

VA



U.S. Department
of Veterans Affairs

DEPARTMENT OF VETERAN'S AFFAIRS
ON
NEW FRONT LOBBY AND PRIMARY CARE ADDITION

Sioux Falls, South Dakota

VA Project # 438-480

Project Specifications – Volume 1

June 22, 2022



STONE GROUP
ARCHITECTS

**DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS**

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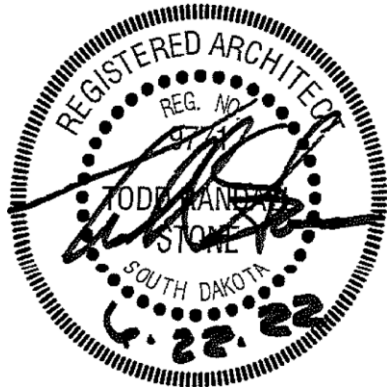
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1.1 DESIGN PROFESSIONALS OF RECORD

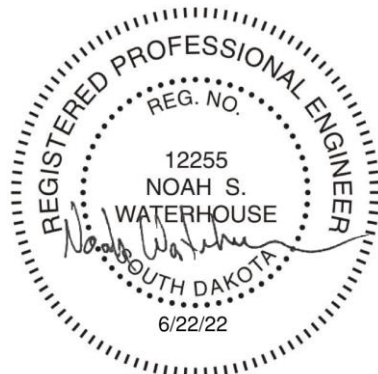
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Todd Randall Stone
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Responsible for: Divisions 01-49 Sections except where indicated below as prepared by other design professionals of record.



- B. Civil Engineer:
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SECTION 32 05 23 - CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS
SECTION 32 12 16 - ASPHALT PAVING
SECTION 32 17 23 - PAVEMENT MARKINGS
DIVISION 33 - UTILITIES (ALL SECTIONS)



C. Landscape Architect:

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605-339-1205
Lyle Pudwill
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SECTION 32 84 00 - PLANTING IRRIGATION
DIVISION 32 90 00 - PLANTING



D. Structural Engineer:

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4750

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DIVISION 03 - CONCRETE (ALL SECTIONS)
SECTION 04 22 00 - CONCRETE UNIT MASONRY
SECTION 05 12 00 - STRUCTURAL STEEL FRAMING
SECTION 05 21 00 - STEEL JOIST FRAMING
SECTION 05 31 00 - STEEL DECKING
SECTION 05 36 00 - COMPOSITE METAL DECKING



E. Mechanical Engineer:

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Jason R. Gottwalt
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Responsible for:

- a. DIVISION 21 - FIRE SUPPRESSION (ALL SECTIONS)
- b. DIVISION 22 - PLUMBING (ALL SECTIONS)
- c. DIVISION 23 - HEATING, VENTILATION, AND AIR-CONDITIONING (HVAC) (ALL SECTIONS)

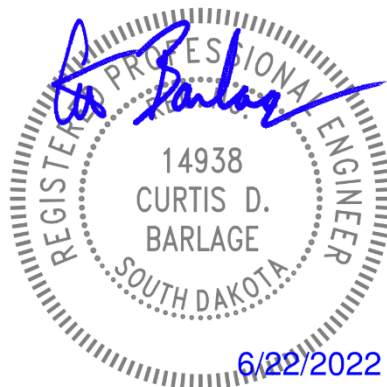


F. Electrical Engineer:

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612-465-7550
Curtis D. Barlage
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Responsible for:

- a. DIVISION 26 - ELECTRICAL (ALL SECTIONS)
- b. DIVISION 27 - COMMUNICATIONS (ALL SECTIONS)
- c. DIVISION 28 - ELECTRONIC SAFETY AND SECURITY (ALL SECTIONS)



END OF DOCUMENT 000107

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G002	PCRA, ICRA, ISLM
G003	SPACE ALLOCATION REPORT
G004	LIFE SAFETY PLAN REVIEWS
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- - - END - - -



**GEOtek ENGINEERING
& TESTING SERVICES, INC.**

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605-335-5512 Fax 605-335-0773

January 15, 2021

Stone Group Architects
600 E. 7th Street
Sioux Falls, South Dakota 57103

Attn: Todd Stone, AIA

Subj: Geotechnical Exploration
New Front Lobby & Primary Care Addition
Royal C. Johnson Veterans Hospital
2501 W. 22nd Street
Sioux Falls, South Dakota
GeoTek #20-M50

This correspondence presents our written report of the geotechnical exploration program for the referenced project. Our work was performed in accordance with your authorization. We are transmitting an electronic copy of our report for your use.

We thank you for the opportunity of providing our services on this project and look forward to continued participation during the design and construction phases. If you have any questions regarding this report, please contact our office at (605) 335-5512.

