
1. Color: Manufacturer's standard.
 2. Toe Guards: Paint to comply with ANSI Z535.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine 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 electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.
- C. Examine walls and floors of pits for suitable conditions where recessed loading dock equipment is to be installed. Pits shall be plumb and square and properly sloped for drainage from back to front of loading dock.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Set curb angles in concrete edges of dock-leveler recessed pits with tops flush with loading platform. Fit exposed connections together to form hairline joints.
- B. Set curb angles in concrete edges of truck-leveler recessed pits with tops flush with driveway. Fit exposed connections together to form hairline joints.
- C. Clean recessed pits of debris.

3.3 INSTALLATION, GENERAL

- A. Install loading dock equipment as required for a complete installation.
 - 1. Rough-in electrical connections.

3.4 INSTALLATION OF RECESSED LOADING DOCK LEVELERS

- A. Attach dock levelers securely to loading dock platform, flush with adjacent loading dock surfaces and square to recessed pit.

3.5 ADJUSTING

- A. Adjust loading dock equipment to function smoothly and safely, and lubricate as recommended by manufacturer.
- B. Test dock levelers for vertical travel and adjust to maintain operating range indicated.
- C. After completing installation of exposed, factory-finished loading dock equipment, inspect exposed finishes and repair damaged finishes.

3.6 MAINTENANCE SERVICE

- A. Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of loading dock equipment Installer. Include quarterly preventive maintenance, repair, or replacement of worn or defective components,

lubrication, cleaning, and adjusting as required for proper loading dock equipment operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain loading dock equipment.

END OF SECTION 11 13 19

SECTION 11 24 29 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 fall arrest system above the metro transit bus which allows user to walk uninterrupted the entire length of the system and provides secure anchorage to arrest a fall by users. System shall be hands-free, allowing user to work with both hands as if normally traveling along walking surface.

- B. Delegated Design:

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.

1.3 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for track system, deceleration devices, trolley, harnesses, and accessories.
 2. Include capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Sealed and signed by a licensed professional engineer responsible for preparation of engineering analysis who thereby certifies preparing or supervising preparation of data to comply with specified requirements and recognized engineering principles and practices. Show plans, elevations, sections, and large-scale details indicating coordination with building structure, relationships with other construction, and coordination with bus clearances. Indicate maximum dynamic and static loads imposed on building structure at points of support. Indicate details of adjoining Work, even though not included in Work of this Section, to ensure coordination of Work and Work of other sections. Schedule and describe anchorage assemblies and their related components. Include data for capacity of each type of fastener for its intended use. Reference detail numbers where applicable. At conclusion of installation, provide “Conforming to Construction” set of Shop Drawings.
- C. Delegated Design Submittal: Sealed and signed by licensed professional engineer who thereby certifies preparing or supervising preparation of data to comply with specified requirements and recognized engineering principles and practices. Include computations for justification of framing elements or sections, connections including fasteners and welds and anchorage assemblies required to support the fall protection system. Provide loads delivered to building.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates: Provide letter signed by manufacturer certifying that the fall protection system components comply with requirements and compliance with contract documents and CFR Part 29 1910.140 with approved drawings and calculations.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fall protection system, to include emergency, operation, and maintenance manuals. Include complete parts list. Include operation and maintenance procedures for proper use and safe operation of equipment.
- 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.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have produced fall protection systems similar to those required for this Project full time for no less than 5 years and shall demonstrate successful installations in the last 5 years, free of litigation, injuries or fatalities resulting from their products or design.

- B. Installer Qualifications: System manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this project full time for no less than 5 years and demonstrate successful installations in the last 5 years, free of litigation, injuries or fatalities resulting from their products or design.
- C. Professional Engineer Qualifications: Professional engineer shall be registered in the manufacturer and be employed by the fall protection manufacturer as a full time fall arrest systems designer.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify field measurements and indicate measurements on Shop Drawings to ensure required fit.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's original unopened protective packaging. Store materials, components, and equipment in original unopened protective packaging off of the ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Fall arrest system manufacturer shall provide secondary framing and bracing required to transmit fall protection loads to the hangar structure support points. Fall arrest system shall be designed to protect users while they are attached to track system. In addition to requirements of this Section. System shall be designed for:
 - 1. Two simultaneous users on rail over metro transit bus for a total of 2 users.
- B. Track System: Single track or dual track fall arrest system, constructed of ASTM A 36/A 36M or ASTM A992/A 992M steel. Components shall be painted safety yellow.
- C. Trolley: All steel body compatible with rail system with 360-degree rotating eye.
- D. Deceleration Devices: Provide one self-retracting lifeline/lanyard (SRL) for each user for which system is designed. Meet or exceed applicable standards of ANSI Z359.13, 29 CFR Part 1910.140, and meeting the following requirements:
 - 1. Maximum Load: 310 pounds.
 - 2. Weight: 20 pounds.
 - 3. Construction: Heavy duty self-contained, portable, sealed aluminum or stainless-steel casing with 3/16-inch minimum stainless-steel wire rope, with swiveling safety snap hooks centrifugal braking system.
 - 4. Cable Length: As required to permit personnel to access the SRL from the ground.
 - 5. Fall Arrest Forces: Less than 900 pounds.

- E. Harnesses: Provide one harness for each user for which the system is designed. Meet or exceed applicable standards of ANSI Z359.11, and 29 CFR Part 1910.140. Full body harness, lightweight nylon, Class III, approved for fall arrest with back and front “D” ring.
- F. Accessories: Meet or exceed standards of ANSI Z359.13 and 29 CFR Part 1910.140.
 - 1. Tagline, nylon filament rope. One on each SRL for the purpose of pulling each cable to floor level for hooking up to the harness.
 - 2. As required for complete installation.
 - 3. Snap hooks.
 - 4. Provide three spare self-retracting lifeline/lanyards and three body harnesses.

2.2 MATERIALS

- A. Fasteners shall be designed and provided by fall protection system manufacturer. All equipment shall be provided by a single source. All materials shall be new and undamaged. Fasteners shall be designed to support a load on the system of two times the maximum design load without failure. Structural steel supporting members supplied by the fall protection manufacture shall comply with Section 05 12 00 “Structural Steel,” and with AWS D1.1/D1.1M.

2.3 FABRICATION

- A. System components shall be of same material unless otherwise indicated. Exposed work shall be true to line and level with accurate angles, surfaces and with straight, square edges. Coordinate anchorage system with hangar structure. Fabricate anchoring devices as recommended by the manufacturer to provide adequate support for intended use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install according to the approved shop drawings and manufacturer's instructions. Install anchorage and fasteners in accordance with manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this Section. Do not load or stress fall arrest system until all materials and fasteners are properly installed and ready for service. Deform threads of all bolted connections after nuts have been installed and torqued to the proper tension or provide prevailing torque lock nuts.

3.2 FIELD QUALITY INSPECTION

- A. Post-Erection Inspection: After erection, Contractor and Contracting Office shall jointly inspect installed system and components to determine compliance with specifications and approved submittals. Systems shall remain out of service until inspection is complete and Letter of Certification has been received by Contracting Officer.
- B. Operational Test: After erection and inspection, statically test the fall protection system in service to determine that each component of system operates as specified, is properly

installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. Rectify deficiencies disclosed by testing and retest system or component to prove that system is fully operational. Any weights required for static proof testing shall be provided by Contractor.

3.3 TRAINING

- A. Operator Training: Provide a minimum of one class (four hour minimum) of operator and maintenance training after system has been installed and proof tested. Training is to be for the users and maintainers of the system conducted at the installation site. The Contractor shall submit attendee list.

3.4 CLEANING

- A. Remove loose materials, crating, and packing materials from premises.

END OF SECTION 11 24 29

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SECTION 12 24 13 ROLLER WINDOW SHADES

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. Manually operated sunscreen roller shades.
 2. Power operated room darkening roller shades.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Samples: Submit full size sample of full range of manufacturer's fabric for each shade type scheduled for confirmation of material by Architect.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Provide assemblies which are complete assemblies produced by one manufacturer, including hardware, accessory items, mounting brackets, and fastening.
- B. Provide materials in weave, density, and colors as selected by the Architect from manufacturer's complete standard products.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 WARRANTY

- A. Manufacturer's standard non-depreciating 25-year limited warranty covering all hardware, chains, and shade cloth.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED SHADES

- A. Basis-of-Design Manufacturer and Product:
 - 1. Manufacturer: MechoShade Corp.
 - 2. Product: MechoShade/5 System.
- B. Solar Shade (WSHD-1)
 - 1. Solar Shadecloth:
 - a. Fabric: ThermoVeil 1300, 5 percent open, 2 by 2 dense basket-weave pattern, colors match 1500 (3 percent open), also 126 inches wide.
 - b. Color: As selected from manufacturer's standard colors by Architect.

2.2 MOTOR OPERATED SHADES

- A. Basis-of-Design Manufacturer and Product:
 - 1. Manufacturer: MechoShade Corp.
 - 2. Product: MechoShade/5 System.
- B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 - a. Electrical Characteristics: 110-V ac.
 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for surface mounting. Provide the following for remote-control activation of shades:
 - a. Group Control Station: Maintained and Momentary-contact, connected with interfaced Audio-visual, Room control station with open, close, and center off functions for single-switch group control.
 4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
- C. Blackout Shade (WSHD-2)
1. Blackout Shadecloth:
 - a. Fabric: ThermoVeil Equinox 0100, blackout shadecloth with opaque acrylic backing, PVC-free, white color reverse side (for exterior). Available 98 inch (24789 mm).
 - b. Color: As selected from manufacturer's standard colors by Architect.

2.3 HARDWARE

- A. Shade system shall be pre-engineered overrunning clutch design that disengages to 90% during the raising and lowering of the shade. The brake can stand a pull force of 40 lb. in the stop position. Requires no adjustment. Self-lubricating hub on to which the brake system is mounted includes an articulated brake assembly which assures smooth, non-jerky operation in raising and lowering the shades. System shall include the following components:
1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
 2. Provide shade hardware that allows for removal and remounting of the shade bands without having to remove the shade tube, drive, or operating support brackets.
 3. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
 4. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
 5. Provide shade hardware system that allow for operation of multiple shade bands (multi-banded shades) by a single chain operator. Connectors shall be offset to assure alignment from the first to the last shade band.
 6. Provide shade hardware constructed of minimum 1/8" thick plated steel or heavier as required to support 150% of the full weight of each shade.

7. Drive Bracket / Brake Assembly:
 - a. Mecho Shade Drive Bracket M5 or equal by equivalent manufacturers.
 - b. Drive Chain: #10 qualified stainless-steel chain rated to 90 lb.
 - c. Minimum Breaking Strength: Nickel plate chain shall not be accepted.

2.4 SHADE BAND

- A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
 1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
 2. Shade **Band** and Shade Roller Attachment:
 - a. Provide extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without deflection. Provide for positive mechanical engagement with drive/brake mechanism.
 - b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable/replaceable with a snap-on/snap-off spline mounting without having to remove shade roller from shade brackets.
 - c. Mounting spline shall not require use of adhesives, adhesive tapes, staples and/or rivets.

2.5 FABRICATION

- A. The shade and the fabric shall hang flat without buckling or distortion. The edge, when trimmed, shall hang straight without curling or raveling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than +/- 1/8" in either direction due to warp distortion or weave design. Shades shall fill window openings from head to sill and jamb to jamb.

2.6 MISCELLANEOUS

- A. Shade Band: As described herein for manual shades.
- B. Finishes: Unless otherwise noted, all exposed aluminum parts have clear anodized finish. Steel parts are to be either nickel plated, satin finish, or have been bonderized prior to painting with a baked, enamel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 ROLLER SHADE INSTALLATION

- A. Coordinate with the work of other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Install the work of this Section in strict accordance with the indicated design and the installation recommendations of the manufacturer.
 - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- C. Upon completion of the installation, put all components through at least ten (10) complete cycles of operation, adjusting as necessary to achieve optimum operation.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

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SECTION 12 46 00
MAGNETIC GLASS DRY-ERASE BOARDS

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 fixed, magnetic, glass dry-erase boards and their mounting systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Submit minimum 6-inch by 6-inch sample in specified finish, with one sample of each piece of mounting hardware.
 2. Manufacturer's product data, including installation data.
 3. Include mounting details, material descriptions, dimensions of individual components and profiles, and finishes including all accessories.
 4. Submit manufacturer's cleaning instructions.
- B. Shop Drawings: Show full-size details, edge details, attachments, etc. Show large-scale elevations, plan views showing room locations and mounting dimensions, cross sections, and tags for each unit to be installed.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty Documentation: Submit manufacturer's written warranty (minimum 20 year) covering material and workmanship, normal wear excepted.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have produced magnetic glass dry-erase boards similar to those required for this Project for no less than 10 years.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify field measurements and indicate measurements on Shop Drawings to ensure required fit.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver only after submittal data is approved and field conditions have been verified.
- B. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- C. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- D. Store and handle materials in accordance with manufacturer's instructions.
- E. Store materials in ventilated place, protected from the weather and with a relative humidity of 60% or less at not less than 60 degrees to 85 degrees Fahrenheit (F).
- F. Protect materials during storage, handling, and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers and Products: Subject to compliance with requirements, available manufacturers and products that may be incorporated into the Work include, but are not limited to, the following.
 - 1. Basis of Design: Glass Whiteboard.com – Professional Series, 2453 American Lane, Elk Grove Village, Illinois, 60007, 1-877-793-1011
 - 2. Other manufacturers: Similar products by other manufacturers:
 - a. Acco Brands – Quartet Brilliance, Four Corporate Drive, Lake Zurich, Illinois 60047, 1-847-541-9500
 - b. Clarus – Float+Depth, 7537 Jack Newell Blvd N, Fort Worth Texas 76118, 1-888-813-7414
- B. Dry-erase boards
 - 1. Steel backed tempered glass.
 - a. Minimum 0.020-inch thick steel plate.
 - 2. Adhesive: Acrylic adhesive sheet.
 - 3. Coating: White enamel baked-on coating.
 - 4. Glass: 6mm thick, tempered, low-iron glass with high-flat, polished edges and square corners.
 - 5. Size: Refer to Drawings.
- C. Accessories: Meet or exceed standards of ANSI Z359.13 and 29 CFR Part 1910.140.
 - 1. Edge grips: Four, round brushed stainless steel.
 - 2. Toggle bolts: 3/16"
 - 3. Accessory tray: Aluminum, minimum 48" long.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Contractor to provide blocking at all install locations.
- B. Examine walls to receive dry-erase boards.
- C. Notify Architect of conditions that would adversely affect installation or subsequent use.
- D. Do not begin installation until unacceptable conditions are corrected.
- E. Install according to the approved shop drawings and manufacturer's instructions. Install anchorage and fasteners in accordance with manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this Section.
- F. Install accessories in accordance with manufacturer's instructions.
- G. Install all accessories in accordance with applicable barrier-free accessibility regulations.

3.2 CLEANING

- A. Clean dry-erase board promptly after installation in accordance with manufacturer's instructions.
- B. Use only chemicals allowed by manufacturer's cleaning instructions (no harsh chemicals).

3.3 PROTECTION

- A. Protect dry erase boards from damage during construction.

END OF SECTION 12 46 00

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SECTION 12 64 00
UPHOLSTERY

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 banquette upholstery.
- B. Related Requirements:
1. Section 06 10 53 "Miscellaneous Rough Carpentry" for banquette framing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of dry-erase wall covering. Include data on physical characteristics, durability, and flame-resistance characteristics.
- B. Shop Drawings: Show location and extent. Indicate seams and termination points.
- C. Samples:
1. Upholstery Fabric: Submit 12"x12" minimum samples for each type of exposed fabric required, of same thickness and material indicated for the Work. If fabrics involve normal color and texture variations, include sample sets showing the full range of variations expected.
 2. Upholstery Foam: Provide range of Highly Resilient Firm foam densities in thicknesses required for determination of "firmness" to be selected.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit for upholstered furnishings to include in the Owner's maintenance manuals. Include precautions for cleaning materials and methods that could be detrimental to dining booth finishes.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer during the immediate past 5 years who has specialized in installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to the manufacturer.
- B. Source Limitations: Obtain each type of upholstered furnishings required, including accessories and mounting components, through one source from a single manufacturer.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify upholstered furnishings layout by field measurements before furnishings piece is fabricated and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that are from the same production run and match products installed. Package extra materials with protective covering for storage and identify with labels describing contents. Deliver the extra materials to Owner's existing facility as directed.
- B. Seat Cushions: Furnish a quantity of full-size units equal to 20 percent of the amount installed.

PART 2 - PRODUCTS

2.1 FABRIC UPHOLSTERED SEATING

- A. General: Fabric-wrapped cushions as noted on drawings.
1. Seat Cushions:
 - a. Padding Thickness; Refer to drawings.
 - b. Padding Density: To be determined with submittal samples.
 - c. Corners: Rounded.
 - d. Attach with method that allows ease of removal for maintenance and cleanability, similar to Velcro or straps and clips. Provide moisture barrier at seat cushion.
 2. Back:
 - a. Padding Thickness; Refer to drawings.
 - b. Padding Density: To be determined with submittal samples.
 - c. Top Corners: Rounded.
 - d. Attachment for seat back cushion with cleats.

2.2 UPHOLSTERY MATERIALS

- A. Upholstery Fabric (UPH-1):
1. Manufacturer: Maharam.
 2. Pattern: Point 466090
 3. Color:001 Ivory and Ember
 4. Content: 97% Rayon, 3% Nylon
 5. Backing: Acrylic
 6. Stain Resistance Application: PFOA-Free Stain Resistant Finish
 7. Width: 53"
 8. Repeat: 31.25 V, 1/2" H

9. Abrasion: 100,000 double rubs.
10. Bolt size: 30 yds.
11. Weight: 26.3oz/ly.
12. Maintenance: S-Clean with mild, waterfree dry cleaning solvent.
13. Country of Origin: USA.
14. Flammability: This textile meets all appropriate flammability requirements for seating.
15. Lightfastness: 40+ Hours.
16. Indoor Upholstery Warranty: 3 years.
17. Install: Railroaded (stripes run vertically).

B. Upholstery Fabric (UPH-2):

1. Manufacturer: Architex.
2. Pattern: Leatheretta.
3. Color: Canister.
4. Content: 80% polyurethane (breathable), 20% Polyester.
5. Repeat: None.
6. Width: 54 in.
7. Weight: 20.0 oz.
8. Backing; Polyester.
9. Cleaning: W:Water-based cleaning agents or foam may be used for cleaning this fabric.
10. Lightfastness 40+ hrs.
11. Fire Codes: CAL TB 117 - 2013 Section I : Pass, UFAC Class I, NFPA 260.
12. Double Rubs: 130,000 double rubs.
13. Hydrolysis: 5weeks.

C. Note: Multiple factors affect fabric durability and appearance retention, including end-user application and proper maintenance. Abrasion results above 100,000 have not been shown to be a reliable indicator of increased durability.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install upholstered furnishings in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions and approved Shop Drawings.

3.3 CLEANING AND PROTECTION

- A. Protect the finished work until date of Substantial Completion.

3.4 OWNER TRAINING

- A. Provide on-site training to Owner's staff on cleaning and maintenance.

END OF SECTION 12 64 00

**SECTION 14 40 00
LIFTS (HOISTS) AND VERTICAL STORAGE UNITS**

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. Work Included:
1. Nine (9) vehicle lifts: ECO 60
 2. One (1) ECO 90
 3. Two (2) vertical storage units:
 - a. one (1) for tire storage and
 - b. one (1) for parts inventory.

- B. Related Work Specified Elsewhere

1. Cast-In Place Concrete Section 03 30 00
2. Plumbing Systems Division 22
3. Electrical Division 26

1.3 SUBMITTALS

- A. Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
1. Shop Drawings: Shop drawings shall include, but not necessarily be limited to, the following:
 - a. Wiring and control schematic and detail diagrams
 - b. Maximum electrical requirements
 - c. Outline dimensions of equipment
 - d. Equipment and component layout
 - e. Details of equipment and controls
 - f. Installation detail
 2. Operation and Maintenance Manuals.

1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

- B. Delivery and Storage of Materials
 - 1. Deliver materials in manufacturer's original sealed containers.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

- A. Manufacturer shall be a reputable manufacturing firm, regularly engaged in the design and manufacture of lifts. All similar items shall be the product of a single manufacturer.
- B. A manufacturer's field service representative shall install the equipment, conduct acceptance testing and train the Owner's personnel in the proper operation and maintenance of the equipment.
- C. The following information shall be provided with the bid documents regarding the manufacturer's experience and qualifications:
 - 1. Provide a minimum of three locations where similar equipment has been provided/installed including the date placed in service.
 - 2. Provide the name and telephone number of individuals at above locations who are familiar with the operation and maintenance of the lift equipment.

1.6 CERTIFICATION REQUIREMENTS

- A. Materials shall comply with ISO, E.N. and meet or exceed 9000 quality standards.
- B. The lift installer shall be certified as a factory authorized installer, trained and authorized by the manufacturer supplying the lift equipment. Certification shall be provided with the bid documents.
- C. The lift manufacturer shall comply with all applicable requirements of the "Buy America" provisions of the Surface Transportation Act as outlined by the Federal Transit Administration and U.S. Department of Transportation.
- D. The Lift Manufacturer shall be held in good standings with the Automobile Lift Institute (ALI).
- E. The lift or lifts, shall be labeled and listed by a Nationally Recognized Testing Laboratory as established by OSHA for conformance to ANSI/ALI ALCTV-1998 Automotive Lifts, "Safety Requirements for the Construction, Care and Use of Automotive Lifts," as published by the American National Standards Institute. The lifts shall be Gold labeled certified with the ALI/ETL certification. The lift company's Quality Management System shall be ISO9001. The lift manufacturer shall comply with all applicable requirements of the Buy America Act.

1.7 APPLICABLE STANDARDS

- A. In addition to the requirements outlined herein, the lift or lifts shall comply with all applicable requirements of Automotive Lift Institute (ALI), American National Standards

Institute (ANSI), and “Safety Requirements for the Construction, Care and Use of Automobile Lifts”, as published by the American National Standards Institute. All electrical apparatus shall be UL Listed.

1.8 WARRANTY

- A. Following completion of installation and start up of lift equipment, the manufacturer shall provide a one (1) year warranty against manufacturing defects in materials, function and workmanship.
- B. Warranty shall include materials and labor necessary to correct defects.
- C. All parts shall be readily available locally in the United States.

PART 2 - PRODUCTS

2.1 SCISSORS IN-GROUND LIFTS

A. Model:

- 1. ECO- 60 as manufactured by Steril-Koni USA Inc.
 - a. General Description: lift shall consist of two lifting units in line with the longitudinal axis of the vehicle, each lifting unit so equipped as to engage the axle and/or suspension as specified herein. One of the two lifting units will be movable fore and aft to affect variable spacing between lifting mechanisms. The other lifting unit shall be fixed.
 - b. Lifting Capacity:
 - 1) Lift shall be capable of raising 60,000 lbs. (27,216 kg), 30,000 lbs. (13,608 kg) Fixed/ 30,000 lbs. (13,608 kg) Moveable.
 - 2) Unbalanced Loads, Moveable 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.
 - c. Travel range for the movable lifting unit is as follows, depending on selected model:
 - 1) 204 inches (ECO 60-17)
- 2. Dimensions:
 - a. Lifting height shall be no less than 70 inches (1,780 mm) as measured from the bolster at full rise to the finished floor.
 - b. Lifting Rate: 90 seconds; 45 inches (1,140 mm) per minute, minimum.
 - c. Maximum depth below finished floor for any structural component or member: 34 inches (864 mm) maximum.
 - d. Movable and fixed lifting unit synchronization: 2 inches (51 mm).
 - e. Lift Units:

- 1) Lift units and continuous recess insert shall be completely removable with no lift components or structural framing permanently embedded in the concrete.
- 2) Lift unit shall be a hydraulically powered, mechanically articulating scissor lift, 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.

3. Movable Lifting Unit:

- a. Movable lifting unit shall relocate horizontally fore and aft while in the fully retracted position.
- b. When the entire travel frame insert has the covers in place and the lift is operational, it forms a continuous recess that shall meet the following design and performance criteria:
 - 1) 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.
 - 2) The movable lifting unit may be recessed below finished floor at any position between the minimum and maximum dimensions of the travel range.
 - 3) The movable lifting unit shall be capable of fore and aft travel while recessed below floor.
- c. 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).
- d. 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.
- e. Aluminum covers for moveable mechanism is 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 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. 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.
- f. Aluminum covers for the moveable mechanism are 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 essentially half moon shaped guide rails in the end section of lift's steel box insert, securely guide the covers as they travel in and out of the recess.
- g. Aluminum covers for the moveable mechanism shall be flush with finished floor within a tolerance of less than 1/8 inch. Covers that are lower than the finished floor are not be acceptable.
- h. Movable lifting unit and the covers shall bear on and slide over UHMW surfaces for low friction and minimal maintenance.

- i. Hydraulically powered carriage drive shall utilize a rack and gear arrangement on both left and right sides for smooth and even fore-aft travel without binding.
 - j. 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.
 - k. All hydraulic and compressed air service lines are fed from control console to moveable lifting unit insert through one PVC chase way per unit.
 - l. All low voltage, intrinsically safe electric service lines shall be fed from the control console to the moveable lifting unit insert through one 3/4 inch rigid conduit per unit, installed to meet local requirements.
4. Fixed Lifting Unit:
- a. Fixed lifting unit shall be drop-in, and bolted in-place with eight 7/8 inch (22 mm) stainless steel anchors.
5. Hydraulic System:
- a. System shall be comprised of high pressure, low volume, single acting, 7 inch (178 mm) diameter cylinders, one in each lifting unit.
 - b. 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.
 - c. High pressure seals shall be internal to the cylinder, where they are protected from salt, dirt, etc.
 - d. Combined, the two cylinders shall only require 7 gallons (26.5 l) of AW 15 hydraulic oil for lifting to full height.
 - e. Each pistons requires 3.5 gallons (13.25 Liters) of hydraulic oil for lifting to full height.
 - f. Each cylinder shall have a hose break velocity fuse (safety check valve) integrally mounted to prevent excessive loss of fluid from the cylinder.
 - g. The hoses shall be of reinforced construction and utilize JIC fittings throughout.
 - h. The hoses feeding the front movable lift carriage shall be supported and contained by a cable carrier to prevent the hoses from dragging or tangling.
 - i. The lift shall be driven by two individual power units, readily available as an off-the-shelf component.
6. Adapters:
- a. The lift system shall include a variety of axle engaging accessory adapters designed to raise heavy vehicles by the axles or chassis. The accessory adapters shall be easily removed for storage and/or change out.
 - b. Adapter Adjustment: Minimum 13.25 inches (337 mm); Maximum 56 inches (1422 mm).
 - c. Bolster Width: 40 inches (1016 mm) minimum.