Respectfully Submitted,
GeoTek Engineering & Testing Services, Inc.

Shawn Maassen

Shawn Maassen, PE
Project Manager

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 SOIL CLASSIFICATION
 SYMBOLS & DESCRIPTIVE TERMINOLOGY

**GEOTECHNICAL EXPLORATION
NEW FRONT LOBBY & PRIMARY CARE ADDITION
ROYAL C. JOHNSON VETERANS HOSPITAL
2501 W. 22ND STREET
SIOUX FALLS, SOUTH DAKOTA
GEOTEK #20-M50**

INTRODUCTION

Project Information

This report presents the results of the recent geotechnical exploration program for the proposed building addition and parking lot expansions for the Royal C. Johnson Veterans Hospital located at 2501 W. 22nd Street in Sioux Falls South Dakota.

Scope of Services

We performed our work in accordance with the authorization of Todd Stone with Stone Group Architects. The authorized scope of services included the following:

1. To perform 9 standard penetration test (SPT) borings to gather data on the subsurface conditions at the project site. However, test boring 6 was not performed due to multiple live utilities that were running through the proposed boring location.
2. To perform laboratory tests that include moisture content, dry density, Atterberg limits, and unconfined compressive strength.
3. To prepare an engineering report that includes the results of the field and laboratory tests as well as our earthwork and foundation recommendations for design and construction.

The scope of our work was intended for geotechnical purposes only. This scope of work did not include determining the presence or extent of environmental contamination at the site or to characterize the site relative to wetlands status.

FIELD DATA

Site Location & Description

The project site is located on the east side of the Royal C. Johnson Veterans Hospital in Sioux Falls, South Dakota. The majority of the site currently consists of parking lots and drive lanes that generally slope down towards the northeast. There are also a few grass covered areas within the site.

Ground Surface Elevations & Test Boring Locations

The ground surface elevations at the test boring locations were determined by using the finished floor of the existing hospital building as a benchmark. The elevation of the finished floor of the existing hospital building (1,500.1 feet) was provided by Stone Group Architects. The ground surface elevations at the test boring locations varied from 1,488.1 feet at test boring 8 to 1,502.2 feet at test boring 9. A site map, showing the relative locations of the test borings, is attached at the conclusion of this report.

Subsurface Conditions

Eight (8) test borings (test borings 1-5 and 7-9) were performed at the project site on January 7 and January 8, 2021. Test boring 6 was not performed due to multiple utilities running through the proposed boring location. The subsurface conditions encountered at the test boring locations are illustrated by means of the boring logs included in the Appendix.

The subsurface conditions encountered at the test boring locations consisted of ½ foot to 4 ½ feet of existing fill materials or topsoil materials overlying loess soils and glacial till soils. The existing fill materials consisted of mostly lean clay soils. The topsoil consisted of lean clay soils. The loess soils consisted of lean clay soils. The glacial till soils consisted of fat clay with sand soils.

The consistency of the soils is indicated by the standard penetration resistance (“N”) values as shown on the boring logs. A description of the soil consistency based on the “N” values can be found on the attached Soil Boring Symbols and Descriptive Terminology data sheet.

We wish to point out that the subsurface conditions at other times and locations at the site may differ from those found at our test boring locations. If different conditions are encountered during construction, it is important that you contact us so that our recommendations can be reviewed.

Water Levels

Measurements to record the groundwater levels were made at the test boring locations. The time and level of the groundwater readings are recorded on the boring logs. Also, a summary of the groundwater levels is shown in Table 1.

Table 1. Groundwater Levels

Test Boring	Ground Surface Elevation, ft	Groundwater Level, ft	Elevation of Groundwater, ft
1	1,498.1	Dry ¹	---
2	1,496.0	Dry ¹	---
3	1,497.5	18	1,479.5
4	1,495.7	Dry ¹	---
5	1,497.4	Dry ¹	---
7	1,498.0	22	1,476.0
8	1,488.1	Dry ¹	---
9	1,502.2	Dry ¹	---

Notes: ¹Similar or shallower water levels would be expected if the bore holes were allowed to stay open for an extended period of time.

The water levels may or may not be an accurate indication of the depth or lack of subsurface groundwater. The limited length of observation restricts the accuracy of the measurements. Long term groundwater monitoring was not included in our scope of work.

ENGINEERING REVIEW & RECOMMENDATIONS

Project Design Data

We understand that the project will consist of constructing a new front lobby and primary care addition on the east side of the Royal C. Johnson Veterans Hospital in Sioux Falls, South Dakota. The proposed addition is a 1-story to 2-story, slab-on-grade structure. However, there will be a 10-foot-deep by 10-foot-wide tunnel below the floor slab to carry utilities between the existing

building and the addition. It is our understanding that the maximum column loads for the building will be on the order of 240 kips and the maximum wall loads will be on the order of 2.5 kips per lineal foot (klf). We assume that foundation support will be provided by perimeter footings resting below frost depth and interior footings resting at or slightly below the floor slabs. It is our understanding that the proposed finished floor elevation for the addition will be 1,500.1 feet. Based on the proposed finished floor elevation and the test boring elevations, up to 4 ½ feet of new fill materials will be required to reach the finished floor elevation within the footprint of the addition.