- d. Bolster and Base Adapters for all lifting units shall recess below finished floor.
 - e. Base adapters shall be restrained to prevent over extension.
 - f. Removal of base adapters shall be accomplished by pulling-up a spring loaded pin and sliding the base adapter off the bolster.
 - g. 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.
7. Controls:
- a. The control system shall conform to all current NEC, UL 201 and OSHA codes.
 - b. The control system shall be PCB operated and continuously monitor all operating functions and safety systems of the lifting units. The control system shall utilize intrinsically safe inclinometers to constantly monitor the elevation of the lifting units to ensure synchronized operation. Synchronization through flow control valves is not acceptable. Control systems that do not constantly monitor the elevation of all lifting units are not acceptable.
 - c. The control system shall have a provision to allow the operator to electronically restrict the maximum lifting height.
 - d. The control system shall provide audio and visual feedback that communicates with the operator. The control system shall facilitate troubleshooting by providing no less than 44 fault codes displayed in numeric fashion on the PCB.
 - e. The enclosure for electrical control components shall be IP 54 rated and have the following controls mounted on the front cover
 - 1) Disconnect switch, 3 phase
 - 2) Push buttons for Lift Raise, Lower and Unlock
 - 3) Selector button for synchronized, moveable, or fixed lifting
 - 4) Push buttons for hydraulic moveable carriage drive
 - f. 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.
 - g. Console access panels shall have key-hole slots and recessed handles for easy removal and installation.
 - h. The control system shall include, on the control box face, a blue HOME indicator lamp. This lamp shall illuminate when all lifting units are fully retracted to inform the operator that the bay is clear to allow entry and exit by the vehicle.
 - i. The control system shall automatically prohibit horizontal movement of the moveable lifting unit when raised above 12 inches A.F.F.
 - j. The control system shall have a provision to allow the operator to open the mechanical locks during rising to reduce noise emission.
 - k. The lift, when fitted with the proper electrical motor, shall operate at the following voltages: 208 (3 phase)
8. Automatic Wheel Base Positioning

- a. The control system shall be equipped with an AWBP (automatic wheel base positioning) system that allows the operator to program not less than 16 wheelbase positions into the control system for reduced set up times. The AWBP system shall include a min. 4 inch 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. Additionally, the color LCD touch screen shall be utilized to display AWBP related error messages and instructions. Once a vehicle has been selected, the moveable lifting unit shall travel to the pre-programmed position without interruptions or stops.
9. Wired Remote Control:
- a. The lift shall be equipped with an ergonomic industrial remote control, rated for use in NEC Class 1, Div. 2, hazardous locations.
 - b. 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)
 - c. Remote control shall allow full function control of the lift, with the following:
 - 1) Push/Pull E-Stop Button
 - 2) Push buttons for Lift Raise, Lower and Unlock
 - 3) Selector button for synchronized lifting
 - 4) Push buttons for hydraulic moveable carriage drive
 - d. 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.
 - e. The control box shall have a provision to disable operation of the remote control during lowering when the bolster is below 12 inches A.F.F.
10. Safety Devices:
- a. Each lifting unit shall be equipped with double lock jaw, gravity engaging, mechanical locks with the first lock position engaging at a minimum height of 18 inches (457 mm).
 - b. Number of Mechanical Lock Stops: 12, minimum.
 - c. Vertical height spacing between each lock stop: 6 inches (152 mm), maximum.
 - d. The mechanical locks shall be made of high strength T-1 steel.
 - e. All push buttons shall be of momentary contact, dead man type.

2.2 SCISSORS STYLE IN-GROUND LIFTS

- A. Scissor style in-ground Lift Model ECO90 as manufactured by Stertil-Koni USA, Inc.
1. General Description:

- a. 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. Two 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.
2. Lifting Capacity:
 - a. 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.
 - b. 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.
 3. Dimensions:
 - a. 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.
 - b. Lifting Rate: 90 seconds; 45 inches (1,140 mm) per minute, minimum.
 - c. Maximum depth below finished floor for any structural component or member: 34 inches (864 mm) maximum.
 - d. Movable and fixed lifting unit synchronization: 2 inches (51 mm).
 - e. Travel range for the movable lifting unit shall be as follows, depending on selected model:
 - 1) ECO 90-17-xx: 204 inches (5,182 mm)
 4. Lifting Units:
 - a. Lifting units and continuous recess inserts shall be completely removable with no lift components or structural framing permanently embedded in the concrete.
 - b. Lifting units shall be hydraulically powered, mechanically articulating scissors, complete with a mechanical locking system.
 - c. All steel surfaces shall be powder coated.
 - d. 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.
 5. Movable Lifting Units:
 - a. The movable lifting unit shall relocate horizontally fore and aft while in the fully retracted position.
 - b. 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:
 - 1) 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.
 - 2) The movable lifting unit may be recessed below finished floor at any position between the minimum and maximum dimensions of the travel range.

- 3) The movable lifting unit shall be capable of fore and aft travel while recessed below floor.
 - c. 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).
 - d. 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.
 - e. 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.
 - f. 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.
 - g. 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.
 - h. 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.
 - i. The movable lifting unit and the covers shall bear on and slide over UHMW surfaces for low friction and minimal maintenance.
 - j. 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.
 - k. 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.
 - l. 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.
 - m. All low voltage, intrinsically safe electric service lines shall be fed from the control console to the movable lifting unit insert through one ¾ inch rigid conduit per lifting unit, installed to meet local requirements.
6. Fixed Lifting Unit:
 - a. The fixed lifting unit shall be bolted in place with eight each 7/8 inch (22 mm) stainless steel anchors.
7. Hydraulic System:

- a. System shall be comprised of three high pressure, low volume, single acting, 7 inch (178 mm) diameter cylinders, one in each lifting unit.
- b. 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.
- c. High pressure seals shall be internal to the cylinder, where they are protected from salt, dirt, etc.
- d. Each cylinder shall require no more than 3.5 gallons (13.25 liters) of hydraulic fluid for lifting to full height.
- e. Combined, the three cylinders shall only require 10.5 gallons (39.75 l) of AW 15 hydraulic fluid for lifting to full height.
- f. Each cylinder shall have a hose break velocity fuse (safety check valve) integrally mounted to prevent excessive loss of fluid from the cylinder.
- g. The hoses shall be of reinforced construction and utilize JIC fittings throughout.
- h. The hoses feeding the movable lift carriage shall be supported and contained by a cable carrier to prevent the hoses from dragging or tangling.
- i. The lift shall be driven by three individual power units, readily available as an off-the-shelf component.

8. Adapters:

- a. 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.
- b. 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.
- c. Sliding base adapters shall be restrained to prevent over extension.
- d. Bolster and base adapters for all lifting units shall recess below finished floor.
- e. Adapter Adjustment: Minimum 13.25 inches (337 mm); Maximum 56 inches (1,422 mm).
- f. Bolster Width: 40 inches (1,016 mm) minimum.

9. Controls:

- a. The control system shall conform to all current NEC, UL 201 and OSHA codes.
- b. The control system shall be PCB operated and continuously monitor all operating functions and safety systems of the lifting units.
- c. The control system shall utilize intrinsically safe inclinometers to constantly monitor the elevation of the lifting units to ensure synchronized operation.
- d. 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.

- e. 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.
- f. On the face of the control console, control elements shall include:
 - 1) "UP" button.
 - 2) "Down" button.
 - 3) "Lock release" button.
 - 4) "Confirm" button
 - 5) 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:
 - a) "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.
 - b) "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.
 - c) "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.
 - d) "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.
 - e) One-touch access to the Guide screen: This area of the touch screen provides to the operator:
 - i. Owner information
 - f) One-touch access to the Information screen: This area of the touch screen provides to all users:
 - i. Owner information
 - ii. Contact information for service provider
 - iii. Equipment time log including lifting unit run times
 - g) One-touch access to the Settings screen which displays various options. The settings screen shall allow control of:

- i. 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).
 - ii. 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.
 - iii. Access to the Shop and Assistance screens: from the Settings screen, authorized users shall have the ability to control the service settings.
- h) One-touch access to the Shop configuration screen options which is PIN protected. The shop configuration screen shall allow adjustment of:
 - i. Edit of owner's details: allows the ability to edit the information displayed on the Owner's field.
- i) One-touch access to the Assistance configuration screen which displays various options and is PIN protected. The maintenance configuration screen shall allow adjustment of:

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

- g. The enclosure for electrical control components shall be IP 54 rated.
- h. 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.
- i. Control console access panels shall have key-hole slots and recessed handles for easy removal and installation.
- j. 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.
- k. The lift, when fitted with the proper electrical motors, shall operate at the following voltages: 208 (3 phase)

10. Safety Devices:

- a. 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).
- b. Number of Mechanical Lock Stops: 12, minimum.
- c. Vertical height spacing between each lock stop: 6 inches (152 mm), maximum.
- d. The mechanical locks shall be made of high strength T-1 steel.
- e. All push buttons shall be of momentary contact, dead man type.

11. Automatic Wheel Base Positioning:

- a. 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.
- b. Once a vehicle has been selected, the movable lifting unit shall travel to the pre-programmed position without interruptions or stops.

12. Wired Remote Control:

- a. The lift shall be equipped with an ergonomic industrial remote control, rated for use in NEC Class 1, Div. 2, hazardous locations.

- b. 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)
- c. Remote control shall allow full function control of the lift, with the following:
 - 1) Push/Pull E-Stop Button
 - 2) Push buttons for Lift Raise, Lower and Unlock
 - 3) Selector button for synchronized (group) or single operation
 - 4) Push buttons for hydraulic movable carriage drive
- d. 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.
- e. 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.

13. HOME Beacon Stack Light:

- a. The lift shall be equipped with an external HOME beacon stack light. This beacon light shall turn green when all lifting units are fully retracted 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.
- b. The beacon light shall have the option to be mounted in a remote location (e.g. by the bay door) for optimum visibility.

2.3 VERTICAL STORAGE UNIT #1 – TIRES

A. Motorized Carousel

- a. Model: #HT54288-0963-SV12 - Custom
- b. Capacity: Max per size
- c. Carrier width: 15'-0"
- d. Height: 15'-0"
- e. Carousel width: 14'-11"
- f. Depth: 9'-4"

2.4 VERTICAL STORAGE UNIT #2 – PARTS

A. Motorized Carousel

- a. Model: #P1812-24-120 - Custom
- b. Height: 16'-3"
- c. Width: 12'-0"
- d. Depth: 6'-3"
- e. Carrier QTY: Max per size

2.5 ACCEPTABLE MANUFACTURERS:

- A. Steril Koni - Lifts
- B. Vidmar – Vertical Storage Units

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until supporting structures have been properly prepared.
- B. If supporting structures preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Transmit submittals and deliverables required by this section.
- B. Furnish product as indicated.
- C. Ensure that substrates are in suitable condition to receive the work of this section.
- D. Clean surfaces thoroughly prior to installation.
- E. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 FABRICATION

- A. Fabricate equipment in accordance with all specifications and approved drawings.

3.4 INSTALLATION

- A. Prior to commencing any on-site work, contractor shall provide facility all the construction details for the lift along with requirements for any specialty embedded items associated with lifts. The contractor and lift installer will closely coordinate requirements during installation phase. Installer shall provide and install materials required for complete and operable installation as indicated on manufacturer's installation drawings.
- B. Provide 3-inch high concrete service pad with chamfered edges under control console.
- C. Install in accordance with manufacturer's instructions.
- D. Test for proper operation, and re-test if necessary, until satisfactory results are obtained.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before substantial completion.

3.6 START-UP DEMONSTRATION

- A. Following installation, the equipment installer shall perform an acceptance test as recommended by the manufacturer. Prior to the test, submit a testing program for approval. The program shall show that the equipment meets all of the conditions described by this specification and that the equipment will perform as intended. Notification of Start-Up Demonstration will be scheduled two weeks in advance of the estimated date.

3.7 TRAINING

- A. After completion of installation the installer shall provide a training program to all operating personnel to correctly demonstrate operation and maintenance procedures of the equipment.
- B. As a minimum training shall include: (1) Proper use and maintenance procedures of the lift; (2) safety features; (3) Cleaning procedures; (4) Proper methods for storage and handling of materials, including troubleshooting; and (5) Servicing, adjusting, routine preventative maintenance.

END OF SECTION 14 40 00

SECTION 21 90 00 WATER BASED FIRE SUPPRESSION SYSTEMS

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 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Fire suppression system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.
- B. Fire Protection Engineer (FPE): For the purposes of these specifications, the FPE shall have one of the following qualifications:
1. The FPE shall be a registered Professional Engineer (PE), who has passed the National Council of Examiners for Engineering and Surveys (NCEES) written examination in fire protection engineering. OR
 2. The FPE shall be a registered Professional Engineer who is regularly engaged in the design of fire protection systems. OR
 3. The FPE shall have Level IV certification for complex fire protection systems layout, plus a minimum of 5 years of work experience in fire protection engineering.
- C. NFPA: National Fire Protection Association

1.3 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.
- B. Standpipe System: Manual Dry-Type, Class I system to include NPS 2-1/2 hose connections for fire department use. Water continuously under pressure available at hose connection supply valves.

1.4 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a FPE, using performance requirements and design criteria indicated.
1. Available fire-hydrant flow modeling indicates the following conditions:
 - a. Date: 08/18/2020

- b. Static Pressure: 86 psig.
 - c. Modeled Flow: 1500 gpm.
 - d. Residual Pressure: 81 psig.
2. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 3. Specific sprinkler design parameters shall be per drawings and per NFPA 13 and per FM Global Property Loss Prevention Data Sheets.
 4. Specific standpipe design parameters shall be per drawings and per NFPA 14 and per FM Global Property Loss Prevention Data Sheets.
 5. Maximum Protection Area per Sprinkler: Per UL listing.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.5 SUBMITTALS

- A. For each item indicated, to be submitted prior to start of construction.
- B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified FPE responsible for their preparation. Design documents shall include the features indicated in NFPA 13, which include but are not limited to:
1. Piping layout, including risers and standpipes.
 2. Valve and sprinkler locations.
 3. Drains and drain outlet locations.
 4. Hydraulically most remote area and sprinkler density.
 5. Hydraulic node locations.
 6. Hydraulic calculations for hydraulically most remote area, including pressures at hydraulic nodes and each sprinkler.
 7. Installation details.
 8. Flow and tamper switch locations.
- D. Fire-Hydrant Flow Test Report: Report shall contain data including, but not limited to:
1. Full name of person who performed the test.
 2. Full name of persons who witnessed the test.
 3. Date of the test.
 4. Static pressure.
 5. Flow rate, and corresponding residual pressure when stated flow rate occurred.
 6. Sketch indicating site location of hydrants used for test.
 7. FPE shall witness or perform the flow test. Flow tests not witnessed or performed by the FPE shall not be used.

- E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable. Contractor shall submit plans to AHJ for review per AHJ requirements.

1.6 CLOSEOUT SUBMITTALS

- A. For each item indicated, to be submitted within 30 days of substantial completion of construction. All submittals shall be delivered to Owner 30 days prior to proposed scheduled final acceptance of system.
- B. Welding certificates, if field welding was performed.
- C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- D. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.
- E. Record Drawings: Submit drawings showing sprinkler system as installed. Drawings shall include, but are not limited to, all features included in the Delegated-Design Submittal.