The above information/assumptions are important factors in our review and recommendations. If there are any corrections or additions to the above-mentioned data, it is important that you contact us so that we can review our recommendations with regards to the revised plans.

Discussion

The test borings encountered up to 4 ½ feet of existing fill materials and topsoil materials. It is our opinion that the existing fill materials and topsoil materials are not suitable for support of the footings for the proposed building addition. However, the existing fill materials could be considered for the indirect support of the floor slabs of the building if the owner is willing to accept some additional risk of floor slab movement or distress.

Regarding the loess soils, they have very low to low strength characteristics, while the glacial till soils have moderate to high strength characteristics. The loess soils are also considered highly compressible. As previously stated, we anticipate that up to 4 ½ feet of filling will occur within the footprint of the proposed building addition in order to achieve the design elevation. Therefore, the loess soils will likely consolidate under the weight of the newly placed fill and the proposed addition.

With that said, it is our opinion that the loess soils could be considered for the indirect support of the floor slabs and lightly loaded footings (wall loads up to 4 klf and column loads up to 100 kips); however, moderately to heavily loaded footings should be supported on either rammed aggregate piers/aggregate piers or helical anchors that extend down into the glacial till soils. It should be noted that rammed aggregate piers/aggregate piers or helical anchors could also be used to support

the lightly loaded footings. If more than 1 option is chosen to support the footings, then we recommend verifying that the expected settlement for each option is compatible.

As previously stated, up to 4 ½ feet of additional fill will be needed to achieve the finished floor elevation of the proposed building addition. A time delay, between the placement of the fill and beginning rammed aggregate pier/aggregate pier installation, helical anchor installation, and footing construction, is recommended in building areas requiring more than 3 feet of fill. This time delay is to allow the underlying soils to compress/settle under the weight of the newly placed fill. See the section labeled *Time Delay* for additional recommendations.

Due to the elevated moisture content levels and very low to low strength characteristics of the loess soils, the subgrade soils will be disturbed easily. With that said, we recommend using track driven excavator for stripping and removals. If it is determined at the time of construction that a dozer does not disturb the subgrade soils, then a dozer could be used for stripping and removals.

Initial Site Preparation – Footprint of the Building Addition

We recommend that at a minimum the initial site preparation in the footprint of the building addition consist of removing any existing pavements, sidewalks, landscaping materials, vegetation, organic fill materials, and topsoil in order to expose the non-organic portions of the existing fill materials or the loess soils. Regarding non-organic existing fill materials, if it desired to minimize the risk of excessive floor slab settlement and/or distress then all existing fill materials should be removed from within the footprint of the building; however, if the owner is willing to accept some additional risk of excessive floor slab settlement and/or distress, then the non-organic existing fill materials that are in good condition would not need to be removed.

We recommend that observations, hand auger borings, and testing be performed on any remaining existing fill materials and the loess soils exposed at the bottom of the excavations. Unstable areas and areas of existing fill materials having low density will require further excavation. The removals should extend at least 10 feet past the edges of the building addition. Following the removals, we recommend placing and compacting general structural fill up to an elevation 6 inches below the bottom of the floor slab.

If groundwater or saturated soils are encountered at the bottom of the excavation, then we recommend placing a layer (approximately 12 inches thick) of crushed rock at the bottom of the excavation prior to the placement of the general structural fill.

Time Delay

Where more than 3 feet of fill is required above the existing grade, we recommend placing the general structural fill (site/floor slab fill) up to the design elevation followed by a time delay between the completion of the fill placement and footing construction in order to allow the underlying soils to compress/settle under the weight of the newly placed fill materials. The full thickness of the fill materials should extend a minimum of 10 feet outside the footprint of the building addition. A delay of 3 to 6 weeks should be expected. Settlement plates could be installed at the beginning stages of earthwork activities to monitor the rate of settlement after the fill has been placed. After the majority of the settlement has occurred, the rammed aggregate pier/aggregate pier installation, helical pile installation, and footing construction could begin.

Lightly Loaded Footings

Lightly loaded footings consist of continuous (wall) footings with loads up to 4 klf and pad (column) footings with loads up to 100 kips. Lightly loaded footings can be supported indirectly on the loess soils using the site preparation described below. Alternately, lightly loaded footings can be supported on rammed aggregate piers/aggregate piers or helical anchors as described in the *Moderately to Heavily Loaded Footings* section.

Site Preparation – Lightly Loaded Footings

Following the initial site preparation and time delay, excavate through any existing fill materials (newly placed structural fill does not need to be removed if it extends all the way to the loess soils) in order to expose the loess soils or to a depth 18 inches below the bottom of footing, whichever is greater.

If groundwater or saturated soils are encountered at the bottom of the footing excavation, then we recommend placing a layer (8 to 12 inches thick) of crushed drainage rock at the bottom of the excavation prior to placing the granular structural fill or pouring the footings.

The bottom of the footing excavations should be laterally oversized 1 foot beyond each edge of the footing for each vertical foot of granular structural fill or crushed drainage rock required below the footing (1 horizontal : 1 vertical).

Foundation Loads & Settlement

If our recommendations for indirectly supporting the lightly loaded footings on the loess soils are followed, then it is our opinion that the lightly loaded footings can be sized for a net allowable soil bearing pressure of up to 2,000 pounds per square foot (psf). With the net allowable soil bearing pressure and our site preparation recommendations, we recommend limiting the wall loads to 4 kips per lineal foot (klf) and the column loads to 100 kips. With the load limits and net allowable soil bearing pressure, total settlement of the footings should be less than 1 inch and differential settlement should be less than ½ inch. Unknown soil conditions at the site that are different from those depicted at the test boring locations could increase the amount of expected settlement.

Moderately to Heavily Loaded Footings

Moderately to heavily loaded footings consist of continuous (wall) footings with loads greater than 4 klf and pad (column) footings with loads greater than 100 kips. Moderately to heavily loaded footings can be supported using either rammed aggregate piers/aggregate piers or helical anchors.

Rammed Aggregate Piers/Aggregate Piers

A system of rammed aggregate piers or aggregate piers could be used to support the footings of the proposed building addition. With the rammed aggregate piers or aggregate piers, there are several support and sequencing options that could be considered. Discussions with the rammed aggregate pier or aggregate pier designer should be made to determine the best course of action.

We recommend that the rammed aggregate piers or aggregate piers be designed by a licensed professional engineer specializing in the design of rammed aggregate piers or aggregate piers. The designer will typically provide a net allowable soil bearing pressure and estimated settlements. The rammed aggregate piers or aggregate piers should be installed by an experienced licensed rammed aggregate pier or aggregate pier contractor. Testing of the rammed aggregate piers and

aggregate piers should be performed at the beginning of the work and during production to confirm the design parameters.

Rammed aggregate piers and aggregate piers are installed using 2 methods, the displacement method and the replacement method. The displacement method consists of probing equipment into the ground without removing soil (no “pre-drilling”). With the displacement method, excess pore pressures develop in soft/saturated clay soils that are displaced, which can temporarily decrease the strength and supporting characteristics of the surrounding soils and cause additional settlement. The replacement method consists of “pre-drilling” a hole, followed by replacing the removed soils with aggregate to construct the pier. With the replacement method, less disturbance occurs to the surrounding soils. With the soils encountered at the site, we recommend that the replacement method be used to construct the piers.

Protection of the rammed aggregate piers and aggregate piers will need to be considered before, during and after installation. The tops of the rammed aggregate piers and aggregate piers should be protected from construction traffic. Excavations performed within close proximity of a rammed aggregate pier or aggregate pier can affect the integrity of the rammed aggregate pier or aggregate pier. With that said, excavation work for underground utility installation, maintenance or future repair should be considered prior to the installation of the rammed aggregate piers or aggregate piers. Excavation work for future construction, maintenance or repairs should also take into account any risks that may affect the integrity of any rammed aggregate piers and aggregate piers.

We would like to point out that not all applications/systems are equivalent and each submitted design should be reviewed. In addition, the designer and installation contractor should have appropriate experience (e.g., at least 5 years of experience and at least 15 or more successfully completed projects).

Helical Anchors

The helical anchors should extend down to competent soils (glacial till soils). We recommend that the helical anchors be designed by a licensed professional engineer specializing in the design of helical anchors. The designer will typically provide a capacity and estimated settlements. Testing

of the helical anchors should be performed at the beginning of the work and during production to confirm the design capacities.

Slab-on-Grade Floor Slabs

If flooring adhesives are used on top of the concrete surface, then the final 6 inches of fill beneath the floor slab consist be select granular fill. If flooring adhesives are not used on top of the concrete surface, then an aggregate base course material or granular structural fill material may be used below the floor slab in the place of the select granular fill. We recommend consulting the floor covering manufacturer for more recommendations if flooring adhesives will be used.

If our recommendations are followed, it is our opinion that the slab-on-grade floor slabs can be designed using a soil modulus of subgrade reaction (k value) of 100 psi/inch.