1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 14, "Installation of Standpipe and Hose Systems."
- D. ASCE/SEI 7, "Minimum Design Loads for Buildings and Other Structures."

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of sprinkler service.

2. Do not proceed with interruption of sprinkler service without Owner's written permission.

1.9 COORDINATION

- A. Coordinate layout and installation of sprinkler systems with other construction, including but not limited to light fixtures, HVAC equipment, and partition assemblies.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Schedule 40.
- B. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10, plain end.
- C. Ferrous fittings per NFPA 13.
- D. Listed ferrous, rubber-gasketed pipe fittings per NFPA 13.
- E. Grooved-Joint, Steel-Pipe Appurtenances:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 2. Pressure Rating: 300 psig (2070 kPa) minimum.
 3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.

4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating: 175 psig (1200 kPa).

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Watts; a Watts Water Technologies company.
2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Design: Two piece.
 - d. Body Material: Bronze or Ductile Iron.
 - e. Stem: Bronze.
 - f. Ball: Chrome plated brass.
 - g. Port: Full.
 - h. Seats: PTFE or TFE.

C. Iron Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig (1200 kPa).
4. Body Material: Cast or ductile iron.
5. End Connections: Lug or Grooved.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Viking Corporation.
 - g. Watts; a Watts Water Technologies company.
2. Standard: UL 312.
3. Pressure Rating: 300 psig (2070 kPa).
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

E. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milwaukee Valve Company.
 - b. NIBCO INC.
2. Standard: UL 262.
3. Pressure Rating: 175 psig (1200 kPa).
4. Body Material: Bronze.
5. End Connections: Threaded.

F. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Tyco Fire & Building Products LP.
 - e. Watts; a Watts Water Technologies company.
2. Standard: UL 262.
3. Pressure Rating: 300 psig (2070 kPa).
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

G. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Valves NPS 2 (DN 50) and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
5. Valves NPS 2-1/2 (DN 65) and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
6. Valve Operation: Integral supervisory switch.

2.4 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. FEBCO.
 - c. Watts; a Watts Water Technologies company.
 - d. Zurn Industries, LLC.

2. Standard: ASSE 1015.
3. Body Material: Lead free bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 (DN 65) and larger.
4. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc. (The).
 - b. Tyco Fire & Building Products LP.
2. Standard: UL 1726.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Type: Automatic draining, ball check.

2.5 FIRE-DEPARTMENT CONNECTIONS

A. Exposed-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Guardian Fire Equipment, Inc.
 - c. Potter Roemer.
 - d. Tyco Fire & Building Products LP.
2. Standard: UL 405.
3. Type: Exposed, projecting, for wall mounting.
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, wall type.
9. Outlet: Back, with pipe threads.
10. Number of Inlets: Two.
11. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."
12. Finish: Polished brass or bronze.

2.6 HOSE CONNECTIONS

A. Nonadjustable-Valve Hose Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Potter Roemer LLC.
 - c. Tyco Fire & Building Products LP.
 - d. Viking Corporation.
2. Standard: UL 668 hose valve for connecting fire hose.
3. Pressure Rating: 300 psig (2070 kPa) minimum.
4. Material: Brass or bronze.
5. Size: NPS 2-1/2 (DN 65).
6. Inlet: Female pipe threads.
7. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.

2.7 SPRINKLER SPECIALTY PIPE FITTINGS

A. Flow Detection and Sprinkler Inspector's Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc. (The).
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

B. Flexible, Sprinkler Hose Fittings:

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Tyco Fire & Building Products LP.
2. Victaulic Company.
3. Viking Corporation.
4. Standard: UL 1474.
5. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
6. Pressure Rating: 175 psig (1200 kPa) minimum.
7. Size: Same as connected piping, for sprinkler.

D. Fire-rated pipe penetration assembly:

1. Listed for the application.

2.8 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Reliable Automatic Sprinkler Co., Inc. (The).
2. Tyco Fire & Building Products LP.
3. Victaulic Company.
4. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Quick response, standard coverage, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

F. Sprinkler Guards: Wire cage with fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Standard: UL 464.
2. Type: Vibrating, metal alarm bell.
3. Finish: Red-enamel factory finish, suitable for outdoor use.

C. Water-Flow Indicators:

1. Standard: UL 346.

2. Water-Flow Detector: Electrically supervised with tamperproof cover.
3. Type: Paddle operated.
4. Pressure Rating: 250 psig (1725 kPa).
5. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Design: Signals that controlled valve is in other than fully open position.

2.10 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Terrice, H. O. Co.
2. Weiss Instruments, Inc.
3. Winters Instruments - U.S.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

D. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 22 11 16 "Supply Piping for Plumbing."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install drain valves on standpipes. Extend drain piping to outside of building.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Fill wet-type sprinkler system piping with water.
- O. Install sleeves and escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
 - 1. Route main drain to exterior. Route auxiliary drains to floor drains or exterior.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

3.6 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes.
- B. Install freestanding hose connections for access and minimum passage restriction.
- C. Install wall-mounted-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Division 10.

3.7 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.8 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.9 IDENTIFICATION

- A. Paint all exterior piping. Apply exterior paint per requirements listed in Division 9.
- B. Paint interior piping where exposed in finished rooms. Paint pipe to match the room background color as viewed from the center of the room. Apply paint per requirements listed in Division 9.
- C. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- D. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26.
- E. Install tags with unique identifier numbers on the following components:
 1. Piping flexible connections.
 2. Valves.
 3. Backflow prevention devices.
 4. Inspector's test fittings.
 5. Alarm devices, including electrical devices.

6. Components not listed above but may potentially require servicing.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 4. Coordinate with fire-alarm tests. Operate as required.
 5. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report test results promptly and in writing to AHJ.

3.11 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.13 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded joints or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 (DN 65) and larger, shall be one of the following:
1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 4. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 5. Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.

3.14 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Finished spaces: Concealed or recessed pendent sprinklers, factory painted white, with escutcheons.
 2. Unfinished spaces: Rough bronze.
 3. Wall Mounting: Sidewall sprinklers.
 4. Spaces Subject to Freezing: dry-barrel pendent sprinklers unless indicated otherwise.
- B. Use sprinklers with temperature ratings higher than expected ambient temperatures. In areas with skylights, use sprinklers with 175 F minimum temperature rating.
- C. Use sprinklers with identical temperature ratings throughout compartments.
- D. Use sprinklers with identical thermal sensitivities throughout compartments.

END OF SECTION 21 90 00

SECTION 22 05 00 COMMON WORK RESULTS FOR PLUMBING

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 ACCURACY OF DATA AND CONTRACT DRAWINGS

- A. The design drawings are diagrammatic and they may not show all physical arrangements, offsets, bends, or elbows which may be required for installation of various materials, equipment, piping, and ductwork systems in allotted spaces. The Contractor shall examine these and other available drawings to determine space limitations and interferences. The Contractor shall be responsible for making any minor changes in location of equipment, pipe and ductwork from that shown on drawings and for all physical details required for installation. Cost for adapting Contractor's work to jobsite conditions shall not be considered as basis of an extra cost to contract. The Contractor shall get approval before proceeding with any change.
- B. Elevation of piping, ductwork and equipment indicated on drawings are to be used as guidelines to assist Contractor with installations. Minor changes to these elevations may be necessary to eliminate unforeseen interferences.
- C. The Contractor must carefully examine the drawings, specifications, and project site, and verify all measurements, distances, levels, materials, equipment, etc. before starting work.
- D. Drawings shall not be scaled for determining exact dimensions or location of equipment.
- E. Except as otherwise specified herein or indicated on drawings, furnish, and install all piping, tubing, valves, specialties and supports to connect fixtures and equipment into their respective systems as required for or incidental to the proper operation of the indicated systems. This shall include the following systems:
1. All miscellaneous piping called for on piping and instrument diagrams, regardless of whether or not indicated in the specifications or on the drawings. Reference shall be made to piping and instrument diagrams, control air piping drawings, and manufacturer's equipment drawings to determine full extent or required piping.

1.3 SUMMARY

- A. This Section includes the following:
1. Joining materials
 2. Dielectric fittings
 3. Escutcheons
 4. Sleeves

5. Sealants
6. Through-penetration firestop assembly
7. Wall and floor penetrations

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings, inside wall spaces, and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. PVC: Polyvinyl chloride plastic.
- G. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.5 SUBMITTALS

- A. Product Data: For the following:
 1. Dielectric fittings.

- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- C. The Contractor or the Contractor's authorized representative must be present to accept delivery of all equipment and materials furnished by him. The Owner's personnel will not knowingly accept, unload, or store anything delivered to the site for the Contractor's use. Inadvertent acceptance of delivered items by a representative of the Owner shall not constitute acceptance or responsibility for any of the materials or equipment. It shall be the Contractor's responsibility to assume all liability for any equipment or materials furnished by him which are delivered to the job site.
- D. Storage of materials on the grounds and within the building shall be in strict accordance with instructions of the Owner. Storage of materials within building shall at no time exceed design carrying capacity of the structural system.
- E. The Owner assumes no responsibility for materials stored in building or on the site. Each Contractor shall assume full responsibility for all losses or damage due to the storing of his materials.
- F. Handle items carefully to avoid damage to components, enclosures and finishes. Follow the manufacturer's rigging instructions when handling and moving equipment.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.9 CODES AND REGULATIONS

- A. All codes and regulations of state and local authorities shall become part of this specification and must be adhered to where they exceed requirements as shown on the drawings or stated in the specifications, without additional cost to the Contract.

1.10 CONTINUITY OF EXISTING SERVICES

- A. Do not interrupt or change existing services without prior written approval. When interruption is required, coordinate length of service time with the Owner to minimize disruption of occupant activities.

1.11 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. The Contractor shall provide operating and maintenance instruction manuals covering each and every item of equipment and devices furnished or erected by the Contractor prior to "Substantial Completion" as required by Division 1.

- B. Each separate manual shall consist of the following:
1. Neatly typewritten table of contents including contractor's name, address, and telephone number; list of each product referenced in manual; and name, address and telephone number of installing contractor and maintenance contractor for each product.
 2. Tabbed sections of catalog data and literature for each product including model number, description and component parts; operating procedures; maintenance procedures; servicing and lubrication schedules; description of sequence of operations; parts lists; illustrations, assembly drawings and diagrams required for maintenance; any additional drawings, diagrams, charts or written text which may be required to supplement product data for particular installation; certified test and balance report; list of control point labels, and wiring diagrams.
 3. Copy of warranty, bond and/or service contract issued for each product including an information sheet for operations personnel with proper procedures in event of a product failure and instances which might affect validity of warranties or bonds.
 4. All literature pertaining to backflow prevention devices shall be in one tabbed section.
 5. Full size sheets, if required, shall be folded into special holding pockets. Faxed, handwritten, or illegible materials are not acceptable.
 6. Simplified Component Locator document which includes the following:
 - a. Cross reference of unique identifier numbers to component descriptions (see "Labeling and Identification" section below for list of required components) arranged in numerical order.
 - b. Scale drawing showing location of each component within 2' of actual location, including elevation above floor.
- C. Prior to final inspection or acceptance, fully instruct designated facility operating and maintenance personnel on operation, adjustment and maintenance of products, equipment, and systems. Review contents of operating and maintenance manual with personnel in full detail to explain all aspects of operations and maintenance.

1.12 PROTECTION OF ROOF

- A. Contractors are cautioned that they must exercise extreme care in any activity involving contact with any installed roof membrane.
- B. Construct protective plywood (3/4 in. thick) runways across the roof for moving, setting, and installing equipment and piping systems. No activity on the roof will be permitted without this protection. Start runways at the point of origin of any equipment placed on roof and terminate at the point of installation on curb or base. At completion of work, or when directed by the Owner, completely remove, neatly and cleanly, without damage to roofing system, these protective items, and runways.
- C. Any and all repairs necessary to bring the roofing system to its original condition shall be made by an approved Roofing Contractor and paid for by the Contractor responsible for the damage.

1.13 WORK COORDINATION

- A. All Trades shall work in cooperation with each other and fit their work into the structure as job conditions may demand. All final decisions as to right-of-way and run of pipes and ducts, etc. shall be made by the Owner. In general, priority shall be arranged as follows: (in order of preference)
1. Recessed lighting fixtures.
 2. Piping which must be drainable, including fire protection piping.
 3. Sheet metal ductwork.
 4. Lighting fixtures.
 5. Plumbing drain lines, downspouts, vents, and sprinkler piping.
 6. Gravity water lines.
 7. Heating hot and chilled water or steam lines.
 8. Refrigerant lines.
 9. Plumbing water supply and gas and air lines.
 10. Electrical conduit.
 11. Control air lines or wiring conduit.

1.14 INSPECTION

- A. The Contractor shall verify the location of underground service, utilities, structures, etc., which may be encountered or be affected by his work and shall be responsible for any damage caused by neglect to provide proper precautions or protection.
- B. Any work that is to be concealed, such as inside walls, inside chases, above ceilings, and inside soffits, shall be inspected by Owner or Architect/Engineer prior to concealment.

PART 2 - PRODUCTS

2.1 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

2. AWWA C110, rubber, flat face, 1/8-inch-thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Solvent Cements and Primers for Joining PVC Plastic Piping:
1. Primer: ASTM F 656.
 2. Cement: ASTM D 2564.
 3. Use primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 4. Use cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
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. Jomar
 - b. Watts
 - c. Zurn/Wilkins
 2. Description:
 - a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
 - b. First End Connection: Solder-joint copper alloy.
 - c. Second End Connection: Threaded ferrous.
- C. Dielectric Flanges:
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. Capitol Manufacturing
 - b. Central Plastics
 - c. Watts
 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig at 180 deg F.

- c. First End Connection: Solder-joint copper alloy.
- d. Second End Connection: Threaded ferrous.

2.3 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe (or pipe insulation, if used) and an OD that completely covers opening. Use one piece, stamped, chrome-plated steel escutcheons with spring clips.