Site Preparation – Tunnel Floor Slab and Elevator Pit Foundations

Following the initial site preparation and time delay, the site preparation for the tunnel floor slab and the elevator pit foundation should consist of excavating to a minimum depth of 18 inches below the bottom-of-footing/bottom-of-slab elevation. We recommend that observations and testing be performed on the materials exposed at the bottom of the excavation. Unstable areas or areas having low density will likely require further excavation. Once the subgrade is approved, granular structural fill or crushed drainage rock should be placed and compacted up to the design grade. We recommend that the final 6 inches of granular structural fill beneath the floor slab consist of select granular fill.

Retaining Walls

We recommend backfilling any retaining walls with free-draining sand. The active lateral earth pressures may be employed only if movement of the walls can be tolerated to reach the active state. A horizontal movement of approximately 1/500 of the height of the wall would be required to develop the active state for granular soils. If the above movement cannot be tolerated, then we recommend using the at-rest lateral earth pressures to design the walls. The zone of the sand backfill should extend a minimum of 2 feet outside the bottom of the foundation and then extend upward and outward at a slope no steeper than 1:1 (horizontal to vertical). Also, we recommend

capping the sand backfill section with 1 foot to 2 feet of clayey soil in areas that will not have asphalt or concrete surfacing to minimize infiltration of surface waters. Table 2 shows the equivalent fluid unit weight values for the various soil types anticipated for this project.

Table 2. Equivalent Fluid Unit Weight Values

Soil Type	At-Rest, pcf		Active, pcf		Passive, pcf	
	Drained	Submerged	Drained	Submerged	Drained	Submerged
Clay	-	-	-	-	220*	115*
Free-Draining Sand (SP)	50	90	35	80	460*	230*

*Value below frost depth – 0 pcf above frost depth.

The passive resistance in front of a retaining wall should not be used in an analysis unless the wall extends well below the depth of frost penetration due to loss of strength upon thawing. In addition, development of passive lateral earth pressure in the soil in front of a wall requires a relatively large rotation or outward displacement of the wall. Therefore, we do not recommend using passive resistance in front of the wall for the analysis.

During backfill operations, bracing and/or shoring of the walls may be needed. Only hand-operated compaction equipment should be used directly adjacent to the walls.

Coefficient of Friction

It is our opinion that a friction factor of 0.35 can be used between the clay soils and the bottom of the concrete. A friction factor of 0.45 can be used between the granular structural fill or drainage rock and the bottom of the concrete. The friction values are considered ultimate values. We recommend applying a theoretical safety factor of at least 2.0.

Excavation

Precautions will be required during earthwork activities in order to reduce the risk of soil disturbance. All excavations within the footprint of the building addition should be performed with a track-driven excavator (backhoe) having a smooth cutting edge. The subgrade should not be exposed to heavy construction traffic from rubber tire vehicles.

If an excavation adjacent to the existing building is to extend below the existing foundations, then we recommend that the excavation extend 1 foot to 2 feet outside the bottom of the existing foundation and then extend downward and outward at a slope no steeper than 1:1 (horizontal to vertical). This may not apply if caving soils are encountered beneath the existing foundations. In this case, temporary shoring or underpinning may be needed.

We recommend extreme caution be exercised while excavating adjacent to any existing structure to prevent undermining of the existing foundations. The excavations adjacent to any existing structure should be performed in small sections such that only a limited area of the foundation soils supporting the existing structure is exposed for a short period of time.

Drainage System for Tunnel & Elevator Pit

We recommend placing drainage pipes beneath the tunnel floor slab and elevator pit. The drainage pipes should have a maximum spacing of 25 feet between pipes and should also be placed along the exterior of the tunnel floor slab and elevator pit. We recommend placing the drainage pipes approximately 18 inches below the tunnel floor slab and the elevator pit (bottom of the granular structural fill or drainage rock). The drainage pipes should be surrounded by a properly graded filter that is wrapped in a geotextile filter fabric to minimize clogging. The drainage pipes should be connected to a suitable means of discharge. We also recommend that a sump pump system be installed.

Seismic Site Classification

Based on the test borings and the 2018 International Building Code (IBC), it is our opinion that the site, as a whole, corresponds to a Site Class D (stiff clay soil). Also, the ground acceleration values are as follows: $S_s = 0.092$ g, $S_1 = 0.035$ g, $S_{M5} = 0.147$ g, $S_{M1} = 0.085$ g, $S_{D5} = 0.098$ g, $S_{D1} = 0.057$ g. Therefore, the seismic design category is "A". The ground acceleration values are based on the ASCE 7-16 (referenced standard for 2018 IBC) with Risk Category IV. If needed, we can provide ground acceleration values for a different design code.

Frost Protection

Footings

We recommend that all footings be placed at a sufficient depth for frost protection. The perimeter footings for heated buildings should be placed such that the bottom of the footing is a minimum of 4 feet below the finished exterior grade. Interior footings in heated buildings can be placed beneath the floor slab. Footings for unheated structures should be placed such that the bottom of the footing is a minimum of 5 feet below the finished exterior grade.

Surface Improvements

It is our opinion that the on-site clay soils have a moderate to high frost susceptibility. Surface improvements, such as pavements, sidewalks and pool decks, constructed on these clay soils are potentially subject to both cosmetic and structural damage caused by frost heaving. The surface improvements should be designed to accommodate the potential frost movements, or non-frost susceptible drainage fill should be placed beneath the surface improvements. If movement cannot be tolerated, then we recommend placing non-frost susceptible drainage fill beneath the surface improvements. The non-frost susceptible drainage fill should extend to a depth of 4 feet below the finished exterior grade. If it is desired to reduce (but not eliminate) the amount of potential frost heave, we recommend consideration be given to placing 1 foot to 2 feet of non-frost susceptible drainage fill beneath the surface improvements.

Pavement Areas

Discussion

We anticipate that the vehicle traffic will consist of mostly automobiles and occasional delivery/garbage trucks. We also anticipate significant filling in the pavement areas. Therefore, if the recommended subgrade preparation is performed then a normal pavement section could be considered.

We would like to point out that the on-site loess soils are easily disturbed when they have high moisture contents, and they do not hold up well to heavy construction traffic. Therefore, if the subgrade of the new parking areas will be exposed to significant amounts of construction traffic

then either cement stabilization of the subgrade soils or the placement of a stabilization geotextile and a layer of subbase material could be considered to provide a stable surface and help protect the underlying subgrade soils.

Subgrade Preparation

We recommend that the subgrade preparation in the pavement areas consist of removing any existing pavements, landscaping materials, and vegetation/highly organic materials. A proofroll should be performed on the exposed subgrade soils with a large pad foot, vibratory drum roller. Any unstable soils will likely need to be removed. Following the removals, the subgrade should be prepared by placing and compacting subgrade fill up to the design elevations.

Once the design elevations have been achieved, we recommend that a proof roll be performed on the exposed subgrade with a truck weighing 20 tons to 30 tons. During the proof roll, unstable areas in the subgrade should be delineated from stable areas. An unstable area would be considered a location with at least 1 inch of rutting or deflection. Unstable areas will need additional corrections to provide a uniform and stable subgrade condition. Additional corrections may include the following: moisture conditioning the soils (e.g. drying the soils by scarification), cement stabilization of the subgrade soils, an overexcavation to remove and replace the unstable subgrade soils, the placement of a woven geotextile fabric at the subgrade surface, and/or the placement of a crushed rock material at the subgrade surface. The type of correction performed should be determined after observing the performance of the subgrade during the proof roll test. We expect that some unstable conditions will likely be encountered during the subgrade preparation, especially during wetter periods of the year.

Pavement Section Thicknesses

Table 3 (on the next page) shows the recommended pavement section thicknesses based on the subsurface conditions and anticipated traffic loads. We assume that the subgrade soils/fill materials have been prepared per our recommendations and are in a stable condition suitable for pavement support.

Table 3. Recommended Pavement Section Thicknesses

Pavement Description	Pavement Surfacing, in	Aggregate Base Course, in
PC Concrete	6	8
Asphalt	4 ½	10

The asphalt pavement should meet the requirements of sections 320 and 321 for Class G and the concrete pavement should meet the requirements of Section 380 of the SDDOT Standard Specifications. It should be noted that routine maintenance such as crack filling, localized patching, and seal coating should be expected with all pavements in our recommendations. The above designs could be reduced if the owner is willing to assume additional maintenance costs or potentially shorter pavement life.

Excavation – Pavement Areas

If soils with high moisture content levels are encountered, then low-ground pressure construction equipment should be used.

Material Types & Compaction Levels

General Structural Fill – The general structural fill should consist of either a granular or clay material. If granular materials are used, it should consist of the granular structural fill as described below. If a clay material is used, then it should consist of a non-organic clay having a liquid limit less than 45. Scrutiny on the clay material's moisture content should be made prior to the acceptance and use. The majority of the on-site loess soils could be reused as general structural fill; however, some moisture conditioning may be required. It should be noted that granular structural fill materials are preferred within the building footprint (especially in areas that have soft or wet soils below the fill being placed) due to ease of placement and compaction, as well as being more resistant to construction disturbance.

Granular Structural Fill – The granular structural fill should consist of a pit-run or processed sand or gravel having a maximum particle size of 3 inches with less than 10 percent by weight passing the #200 sieve. The granular structural fill should be placed in lifts of up to 1 foot in thickness.