2.4 SLEEVES

- A. PVC Pipe: ASTM D 1785, Schedule 40.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron Pipe: ASTM A 888 or CISPI 301.
- D. Ductile Iron Pipe: AWWA/ANSI C150/A21.50.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.5 FOUNDATION WALL SLEEVES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico
 - 3. Linkseal
- B. Typical product: Linkseal Model CS
- C. Description:
 - 1. Wall Pipe: with integral waterstop on outer dimension. Sized for use with mechanical sleeve seal.
 - 2. Wall Pipe: with integral waterstop on outer dimension. Sized for use with mechanical sleeve seal.
 - 3. Description: Cast iron, ductile iron, or plastic sleeve with integral waterstop on outer dimension. Sized for use with mechanical sleeve seal.

2.6 CASING END SEALS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico
 - 3. Pipeline Seal and Insulator

- B. Typical product: Calpico Model W.
- C. Description:
1. General: Flexible membrane system intended to prevent soil from entering annular space between pipes and casings.
 2. Membrane: Either of the following:
 - a. 1/8" thick flexible coal-tar sheet reinforced with fiberglass.
 - b. 1/8" neoprene.
 - c. 1/8" Buna-N (nitrile).
 - d. 1/8" EPDM.
 3. Clamps: Stainless band clamps.
 4. On split type membranes: Provide adhesive membrane lap seal per manufacturer's installation instructions.

2.7 SEALANTS

- A. Reference Division 7 specification for sealant requirements.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations. Exceptions:
1. Where otherwise indicated on drawings.
 2. Equipment rooms.
 3. Service areas.
 4. Horizontal piping close to ceiling where no ceiling exists.
- D. Where piping is installed exposed, install as follows:
1. Install piping at right angles and parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 2. Install vertical piping close to walls.
 3. Install horizontal piping close to ceilings.
- E. Where piping is installed above accessible ceilings, install piping to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.

- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation where required.
- K. Full lengths of pipe shall be used. Short lengths and couplings will not be permitted.
- L. Where more than one pipe material specification or valve is allowed for a particular service, the Contractor is required to use one and only one of the pipe materials specified throughout project. Two or more different piping materials or valves for same service will not be allowed unless indicated otherwise on drawings or specified herein.
- M. Independently support piping so that its weight shall not be supported by the equipment to which it is connected.
- N. Size reduction shall be made using reducing fittings; bushings are not acceptable.
- O. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.
- P. Cover ends of piping during installation to keep inside of piping clean.
- Q. Piping shall not be routed through electrical rooms or transformer vaults, or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.
- R. Use only wrenches having square flat jaws, or non-metallic strap wrenches on brass specialties; wrench marks not permitted.
- S. Select system components with pressure rating equal to or greater than system operating pressure.
- T. Install escutcheons at exposed piping penetrations of walls, ceilings, and floors in finished spaces.
- U. Fire-Barrier Pipe Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with approved through-penetration firestop assemblies. Refer to Division 07 Section "Penetration Firestopping" for materials.
- V. Aboveground Non-Fire Barrier Pipe Penetrations
 - 1. All except waterproof floors:
 - a. Install sleeves for pipes passing through concrete walls, masonry walls, gypsum-board partitions, concrete floors, and roof slabs.
Exception: Sleeves are not required for core-drilled holes in concrete.
Exception: Permanent sleeves are not required for holes formed in concrete by removable sleeves.

- 1) Install sleeves flush with both surfaces.
Exception: In mechanical rooms, install floor sleeves 2 inches above finished floor.
- 2) Aboveground: Use sleeves that are large enough to provide at least ¼ inch annular clear space between sleeve and pipe or pipe insulation. Use cast iron, galvanized steel, or PVC sleeves on pipe sizes 4 inches and smaller. Use galvanized sheet steel sleeves on pipe sizes larger than 4 inches.
- 3) Aboveground: Seal annular space around outside of sleeves with grout or sealant.
- 4) Aboveground: Seal annular space between pipe (or pipe insulation) and sleeve with flexible sealant. Refer to Division 07 Section "Joint Sealants" for materials and installation.

2. Waterproof floors:

a. Install sleeves for pipes passing through floors.

- 1) Install sleeves flush with bottom surface and 2 inches above finished floor.
- 2) Use sleeves that are large enough to provide at least 1/4 inch annular clear space between sleeve and pipe or pipe insulation. Use cast iron, galvanized steel, or PVC sleeves.
- 3) Seal annular space around outside of sleeves with sealant.
- 4) Seal annular space between pipe (or pipe insulation) and sleeve with flexible sealant. Refer to Division 07 Section "Joint Sealants" for materials and installation.

W. Underground Pipe Penetrations and Transitions

1. Through foundation walls, both sides underground:

a. Install sleeves for pipes passing through foundation walls.

Exception: Sleeves are not required for core-drilled holes in concrete.

Exception: Permanent sleeves are not required for holes formed in concrete by removable sleeves.

- 1) Install sleeves flush with both surfaces.
- 2) Use sleeves that are large enough to provide at least 1-inch annular clear space between sleeve and pipe (or pipe insulation). Use cast iron sleeves.

X. Verify final equipment locations for roughing-in.

Y. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672.
 - 3. PVC DWV Piping: Join according to ASTM D 2855.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. In exposed areas, paint plumbing systems, equipment, and components as specified in Division 09 painting Sections.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.7 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.

- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 22 05 00

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SECTION 22 05 19 METERS AND GAGES FOR PLUMBING

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. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.

- B. Related Sections:

1. Section 22 11 16 "Supply Piping for Plumbing" for water meters inside the building.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For each type of product indicated, to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Terrice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - c. Winters Instruments - U.S.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.

8. Stem: Aluminum, brass, or stainless steel and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
11. Scale Range: 30 deg F 240 deg F

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Type: Stepped shank unless straight or tapered shank is indicated.
4. Bore: Diameter required to match thermometer bulb or stem.
5. Insertion Length: Length required to match thermometer bulb or stem.
6. Lagging Extension: Include on thermowells for insulated piping and tubing.
7. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Terrice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - c. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel ;4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
12. Scale Range: 0 psi 200 psi

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
- H. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 22 05 19

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SECTION 22 05 23 GENERAL-DUTY VALVES FOR PLUMBING

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. Bronze ball valves.
2. Iron, single-flange butterfly valves.
3. Bronze swing check valves.
4. Iron swing check valves.
5. Bronze gate valves.
6. Chainwheels.
7. Balancing valves.

- B. Related Sections:

1. Section 22 05 53 "Identification for Plumbing" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

- B. ASME Compliance:
1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 2. ASME B31.1 for power piping valves.
 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set gate valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
1. Handwheel: For valves other than quarter-turn types.
 2. Hand-lever: For quarter-turn valves NPS 6 and smaller.
 3. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.
5. Pressure Seal Joint: with press end adapters as recommended by press end fitting manufacturer.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Bronze Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Watts; a Watts Water Technologies company.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Lead-Free Bronze.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Bronze.
 - i. Port: Full.

2.3 IRON BUTTERFLY VALVES

A. Iron, Single-Flange Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.

- d. NIBCO INC.
- e. Watts; a Watts Water Technologies company.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

2.4 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. Hammond Valve.
- c. Milwaukee Valve Company.
- d. NIBCO INC.
- e. Watts; a Watts Water Technologies company.

2. Description:

- a. Standard: MSS SP-80, Type 4.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: Lead free bronze.
- e. Disc: PTFE or TFE.

2.5 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Babbitt Steam Specialty Co.
- 2. Roto Hammer Industries.
- 3. Trumbull Industries.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Babbitt Steam Specialty Co.
- 2. Roto Hammer Industries.
- 3. Trumbull Industries.

- C. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.

2.6 BALANCING VALVES

A. Thermostatic Balancing Valve

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Controls
 - b. Caleffi Hydronic Solutions
 - c. ThermOmegaTech
2. Type: Thermostatic self-actuating balancing valve. Valve shall not have positive shut-off.
3. Body: DZR brass or stainless steel.
4. Size: Same as connected piping, but not larger than NPS 2.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

- E. Install chainwheels on operators for ball, butterfly, and gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Ball, or butterfly valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check.
 - b. NPS 2-1/2 and Larger for Domestic Water: Bronze swing check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

3.5 COMPRESSED-AIR VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two-piece, full port, bronze with bronze trim.
 - 3. Bronze Swing Check Valves.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Iron, Grooved-End Butterfly Valves.
 - 3. Iron Swing Check Valves.

3.6 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 3 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two-piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves.
4. Bronze Gate Valves.
5. Thermostatic Balancing Valves.

B. Pipe NPS 4 and Larger:

1. Iron Valves: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves.
3. Iron Swing Check Valves

END OF SECTION 22 05 23

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SECTION 22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Fastener systems.
4. Pipe positioning systems.
5. Equipment supports.

- B. Related Sections:

1. Section 22 05 00 "Common Work Results for Plumbing."

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ERICO International Corporation.
 2. Rilco Manufacturing Co., Inc.
 3. Value Engineered Products, Inc.
- B. Insulation-Insert Material: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psi minimum compressive strength. Provide with vapor barrier for piping operating below ambient air temperature.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink, and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Non-staining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

- b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install Protective shields that span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 4. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.3 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.4 HANGER AND SUPPORT SCHEDULE

- A. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- B. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- D. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- E. Use padded hangers for piping that is subject to scratching.
- F. Use thermal-hanger shield inserts for insulated piping and tubing.
- G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, hangers and supports shall be MSS Type 1 – 46.
- H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, vertical piping clamps shall be MSS Type 8 or 42.
- I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, hanger rod attachments shall be MSS Type 13 – 17.
- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, building attachments shall be MSS Type 18 – 58.
- K. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

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SECTION 22 05 53 IDENTIFICATION FOR PLUMBING

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. Equipment labels.
2. Pipe labels.
3. Valve tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services, Inc.
 - c. Seton Identification Products.
2. Material and Thickness: Multilayer plastic, 1/8-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.

9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Brady Corporation.
 2. Marking Services Inc.
 3. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 1. Lettering Size: Size letters according to ASME A13.1 for piping.

2.3 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Brady Corporation.
 2. Marking Services Inc.
 3. Seton Identification Products.
- B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link chain or beaded chain.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting."
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
1. Compressed Air Piping:
 - a. Background: Safety blue.
 - b. Letter Colors: White.
 2. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.
 3. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Safety white.
 - b. Letter Color: Black.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - c. Compressed Air: 1-1/2 inches, round.

END OF SECTION 22 05 53

SECTION 22 07 00 INSULATION FOR PLUMBING

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. Insulation Materials
 2. Insulating Cements
 3. Adhesives
 4. Mastics
 5. Sealants
 6. Factory Applied Jackets
 7. Field Applied Jackets
 8. Tapes
 9. Protective Shielding Guards

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 Scheduling articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armacell LLC.

2. Flexible Elastomeric Insulation: Comply with ASTM C534 / C534M-14

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.
2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. For indoor applications, adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armacell LLC.
 - b. Childers Brand; H. B. Fuller Construction Products.
 - c. Eagle Bridges - Marathon Industries.
 - d. Foster Brand; H. B. Fuller Construction Products.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
- E. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Knauf Insulation.
 - d. Foster Brand; H. B. Fuller Construction Products.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

2.4 SEALANTS

- A. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Joint Sealants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Pittsburgh Corning Corporation.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 5. Color: White or gray.
- C. ASJ Flashing Sealants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.

- c. Foster Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.7 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGuire Manufacturing.
 - b. Plumberex Specialty Products, Inc.
 - c. Truebro.
 - d. Zurn Industries, LLC.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
 - N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
 - O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
 - P. For above-ambient services, do not install insulation to the following:
 1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.
 5. Manholes.
 6. Handholes.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Division 7 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- C. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be

- butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches

over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.9 FINISHES

- A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 "Exterior Painting" and "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, two locations of threaded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 1. Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 1. NPS 1-1/2 (DN 40) and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Protective shielding pipe covers.
- D. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

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SECTION 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS

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 commissioning process requirements for Plumbing systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Section 01 91 00 "Commissioning" for general commissioning process requirements.

1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. Systems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Complete and deliver construction checklists.
- D. Participate in Plumbing systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.5 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual Plumbing systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Review equipment and control systems submittals.
- D. Witness sample of pressure testing, leak testing, flushing, and equipment startup.
- E. Review equipment start-up and checkout plans and forms.
- F. Provide test data, inspection reports, and certificates in Systems Manual.

1.6 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for plumbing systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
 - 5. Test and inspection reports and certificates.
 - 6. Corrective action documents.
 - 7. Verification of testing, adjusting, and balancing reports.

1.7 SUBMITTALS

- A. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify that plumbing systems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

3.2 TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

- B. Scope of testing shall include energy using and related portions of the plumbing system. Testing shall include measuring effectiveness of operational and control functions.
- C. The CxA along with the Plumbing Subcontractor shall prepare detailed testing plans, procedures, and checklists for Plumbing systems, subsystems, and equipment.
- D. Simulated conditions may need to be imposed on the system. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. The CxA may direct that set points be altered when simulating conditions is not practical. After tests, return settings to normal operating conditions.
- E. The following equipment and systems will be tested.
 - 1. Water Heaters
 - 2. Water Softener
 - 3. Recirculation pump
 - 4. Air Compressor
 - 5. Power Washer
 - 6. Water supply piping
 - 7. Sanitary Drain and Vent
 - 8. Oil interceptor

END OF SECTION 22 08 00

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SECTION 22 11 16 SUPPLY PIPING FOR PLUMBING

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. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

- B. Related Requirements:

1. Section 22 05 00 "Common Work Results for Plumbing."
2. Section 22 05 19 "Meters and Gages for Plumbing."
3. Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
4. Section 22 05 53 "Identification for Plumbing."
5. Section 22 11 19 "Supply Piping Specialties for Plumbing."

1.3 SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

- B. Potable-water piping, and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Products Corporation.
 - b. NIBCO INC.
 - c. Viega LLC.
 - 2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
 - 3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.

- E. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Sheet.
- C. Color: Black.

2.5 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing" and with requirements for drain valves and strainers in Section 22 11 19 "Supply Piping Specialties for Plumbing."
- F. Install shutoff valve immediately upstream of each dielectric fitting.

- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Supply Piping Specialties for Plumbing."
- H. Install domestic water piping level without pitch and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing."
- S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 11 23 "Supply Piping Pumps for Plumbing."
- T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 "Meters and Gages for Plumbing."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors.
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 00 "Common Work Results for Plumbing."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 00 "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing."

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.

- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
 1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping according to the requirements for potable domestic water piping.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, combined domestic water piping, shall be one of the following:
 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and solder joints.
 2. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
 3. Push-on-joint, ductile-iron pipe; standard-pattern, push-on-joint fittings; and gasketed joints.
- D. Aboveground domestic water and fire piping, shall be one of the following:
 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves for piping NPS 2-1/2 and larger.
 2. Hot-Water Circulation Piping, Balancing Duty: Thermostatic balancing valves.
 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

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SECTION 22 11 19 SUPPLY PIPING SPECIALTIES FOR PLUMBING

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. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water-hammer arresters.
11. Trap-Guard.
12. Flexible connectors.

- B. Related Requirements:

1. Section 22 05 19 "Meters and Gages for Plumbing" for thermometers, pressure gages, and flow meters in domestic water piping.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping, and components shall comply with NSF 61 Annex G and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Prier Products, Inc.
 - d. Watts; a Watts Water Technologies company.
 - e. Zurn Industries, LLC.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.4 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts; a Watts Water Technologies company.
 - c. Zurn Industries, LLC.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron or steel with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:
 - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
 - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
 - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Watts; a Watts Water Technologies company.
 - d. Zurn Industries, LLC.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller; cast iron or steel with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CLA-VAL Automatic Control Valves.
 - b. Watts; a Watts Water Technologies company.
 - c. Zurn Industries, LLC.
2. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body with stainless steel trim.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.

4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Finish: Rough bronze.
8. Piping Finish: Copper.
9. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers.
2. Standard: ASSE 1016 or ASSE 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Finish: Rough or chrome-plated bronze.

2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron or steel with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve.

2.8 HOSE BIBBS

A. Hose Bibbs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. Prier Products, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Watts; a Watts Water Technologies company.
 - e. Woodford Manufacturing Company.
 - f. Zurn Industries, LLC.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Finished Rooms: Chrome or nickel plated.
10. Operation for Equipment Rooms: Wheel handle or operating key.
11. Operation for Finished Rooms: Operating key.
12. Include operating key with each operating-key hose bibb.
13. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.9 WALL HYDRANTS

A. Non-freeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Prier Products, Inc.
 - b. Smith, Jay R. Mfg. Co.
 - c. Watts; a Watts Water Technologies company.
 - d. Woodford Manufacturing Company.
 - e. Zurn Industries, LLC.
2. Standard: ASSE 1019, Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Plumbing Products.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Watts; a Watts Water Technologies company.
 - e. Zurn Industries, LLC.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.12 TRAP-GUARD

A. Trap-Guard Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sioux Chief Manufacturing Company, Inc.
 - b. Smith, Jay R. Mfg. Co.
 - c. Watts; a Watts Water Technologies company.
 - d. Zurn Industries, LLC.
2. Standard: ASSE 1072-07.
3. Body: Elastomeric, normally closed.
4. Gravity Drain Outlet Connection: Insert

2.13 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexi-craft Industries.
2. Flex-Weld, Inc.
3. Metra-flex Company (The).

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install water-control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
- F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs when using surface mounted style.
- H. Install water-hammer arresters in water piping according to PDI-WH 201.
- I. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
- J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- K. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

- L. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Pressure vacuum breakers.
 - 2. Intermediate atmospheric-vent backflow preventers.
 - 3. Reduced-pressure-principle backflow preventers.
 - 4. Water pressure-reducing valves.
 - 5. Thermostatic balancing valves.
 - 6. Primary, thermostatic, water mixing valves.
 - 7. Individual fixture water tempering valves.
 - 8. Hose stations.
 - 9. Supply-type, trap-seal primer device.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 11 19

SECTION 22 11 23 SUPPLY PIPING PUMPS FOR PLUMBING

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. In-line, sealless centrifugal pumps.

1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- B. ECM Motor: Electronically Commutated Motor/Permanent Magnet Motor.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 IN-LINE, VARIABLE SPEED ECM MOTOR PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bell & Gossett; a Xylem brand.
2. Grundfos Pumps Corp.
3. Wilo USA, LLC.

- B. Description: Factory-assembled and –tested, single-stage, in-line, variable speed centrifugal pumps with integral speed control.

- C. Pump Construction:

1. Casing: Bronze or Stainless Steel, with companion-flange connections.
2. Impeller: Corrosion-resistant material.
3. Motor: Integrated synchronous motor using ECM technology with permanent magnetic rotor.
4. Control: Pump speed will vary to maintain a constant temperature of the fluid.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install pumps with motors and pump shafts horizontal.
- E. Install continuous-thread hanger rods and elastomeric hangers of sufficient size to support pump weight. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- F. Install thermostats in hot-water return piping.

3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 11 16 "Supply Piping for Plumbing." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install shutoff valve and strainer on suction side of each in-line, sealless centrifugal pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.
- D. Connect thermostats, to pumps that they control.

3.4 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Perform visual and mechanical inspection.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Pumps and controls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Perform startup service on in-line, sealless centrifugal pumps.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Set thermostats, for automatic starting and stopping operation of pumps.
 - 5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.

- b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 7. Start motor.
 8. Open discharge valve slowly.
 9. Adjust temperature settings on thermostats.
- B. Engage a factory authorized service representative to perform startup service on booster pumps.
 1. Complete installation and startup check according to manufacturer's written instructions.

3.7 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting booster pump to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain pumps.

END OF SECTION 22 11 23

SECTION 22 13 16 DRAIN AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

- B. Related Sections:

1. Section 22 13 29 "Drain Pumps" for effluent and sewage pumps.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 100 psig.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

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

- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of sanitary waste service.

2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

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

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Fernco Inc.
 - c. Mission Rubber Company, LLC; a division of MCP Industries.
 - d. Tyler Pipe; a subsidiary of McWane Inc.
 2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Mission Rubber Company, LLC; a division of MCP Industries.
 - d. Tyler Pipe; a subsidiary of McWane Inc.
 5. Standards: ASTM C 1277 and ASTM C 1540.
 6. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 1785, drain, waste, and vent.

- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Fernco Inc.
 - 2) Froet Industries LLC.
 - 3) Mission Rubber Company, LLC; a division of MCP Industries.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.6 ENCASUREMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch minimum thickness.
- C. Form: Sheet.
- D. Color: Black.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install steel piping according to applicable plumbing code.
- O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- P. Install aboveground PVC piping according to ASTM D 2665.
- Q. Install underground PVC piping according to ASTM D 2321.
- R. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- S. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section 22 13 19 "Drain Piping Specialties for Plumbing."
 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 13 19 "Drain Piping Specialties for Plumbing."
 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 13 19 "Drain Piping Specialties for Plumbing."
- T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 00 "Common Work Results for Plumbing."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 00 "Common Work Results for Plumbing."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 00 "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- F. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Unshielded, non-pressure transition couplings.
 - 3. In Force Main Piping: Fitting-type transition couplings.
- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Section 22 05 23 "General-Duty Valves for Plumbing."
- B. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Install horizontal backwater valves with cleanout cover flush with floor.
 6. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 22 13 19 "Drain Piping Specialties for Plumbing."
 7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing."

3.9 FIELD QUALITY CONTROL

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

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and CISPI hubless-piping couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- C. Aboveground, vent piping shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- D. Underground, soil, waste, and vent piping shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- E. Underground, control conduit shall be any of the following:
 - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 13 16

SECTION 22 13 19 DRAIN PIPING SPECIALTIES FOR PLUMBING

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. Cleanouts.
 2. Floor drains.
 3. Miscellaneous sanitary drainage piping specialties.
 4. Flashing materials.
 5. Catch Basins.
- B. Related Requirements:

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

- A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Metal Floor Cleanouts:

- 1. ASME A112.36.2M, Cast-Iron Cleanouts:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Smith, Jay R. Mfg. Co.
 - 2) Watts; a Watts Water Technologies company.
 - 3) Zurn Industries, LLC.
 - 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Body or Ferrule: Cast iron.
 - 5. Closure: Brass plug with tapered threads.
 - 6. Adjustable Housing Material: Cast iron.
 - 7. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 8. Top Loading Classification: Medium Duty.

B. Cast-Iron Wall Cleanouts:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.
 - b. Watts; a Watts Water Technologies company.
 - c. Zurn Industries, LLC.
- 2. Standard: ASME A112.36.2M. Include wall access.
- 3. Size: Same as connected drainage piping.
- 4. Body: Cast-iron soil pipe test tee as required to match connected piping.
- 5. Closure: drilled-and-threaded brass plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass, or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.
 - b. Watts; a Watts Water Technologies company.
 - c. Zurn Industries, LLC.
2. Body Material: Cast Iron.
3. Seepage Flange: Required.
4. Clamping Device: Required.
5. Outlet: Bottom.
6. Top or Strainer Material: Nickel bronze.
7. Top Loading Classification: Medium Duty.
8. Trap Material: Same as connected drainpipe.
9. Trap Pattern: Deep-seal P-trap.
10. Trap Features: Trap-seal primer valve drain connection.

B. Hub Drains

1. Description:
 - a. Field fabricated open drain with P-trap.
 - b. Material: Same as connected drainpipe.
 - c. Trap Material: Same as connected drainpipe.
 - d. Trap Pattern: Deep-seal P-trap.
 - e. Trap Features: Trap-seal primer valve drain connection.

C. Floor Sinks

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.
 - b. Watts; a Watts Water Technologies company.
 - c. Zurn Industries, LLC.
2. Body Material: Cast Iron with acid resistant finish.
3. Seepage Flange: Not Required.
4. Clamping Device: Not Required.
5. Outlet: Bottom.
6. Top or Strainer Material: Nickel bronze half grate.
7. Top Loading Classification: Medium Duty.

8. Trap Material: Same as connected drainpipe.
9. Trap Pattern: Deep-seal P-trap.
10. Trap Features: Trap-seal primer valve drain connection.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

B. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.4 CATCH BASINS & STORM MANHOLES

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6" minimum thickness for floor slab and 4" minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
2. Riser Sections: 4" minimum thickness, 48" diameter, and lengths to provide depth indicated.
3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
5. Grade Rings: Include two (2) or three (3) reinforced-concrete rings, of 6" to 9" total thickness that match 24" diameter frame and grate.
6. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one (1) step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12" to 16" intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60".
7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (ASSHTO HS20-44), structural loading. Include 24" ID by 7" to 9" riser with 4" minimum width flange, and 26" diameter flat grate with small, square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.
2. Provide solid cover for storm manholes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 6. Use NPS 6 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.

- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

- F. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

- G. Assemble open drain fittings and install with top of hub 2 inches above floor.

- H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

- J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- K. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
- L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 22 13 16 "Drain and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Oil Interceptors: Connect inlet, outlet, vent, piping to unit; flow-control fitting and vent to unit inlet piping.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Stamp into the manhole cover for the following:
 - 1. Oil interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing."

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 13 23 DRAIN INTERCEPTORS FOR PLUMBING

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. Oil interceptors.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of plastic interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
1. Notify Construction Manager and no fewer than seven days in advance of proposed interruption of service.
 2. Do not proceed with interruption of sewer services without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 OIL INTERCEPTORS

A. Plastic or Fiberglass Oil Interceptors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Green Turtle Zurn.
 - b. Schier Products Company.
 - c. Town & Country Plastics, Inc.
2. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain oil and to permit wastewater flow.
3. Structural Design Loads:
 - a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
4. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
 - a. Include indented top design with lettering cast into cover, using wording equivalent to "OIL INTERCEPTOR."

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 "Earth Moving."

3.2 INSTALLATION

- A. Install risers from top of underground exterior interceptors to manholes and gratings at finished grade.
- B. Set tops of manhole frames and covers flush with finished surface in pavements.
- C. Set tops of grating frames and grates flush with finished surface.
- D. Set plastic interceptor level and plumb.
- E. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 22 13 16 "Drain and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

- C. Oil Interceptors: Connect inlet, outlet, vent piping to unit; flow-control fitting and vent to unit inlet piping.

3.4 IDENTIFICATION

- A. Identification materials and installation are specified in Division 31 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
1. Use warning tapes or detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 22 13 23

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SECTION 22 15 13 COMPRESSED AIR PIPING

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 SUBMITTALS

- A. Product Data: For the following:
1. Safety valves.
 2. Pressure regulators. Include rated capacities and operating characteristics.
 3. Automatic drain valves.
 4. Filters. Include rated capacities and operating characteristics.
 5. Lubricators. Include rated capacities and operating characteristics.
 6. Quick couplings.
 7. Hose assemblies.
 8. Hose Reels.
- B. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.3 QUALITY ASSURANCE

- A. ASME Compliance:
1. Comply with ASME B31.1, "Power Piping," for high-pressure compressed-air piping.
 2. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.
1. Steel Nipples: ASTM A 733 made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
 2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
 3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
 4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
 5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.

6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.

2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 VALVES

- A. Metal Ball, Butterfly, Check and Globe Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing."

2.4 FLEXIBLE PIPE CONNECTORS

- A. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 1. Working-Pressure Rating: 200 psig minimum.
 2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
 3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.6 ESCUTCHEONS

- A. General Requirements: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
- B. Split-Plate, Stamped-Steel Escutcheons: With exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.

2.7 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

- B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.
 - 1. Type: Pilot operated.
- C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.
- D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.
- E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.
- F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration and drain cock.
- G. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal.
 - 1. Provide with automatic feed device for supplying oil to lubricator.

2.8 QUICK COUPLINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aeroquip Corporation; Eaton Corp.
 - 2. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.
 - 3. Schrader-Bridgeport/Standard Thomson.
 - 4. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
- B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
 - 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
 - 2. Plug End: Straight-through type with barbed outlet for attaching hose.