Crushed Drainage Rock – The crushed drainage rock should be washed and meet the gradation specifications shown in Table 4.

Table 4. Crushed Drainage Rock Gradation Specifications

Sieve Size	Percent Passing
1 ½-inch	100
1-inch	70 – 90
¾-inch	25 – 50
3/8-inch	0 – 5

Select Granular Fill – The select granular fill should consist of a medium to coarse grained, free-draining sand or rock having a maximum particle size of 1 inch with less than 5 percent by weight passing the #200 sieve. The select granular fill should be placed in lifts of up to 1 foot in thickness.

Exterior Foundation Wall Backfill – We recommend either clay or granular soils be used to backfill the exterior side of the foundation walls. Debris, organic material, or over-sized material should not be used as backfill. If granular soils are used in areas that will not have asphalt or concrete surfacing, we recommend capping the granular soils with at least 1 to 2 feet of clay soils to minimize infiltration of surface water. The exterior backfill should be placed in lifts of up to 1 foot in thickness.

Interior Foundation Wall Backfill – We recommend that granular structural fill be used to backfill the interior side of the foundation walls. It should be placed in lifts up to 1 foot in thickness.

Free-Draining Sand – The free-draining sand should have a maximum particle size of 1 inch with less than 5 percent by weight passing the #200 sieve. The free-draining sand should be placed in lifts of up to 1 foot in thickness.

Subgrade Fill – The subgrade fill should consist of either a granular or clay material. Debris, organic material, or over-sized material should not be used as subgrade fill. If a granular material is used, then it should consist of a pit-run or processed sand or gravel having a maximum particle size of 3 inches. The granular material can be placed in lifts of up to 1 foot in thickness. If a clay material is selected, then it should consist of a non-organic clay having a liquid limit less than 45. Scrutiny on the clay material's moisture content should be made prior to the acceptance and use.

The clay fill should be placed in lifts of up to 6 inches in thickness. Portions of the on-site soils could be used as subgrade fill however some drying will likely be needed.

Aggregate Base Course Material – We recommend that the aggregate base course materials meet the requirements of Sections 260 and 882 of the SDDOT Standard Specifications.

Recommended Compaction Levels – The recommended compaction levels listed in Table 5 are based on a material's maximum dry density value, as determined by a standard Proctor (ASTM: D698) test.

Table 5. Recommended Compaction Levels

Placement Location	Compaction Specifications
Below Footings	97%
Below Floor Slabs	97%
Exterior Foundation Wall Backfill for Slab-on-Grade Structures	95%
Behind Retaining Walls	95% - 98%
Subgrade in Pavement Areas	95%
Base Course in Pavement Areas	97%
Granular Subbase in Pavement Areas	97%
Non-Structural Areas	90%

Notes: Compaction specifications are not applicable with the crushed drainage rock.

Recommended Moisture Levels – The moisture content of the clay backfill materials, when used as backfill around the exterior of a foundation should be maintained within a range of plus 1 percent to minus 4 percent of the materials' optimum moisture content. When the clay backfill materials are used as general structural fill, below a pavement area, or as site grading, the materials' moisture content should be maintained within a range of minus 1 percent to minus 4 percent of the materials' optimum moisture content. The optimum moisture content should be determined using a standard Proctor (ASTM: D698) test.

The moisture content of the granular backfill materials should be maintained at a level that will be conducive for vibratory compaction.

Drainage

Proper drainage should be maintained during and after construction. The general site grading should direct surface run-off waters away from the excavations. Water which accumulates in the excavations should be removed in a timely manner.

Finished grades around the perimeter of the structures should be sloped such that positive drainage away from the structures is provided. Also, a system to collect and channel roof run-off waters away from the structures is suggested.

CONSTRUCTION CONSIDERATIONS**Groundwater & Surface Water**

Water may enter the excavations due to subsurface water, precipitation or surface run off. Any water that accumulates in the bottom of the excavations should be immediately removed and surface drainage away from the excavations should be provided during construction.

Disturbance of Soils

The soils encountered at the test boring locations are susceptible to disturbance and can experience strength loss caused by construction traffic and/or additional moisture. Precautions will be required during earthwork activities in order to reduce the risk of soil disturbance.

Cold Weather Precautions

If site preparation and construction is anticipated during cold weather, we recommend all foundations, slabs and other improvements that may be affected by frost movements be insulated from frost penetration during freezing temperatures. If filling is performed during freezing temperatures, all frozen soils, snow and ice should be removed from the areas to be filled prior to placing the new fill. The new fill should not be allowed to freeze during transit, placement and compaction. Concrete should not be placed on frozen subgrades. Frost should not be allowed to penetrate below the footings. If floor slab subgrades freeze, we recommend the frozen soils be removed and replaced, or completely thawed, prior to placement of the floor slab. The subgrade

soils will likely require reworking and recompacting due to the loss of density caused by the freeze/thaw process.