2.9 HOSE REELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Reel Craft.
 - 2. Graco.
 - 3. Balcrank.

B. Features/Performance/Construction:

1. Reels:

- a. Construction: Frames, discs, and drum shall be fabricated of heavy-duty steel.
- b. Double Pedestal arm: Reel Frame shall have double pedestal arms that are welded and gusseted.
- c. Hose guide arm: Reel hose guide arm shall be adjustable with nylon rollers on all four sides of roller assembly at hose opening.
- d. Rewind mechanism: Reel spring shall be enclosed and fastened to reel drum with a reinforcing clip.
- e. Bearings and ratchet latch: Reel shall have permanently lubricated bearings and extra-large ratchet latch with audible hose position lock.

C. Finish: Durable enamel in manufacturer's standard color.

2.10 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use the following piping materials for each size range:

1. NPS 2 and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. NPS 2-1/2 to NPS 4: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.

B. Drain Piping: Use the following piping materials:

1. NPS 2 and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.
2. NPS 2 and Smaller: PVC pipe and fittings; and solvent-cemented joints.

3.2 VALVE APPLICATIONS

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing" for metal general-duty valves. Use metal valves, unless otherwise indicated.

1. Metal General-Duty Valves: Use valve types specified in "Valve Applications" Article in Division 22 Section "General-Duty Valves for Plumbing" according to the following:
 - a. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.
 - b. Grooved-end valves may be used with grooved-end piping and grooved joints.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
 1. Use steel companion flange with gasket for connection to steel pipe.
- I. Flanged joints may be used instead of specified joint for any piping or tubing system.
- J. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- K. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- L. Install pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing."
- M. Install piping to permit valve servicing.

- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints for Steel Piping: Join according to AWS D10.12/D10.12M.
- E. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

3.5 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing."
- B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.
- D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.6 FLEXIBLE PIPE CONNECTOR INSTALLATION

- A. Install flexible pipe connectors in discharge piping of each air compressor.
- B. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.7 SPECIALTY INSTALLATION

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

- C. Install air-line pressure regulators in branch piping to equipment and tools.
- D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- E. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.
- F. Install air-line lubricators in branch piping to machine tools.
- G. Install quick couplings at piping terminals for hose connections.
- H. Install hose assemblies at hose connections.

3.8 CONNECTIONS

- A. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.
- B. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

3.9 SLEEVE INSTALLATION

- A. Sleeves are not required for core-drilled holes.
- B. Permanent sleeves are not required for holes formed by removable PE sleeves.
- C. Install sleeves for pipes passing through concrete and masonry walls using galvanized-steel pipe.
 - 1. Seal space outside of sleeve fittings with grout.
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Plumbing contractor shall provide penetration firestopping associated with the scope of Work in this specification section where required in accordance with UL requirements.

3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.

3.11 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Vertical Piping: MSS Type 8 or 42, clamps.
- C. Individual, Straight, Horizontal Piping Runs:
 - 1. MSS Type 1, adjustable, steel clevis hangers.

- D. Support horizontal piping within 12 inches of each fitting and coupling.
- E. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 to NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 12 feet with 3/8-inch rod.
 - 3. NPS 2: 13 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 14 feet with 1/2-inch rod.
 - 5. NPS 3: 15 feet with 1/2-inch rod.
- F. Install supports for vertical, Schedule 40, steel piping every 15 feet.

3.12 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing."

3.13 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 200 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 2. Repair leaks and retest until no leaks exist.
 - 3. Inspect filters, lubricators, and pressure regulators for proper operation.
- C. Prepare test reports.

END OF SECTION 22 15 13

SECTION 22 15 19 AIR COMPRESSORS AND RECEIVERS

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. Lubricated, reciprocating air compressors.

1.3 DEFINITIONS

- A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in acfm.
- B. Standard Air: Free air at 68 deg F and 1 atmosphere (29.92 in. Hg) before compression or expansion and measured in scfm.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Operation and Maintenance Data: For compressed-air equipment to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.
- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
 - 1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
 - 2. Motor Controllers: Full-voltage, combination magnetic type with under voltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
 - 3. Control Voltage: 120-V ac or less, using integral control power transformer.
 - 4. Motor Overload Protection: Overload relay in each phase.
 - 5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
- C. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.2 ROTARY-SCREW AIR COMPRESSORS

- A. Rotary-Screw Air Compressors:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Ingersoll Rand.
 - b. Kaeser.
 - c. Quincy.
 - 2. Description: Packaged unit.
 - 3. Air Compressor(s): Single-stage, oil-free, rotary-screw type with nonlubricated helical screws and lubricated gearbox, and of construction that prohibits oil from entering compression chamber.
 - a. Cooling/Lubrication System: Unit-mounted, air-cooled exchanger package pre-piped to unit; with air-pressure circulation system with coolant stop valve, full-flow coolant filter, and thermal-bypass valve.
 - b. Air Filter: Dry type, with maintenance indicator and cleanable replaceable filter element.
 - c. Air/Coolant Receiver and Separation System: 150-psig- (1035-kPa-) rated steel tank with ASME safety valve, coolant-level gage, multistage air-coolant separator element, minimum pressure valve, blowdown valve, discharge check valve, coolant stop valve, full-flow coolant filter, and thermal-bypass valve.
 - d. Capacity Control: Capacity modulation between zero and 100 percent air delivery, with operating pressures between 60 and 135 psig (345 and 690 kPa). Include necessary control to hold constant pressure. When air demand is zero, unload compressor by using pressure switch and blowdown valve.

- e. Mounting: Freestanding.
- 4. Sound-attenuation enclosure.
- B. Capacities and Characteristics:
 - 1. Compressed-Air Service: Shop air.
 - 2. Air Compressor(s): One.
 - 3. Standard-Air Capacity of Each Air Compressor: 335 scfm (standard L/s) free air.
 - 4. Actual-Air Capacity of Each Air Compressor: 300 acfm (actual L/s) delivered.
 - 5. Discharge-Air Pressure: 135.
 - 6. Discharge-Air Temperature: 100° F (deg C) or less.
 - 7. Motor (Each Air Compressor):
 - a. Horsepower: 75.
 - b. Speed: 1531 rpm.
 - 8. Electrical Characteristics:
 - a. Volts: 460.
 - b. Phase(s): Three.
 - c. Hertz: 60.
 - d. Full-Load Amperes: 101.
 - e. Maximum Overcurrent Protection: 150 amperage.

2.3 RECEIVER TANK

- A. Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 1. Orientation: Vertical Arrangement.
 - 2. Capacity: See drawing schedule.
 - 3. Interior finish: Epoxy.
 - 4. Pressure Rating: 165psig minimum.
 - 5. Pressure Regulator Setting: 135psig.
 - 6. Pressure Relief Valve Setting: 137psig.
 - 7. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.

2.4 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified.
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Equipment Mounting: Install air compressors and air dryers anchored to concrete bases using elastomeric pads. Comply with requirements in Division 03 Section "Cast-in-Place Concrete."
- B. Arrange equipment so controls and devices are accessible for servicing.
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Install the following devices on compressed-air equipment:
 - 1. Pressure Gage and Safety Valve: Install on each compressed-air receiver.
 - 2. Pressure Regulators: Install downstream from air compressors and dryers.
 - 3. Automatic Drain Valves: Install on filters and dryers. Discharge condensate over nearest floor or open site drain.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Compressed Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.

3.3 IDENTIFICATION

- A. Identify general-service air compressors and components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing."

3.4 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that air-compressor inlet filters and piping are clear.
 - 3. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
 - 4. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure but not higher than rating of system components.
 - 5. Drain receiver tanks.
 - 6. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 7. Test and adjust controls and safeties.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air compressors and dryers.

END OF SECTION 22 15 19

SECTION 22 31 00 DOMESTIC WATER SOFTENERS

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. Commercial Water softeners.
 2. Chemicals.
 3. Water-testing sets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water softeners.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 3. Wiring Diagrams: For power, signal, and control wiring.
- B. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of water softeners and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended application.
- C. ASME Compliance: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code, where indicated.
- D. UL Compliance: Fabricate and label water softeners to comply with UL 979, "Water Treatment Appliances."

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softeners that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures of mineral and brine tanks.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - d. Attrition loss of resin exceeding 3 percent per year.
 - e. Mineral washed out of system during service run or backwashing period.
 - f. Effluent turbidity greater and color darker than incoming water.
 - g. Fouling of underdrain system, gravel, and resin with turbidity or by dirt, rust, or scale from water softener or soft water, while operating according to manufacturer's written operating instructions.
 2. Warranty Period: 5 years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

- A. Maintenance: Submit four copies of manufacturer's "Agreement for Continued Service and Maintenance," before Substantial Completion, for Owner's acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing to include replacing materials and equipment. Include one-year term of agreement with option for one-year renewal.

PART 2 - PRODUCTS

2.1 WATER SOFTENERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Culligan International Company.
 2. Diamond Water Systems, Inc.
 3. Hellenbrand Inc.
- B. Description: Factory-assembled, pressure-type water softener.
1. Standard: Comply with NSF 61 Annex, "Drinking Water System Components - Health Effects."
 2. Model: progressive/metered water softening system.
 3. Configuration: Twin unit with two mineral tanks and two brine tanks.
 4. Mounting: On housekeeping pad.
 5. Mineral Tanks: FRP, pressure-vessel quality.
 - a. Construction: Fabricated and stamped to comply with ASME Boiler and Pressure Vessel Code."

- b. Pressure Rating: 125 psig minimum.
 - c. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
 - d. Distribution System: Hub and radial-arm or header-lateral type; fabricated from nonmetallic pipe and fittings with individual, fine-slotted, non-clogging plastic strainers, and arranged for even flow distribution through resin bed.
 - 6. Controls: Electronic programmable, fully automatic; factory wired, and factory mounted on unit.
 - a. Adjustable duration of various regeneration steps.
 - b. Push-button start and complete manual operation.
 - c. Electric time clock and switch for fully automatic operation, adjustable to initiate regeneration at any hour of day and any day of week or at fixed intervals.
 - d. Electronic water meter, adjustable to initiate regeneration according to time clock schedule or by volume override.
 - 7. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressure; does not require field adjustments.
 - a. Demand-Initiated Control: Each mineral tank of twin mineral-tank unit is equipped with automatic-reset-head water meter that electrically activates cycle controllers to initiate regeneration at preset total in gallons. Head automatically resets to preset total in gallons for next service run. Electrical lockout prevents simultaneous regeneration of both tanks.
 - 8. Brine Tank: Combination measuring and wet-salt storing system.
 - a. Tank and Cover Material: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
 - b. Brine Valve: Float operated, and plastic fitted for automatic control of brine withdrawal and freshwater refill.
 - c. Size: 330lb each.
 - 9. Factory-Installed Accessories:
 - a. Piping, valves, tubing, and drains.
 - b. Sampling cocks.
 - c. Main-operating-valve position indicators.
 - d. Water meters.
- C. Capacities and Characteristics:
 - 1. Water Analysis:
 - a. Hardness: 25 grains/gal. or ppm.

2.2 WATER-TESTING SETS

- A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

PART 3 - EXECUTION

3.1 WATER SOFTENER INSTALLATION

- A. Equipment Mounting:
1. Install water softeners on cast-in-place concrete equipment base(s).
- B. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.
- C. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.
- D. Install remote salt delivery system to the top of brine tanks and have delivery system piping piped to the outside of the building in a location a delivery truck can access.
- E. Install water-testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 11 16 "Supply Piping for Plumbing." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to equipment, allow space for service and maintenance of equipment.
- C. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.
1. Metal and plastic valves are specified in Section 22 05 23 "General-Duty Valves for Plumbing."
 2. Exception: Water softeners with factory-installed shutoff valves at locations indicated.
- D. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Section 22 05 19 "Meters and Gages for Plumbing."
1. Exception: Water softeners with factory-installed pressure gages at locations indicated.
- E. Install valved bypass in water piping around water softeners.
1. Metal and plastic valves are specified in Section 22 05 23 "General-Duty Valves for Plumbing." Water piping is specified in Section 22 11 16 "Supply Piping for Plumbing."

- F. Install drains as indirect wastes to spill into open drains or over floor drains or floor sinks.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing."

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- B. Water softeners will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

- B. Add water to brine tanks and fill with salt:

- C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples) and prepare certified test reports for required water performance characteristics. Comply with the following:

1. ASTM D 859, "Test Method for Silica in Water."
2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
3. ASTM D 1068, "Test Methods for Iron in Water."
4. ASTM D 1126, "Test Method for Hardness in Water."
5. ASTM D 1129, "Terminology Relating to Water."
6. ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water softeners.

END OF SECTION 22 31 00

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SECTION 22 34 00 FUEL-FIRED, DOMESTIC-WATER HEATERS

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. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
 2. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Three year(s).
 - b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

- A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bock Water Heaters.
 - b. Bradford White Corporation.
 - c. Heat Transfer Products, Inc.
 - d. Smith, A. O. Corporation.
 2. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
 3. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

- b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
4. Factory-Installed Storage-Tank Appurtenances:
- a. Anode Rod: Electronic anode system or replaceable magnesium anode.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters, and natural-gas fuel.
 - g. Temperature Control: Adjustable thermostat.
 - h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Smith, A. O. Corporation.
 - c. Watts.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charged to minimum system-operating pressure at tank.
3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.

2.3 COMMERCIAL, GAS-FIRED, PRESSURE WASHER

- A. Commercial, Gas-Fired, Pressure Washer:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hotsy.
 - b. Landa.
 - c. Alkota Cleaning Systems, Inc.

2. Description:
 - a. Burner: NG Fired, 365,000btu minimum capacity, AGA listed controls, ring type with aspirating spuds, natural gas.
 - b. All open flames and fire rings shall be mounted at minimum of 18 inches above the finished floor.
 - c. Heating Coil: Vertically-fired, one inch outside diameter, hydrostatic-pressured tested; 14,900psi burst rating
 - d. Water pump: Triplex water pump with positive displacement, ceramic pluggers, brass manifold, and oil bath crankcase.
 - e. Fabrication: Welded angle iron Frame shall have heavy guage tank and cabinet.
 - f. Supplier shall provide 1/2"inch outside diameter ASTM-A-312 Schedule 38 stainless steel piping. Provide ANSI/ASME B 31.3 stainless steel fittings. Provide piping from high-pressure wash unit to each trigger gun wand for a complete operable system.
 - g. Manufacturer shall supply all necessary soap system equipment including piping, fittings, distribution hose, and connections for a complete operable soap distribution system.
 - h. Programmable smart relay feature shall control over run time, auto start/stop and shut down functionality.

3. Controls:
 - a. Adjustable temperature controller, safety pressure relief valve, pressure switch, ON/OFF electric motor switch with overload protection, unloader, water heater switch, detergent valve and automatic non-contaminating float valve.
 - b. 24v backdraft diverter in exhaust duct wired to PLC controls.

4. Accessories:
 - a. Trigger gun (one trigger for each location)
 - b. Wall mounted remote control for hot/cold water.
 - c. 36 inch wand (one each per trigger gun location)
 - d. Nozzle (one each per trigger gun location)
 - e. Quick coupler (one each per trigger gun location)
 - f. Soap Solenoid and switch ((one each per trigger gun location)
 - g. Replacement nozzle: (one pack per trigger gun, pack of four, 4-1/2" millimeter with quick disconnect)
 - h. Draft diverter: (one per unit)
 - i. Reel (one each per trigger gun location)
 - j.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Division 3.
1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 2. Maintain manufacturer's recommended clearances.
 3. Arrange units so controls and devices that require servicing are accessible.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23 "General-Duty Valves for Plumbing."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 23 11 23 "Facility Natural-Gas Piping."
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Supply Piping Specialties for Plumbing."
- F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing."
- G. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Fill domestic-water heaters with water.
- I. Charge domestic-water thermal expansion tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Supply Piping for Plumbing."
- B. Comply with requirements for gas piping specified in Section 23 11 23 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain domestic-water heaters.

END OF SECTION 22 34 00

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SECTION 22 40 00 PLUMBING FIXTURES

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 conventional plumbing fixtures and related components:

1. Faucets for lavatories and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Commercial sinks.
10. Kitchen sinks.
11. Service sinks.
12. Service basins.
13. Owner-furnished fixtures.

- B. Related Sections include the following:

1. Division 22 Section "Supply Piping Specialties for Plumbing" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
2. Division 22 Section "Emergency Plumbing Fixtures."

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- D. FRP: Fiberglass-reinforced plastic.
- E. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
1. Plastic Mop-Service Basins: ANSI Z124.6.
 2. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
 3. Vitreous-China Fixtures: ASME A112.19.2M.
 4. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 5. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M. (coordinate with applicable codes)
 2. Faucets: ASME A112.18.1.
 3. Hose-Connection Vacuum Breakers: ASSE 1011.
 4. Hose-Coupling Threads: ASME B1.20.7.
 5. NSF Potable-Water Materials: NSF 61.
 6. Pipe Threads: ASME B1.20.1.

7. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 8. Supply Fittings: ASME A112.18.1.
 9. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Plastic Tubular Fittings: ASTM F 409.
 4. Brass Waste Fittings: ASME A112.18.2.
 5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Flexible Water Connectors: ASME A112.18.6.
 2. Floor Drains: ASME A112.6.3.
 3. Hose-Coupling Threads: ASME B1.20.7.
 4. Off-Floor Fixture Supports: ASME A112.6.1M.
 5. Pipe Threads: ASME B1.20.1.
 6. Plastic Toilet Seats: ANSI Z124.5.
 7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
 2. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
 3. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
 4. Flushometer Tank, Repair Kits: Equal to 5 percent of amount of each type installed, but no fewer than 2 of each type.
 5. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
 6. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

- A. Lavatory Faucets:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Standard Companies, Inc.
 - b. Chicago Faucets.
 - c. Elkay Manufacturing Co.
 - d. Kohler Co.
 - e. Moen, Inc.
 - f. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Single-control mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
- a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm.
 - d. Centers: Single Hole.
 - e. Mounting: Deck, exposed.
 - f. Inlet(s): NPS 1/2 male shank.
 - g. Spout: Rigid type.
 - h. Spout Outlet: Spray.
 - i. Operation: Sensor.
 - j. Drain: Grid.
 - k. Tempering Device: Thermostatic.

2.2 SINK FAUCETS

A. Sink Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Chicago Faucets.
 - c. Elkay Manufacturing Co.
 - d. Just Manufacturing Company.
 - e. Kohler Co.
 - f. Moen, Inc.
 - g. Speakman Company.
 - h. T & S Brass and Bronze Works, Inc.
 - i. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Kitchen faucet without spray, Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
3. See fixture schedule on drawings for complete description of fixture and accessories.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 2.5 gpm, unless otherwise indicated.
 - d. Backflow Protection Device for Hose Outlet: Required.
 - e. Backflow Protection Device for Side Spray: Required.

- f. Inlet(s): NPS 1/2 male shank.
- g. Spout Outlet: Aerator Vacuum Breaker: Not required.
- h. Drain: Grid.

2.3 FLUSHOMETERS

A. Flushometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sloan Valve Company.
 - b. Zurn Plumbing Products Group; Commercial Brass Operation.
 - c. Hydrotek International, Inc.
2. Description: Flushometer for urinal and water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
3. See fixture schedule on drawings for complete description of fixture and accessories.
 - a. Internal Design: Diaphragm operation.
 - b. Style: Exposed.
 - c. Trip Mechanism: hardwire, sensor with manual push button.

2.4 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Bemis Manufacturing Company.
 - c. Church Seats.
 - d. Kohler Co.
 - e. Olsonite Corp.
 - f. Sperzel.
2. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front without cover.
 - c. Size: Elongated.
 - d. Hinge Type: CK, check.
 - e. Class: Heavy-duty commercial.
 - f. Color: White.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Co.
 - b. McGuire Manufacturing Co., Inc.
 - c. TCI Products.
 - d. TRUEBRO, Inc.
 - e. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Josam Company.
 2. MIFAB Manufacturing Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Supports:
 1. Description: Combination carrier designed for accessible and or standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical, or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- C. Urinal Supports:
 1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
 2. Accessible-Fixture Support: Include rectangular steel uprights.

2.7 DISPOSERS

- A. Disposers:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. In-Sink-Aerator; a div. of Emerson Electric Co.
 - c. KitchenAid.

- d. Maytag Co.
2. Description: Continuous-feed household, food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; anti-splash guard; and combination cover/stopper.
3. See fixture schedule on drawings for complete description of fixture and accessories.
 - a. Type: Continuous-feed household.
 - b. Model: Sound-insulated chamber and stainless-steel outer shell.
 - c. Motor: 115-V ac, 1725 rpm, 1 hp with overload protection.

2.8 WATER CLOSETS

A. Water Closets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Plumbing, L.L.C./Fiat Products.
 - b. American Standard Companies, Inc.
 - c. Kohler Co.
 - d. Zurn.
2. Description Accessible, wall and Wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
3. See fixture schedule on drawings for complete description of fixtures and accessories.
 - a. Style: One piece.
 - 1) Bowl Type: Elongated with siphon-jet design.
 - 2) Design Consumption: 1.28 gal. /flush.
 - 3) Trip Mechanism: Lever-handle actuator.
 - 4) Color: White.
 - b. Supply: NPS 1 1/4 chrome-plated brass or copper with wheel-handle stop.
 - c. Style: Flushometer valve.
 - 1) Bowl Type: Elongated with siphon-jet design.
 - 2) Design Consumption: 1.28 gal. /flush.
 - 3) Color: White.
 - d. Fixture Support: Water-closet support combination carrier.

B. Water Closets, Floor Mounted:

1. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
 - a. American Standard Companies, Inc.

- b. Crane Plumbing, L.L.C./Fiat Products.
 - c. Kohler Co.
2. Description: Accessible, floor Floor-mounting, floor-outlet, vitreous-china fixture designed for gravity-type tank operation.
- a. Style: Close coupled.
 - 1) Bowl Type: Elongated with design. Include bolt caps matching fixture.
 - 2) Height: Accessible.
 - 3) Design Consumption: 1.6 gal./flush.
 - 4) Tank: Gravity type with trim. Include cover.
 - 5) Trip Mechanism: Lever-handle actuator.
 - 6) Color: White.
 - b. Supply: NPS 3/8 chrome-plated brass or copper with screwdriver stop.

2.9 URINALS

A. Urinals:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. American Standard Companies, Inc.
 - b. Crane Plumbing, L.L.C./Fiat Products.
 - c. Eljer.
 - d. Kohler Co.
 - e. Zurn.
2. Description: See fixture schedule on drawings for complete description of fixture and accessories. Accessible, wall and Wall mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
3. See fixture schedule on drawings for complete description of fixture and accessories.
- a. Type: Siphon jet.
 - b. Strainer or Trapway: Integral cast strainer with integral trap.
 - c. Design Consumption: .125 gal./flush.
 - d. Color: White.
 - e. Supply Spud Size: NPS 3/4.
 - f. Outlet Size: NPS 2.
 - g. Flushometer: 3/4 inch.
 - h. Fixture Support: Urinal Floor mounted chair carrier.

2.10 LAVATORIES

A. Lavatories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Standard Companies, Inc.
 - b. Eljer.
 - c. Kohler Co.
 - d. American Standard Companies, Inc.
 - e. Crane Plumbing, L.L.C./Fiat Products.
2. Description: See fixture schedule on drawings for complete description of fixture and accessories.

2.11 COMMERCIAL SINKS

A. Commercial Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Tabco.
 - b. Elkay Manufacturing Co.
 - c. Just Manufacturing Company.
 - d. Metal Masters Foodservice Equipment Co., Inc.
2. Description: See fixture schedule on drawings for fixture description, counter-mounting, stainless-steel commercial sink with backsplash.

2.12 SERVICE BASINS

A. Service Basins:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Crane Plumbing, L.L.C./Fiat Products.
 - c. Flore-stone Products Co., Inc.
 - d. Precast Terrazzo Enterprises, Inc.
 - e. Stern-Williams Co., Inc.
 - f. Mustee, E. L. & Sons, Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
2. Description: Flush-to-wall, floor-mounting, precast terrazzo fixture with rim guard. See fixture schedule on drawings for complete description of fixture and accessories.
 - a. Shape: Square.
 - b. Size: 24 by 24 inches.
 - c. Height: 12 inches with dropped front.
 - d. Rim Guard: On all top surfaces.
 - e. Color: Not applicable.
 - f. Drain: Grid with NPS 3 outlet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to roughing-in drawings.
- I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing."
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

- M. Install toilet seats on water closets.
- N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- Q. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.
- S. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 22 45 00 EMERGENCY PLUMBING FIXTURES

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 emergency plumbing fixtures:
1. Eye/face wash equipment.
 2. Combination units.
 3. Water-tempering equipment.
- B. Related Sections include the following:
1. Division 22 Section "Supply Piping Specialties for Plumbing" for backflow preventers.
 2. Division 22 Section "Drain Piping Specialties for Plumbing" for floor drains.

1.3 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Tepid: Moderately warm.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 EYE/FACE WASH EQUIPMENT

A. Eye/Face Wash Equipment:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Bradley Corporation.
 - b. Guardian Equipment Co.
 - c. Haws Corporation.
2. Description: Plumbed, freestanding, pedestal eye/face wash equipment.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Receptor: Plastic bowl.
 - e. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2. Include galvanized-steel indirect connection to drainage system.

2.2 COMBINATION UNITS

A. Combination Units:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Bradley Corporation.
 - b. Guardian Equipment Co.
 - c. Haws Corporation.
2. Description: Plumbed, accessible, freestanding, with emergency shower and eye/face wash equipment.
 - a. Piping: Chrome-plated brass or stainless-steel.
 - 1) Unit Supply: NPS 1-1/2 from top.
 - 2) Unit Drain: Outlet at side near bottom.
 - 3) Shower Supply: NPS 1 with flow regulator and stay-open control valve.

- 4) Eye/Face Wash Supply: NPS 1/2 with flow regulator and stay-open control valve.
- b. Shower Capacity: Deliver potable water at rate not less than 20 gpm for at least 15 minutes.
 - 1) Control-Valve Actuator: Pull rod.
 - 2) Shower Head: 3-inch minimum diameter, plastic.
- c. Eye/Face Wash Equipment: With capacity to deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle.
 - 2) Receptor: Plastic or stainless-steel bowl.

2.3 WATER-TEMPERING EQUIPMENT

A. Water-Tempering Equipment:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Bradley Corporation.
 - b. Haws Corporation.
 - c. Lawler Manufacturing Co., Inc.
 - d. Leonard Valve Company.
2. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.

2.4 SOURCE QUALITY CONTROL

- A. Certify performance of plumbed emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing."
 - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters and Gages for Plumbing."
- G. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system.
- H. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations.
- I. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
- C. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.

3.4 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.

- B. Electrical-Component Testing: After electrical circuitry has been energized, test for compliance with requirements.
 - 1. Test and adjust controls and safeties.
- C. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- D. Report test results in writing.

3.5 ADJUSTING

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

END OF SECTION 22 45 00

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SECTION 22 47 00 WATER COOLERS

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 drinking fountains and water coolers and related components:
1. Pressure water coolers.
 2. Fixture supports.

1.3 DEFINITIONS

- A. Accessible Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Cast Polymer: Dense, cast-filled-polymer plastic.
- C. Fitting: Device that controls flow of water into or out of fixture.
- D. Fixture: Drinking fountain or water cooler unless one is specifically indicated.
- E. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.

- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

- A. Water Coolers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Oasis Corporation.
 - 2. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult -mounting height.
 - a. Cabinet: Bilevel with two attached cabinets, all stainless steel.
 - b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
 - c. Bottle filler: Yes.
 - d. Control: Push bar.
 - e. Supply: NPS 3/8 with ball, valve.
 - f. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - g. Drain(s): Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.1.
 - h. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - i. Capacity: See fixture schedule on drawings for fixture capacities and characteristics. Support: Type II, water cooler carrier. Refer to "Fixture Supports" Article.

2.2 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Josam Co.
 2. MIFAB Manufacturing, Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
1. Type II: Bilevel, hanger-type carrier with three vertical uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

- A. Install fixtures level and plumb. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use and install ball valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- C. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.
- D. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.6 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 22 47 00

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