Excavation Sideslopes

The excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches". This document states that the excavation safety is the responsibility of the contractor. Reference to this OSHA requirement should be included in the project specifications.

Observations & Testing

This report was prepared using a limited amount of information for the project and a number of assumptions were necessary to help us develop our conclusions and recommendations. It is recommended that our firm be retained to review the geotechnical aspects of the final design plans and specifications to check that our recommendations have been properly incorporated into the design documents.

The recommendations submitted in this report have been made based on the subsurface conditions encountered at the test boring locations. It is possible that there are subsurface conditions at the site that are different from those represented by the test borings. As a result, on-site observation during construction is considered integral to the successful implementation of the recommendations. We believe that qualified field personnel need to be on-site at the following times to observe the site conditions and effectiveness of the construction.

Excavation

We recommend that a geotechnical engineer or geotechnical engineering technician working under the direct supervision of a geotechnical engineer observe all excavations for foundations, slabs and pavements. These observations are recommended to determine if the exposed soils are similar to those encountered at the test boring locations, if unsuitable soils have been adequately removed and if the exposed soils are suitable for support of the proposed construction. These observations should be performed prior to placement of fill or foundations.

Testing

After the subgrade is observed by a geotechnical engineer/technician and approved, we recommend a representative number of compaction tests be taken during the placement of the granular structural fill and backfill placed below foundations, slabs and pavements, beside foundation walls and behind retaining walls. The tests should be performed to determine if the required compaction has been achieved. As a general guideline, we recommend at least 1 test be taken for every 2,000 square feet of granular structural fill placed in building, at least 1 test for every 75 feet to 100 feet in trench fill, and for every 2-foot thickness of fill or backfill placed. The actual number of tests should be left to the discretion of the geotechnical engineer. Samples of proposed fill and backfill materials should be submitted to our laboratory for testing to determine their compliance with our recommendations and project specifications.

SUBSURFACE EXPLORATION PROCEDURES

Test Borings

We performed 8 SPT borings, on January 7 and January 8, 2021, with a truck rig equipped with hollow-stem auger. Soil sampling was performed in accordance with the procedures described in ASTM:D1586. Using this procedure, a 2-inch O.D. split barrel sampler is driven into the soil by a 140-pound weight falling 30 inches. After an initial set of 6 inches, the number of blows required to drive the sampler an additional 12 inches is known as the penetration resistance, or “N” value. The “N” value is an index of the relative density of cohesionless soils and the consistency of cohesive soils.

The test borings were backfilled with on-site materials and some settlement of these materials can be expected to occur. Final closure of the holes is the responsibility of the client or property owner.

The soil samples collected from the test boring locations will be retained in our office for a period of 1 month after the date of this report and will then be discarded unless we are notified otherwise.

Soil Classification

As the samples were obtained in the field, they were visually and manually classified by the crew chief according to ASTM:D2488. Representative portions of all samples were then sealed and returned to the laboratory for further examination and for verification of the field classification. In addition, select samples were then submitted to a program of laboratory tests. Where laboratory classification tests (sieve analysis and Atterberg limits) have been performed, classifications according to ASTM:D2487 are possible. Logs of the test borings indicating the depth and identification of the various strata, the “N” value, the laboratory test data, water level information and pertinent information regarding the method of maintaining and advancing the drill holes are also attached in Appendix. Charts illustrating the soil classification procedures, the descriptive terminology and the symbols used on the boring logs are also attached in Appendix.

Water Level Measurements

The water levels indicated on the boring logs may or may not be an accurate indication of the depth or lack of subsurface groundwater. The limited length of observation restricts the accuracy of the measurements. Long term groundwater monitoring was not included in our scope of work.

Subsurface groundwater levels should be expected to fluctuate seasonally and yearly from the groundwater readings recorded at the test borings. Fluctuations occur due to varying seasonal and yearly rainfall amounts and snowmelt, as well as other factors.

Laboratory Tests

We performed laboratory tests on select samples to aid in determining the index properties of the soils. The tests consisted of dry density, moisture content, Atterberg limits (liquid and plastic limits), and unconfined compressive strength. The laboratory tests were performed in accordance with the appropriate ASTM procedures. The results of the laboratory tests are shown on the boring logs opposite the samples upon which the tests were performed or on the data sheets included in the Appendix.

LIMITATIONS

The recommendations and professional opinions submitted in this report were based upon the data obtained through the sampling and testing program at the test boring locations. We wish to point out that because no exploration program can totally reveal the exact subsurface conditions for the entire site, conditions between test borings and between samples and at other times may differ from those described in our report. Our exploration program identified subsurface conditions only at those points where samples were retrieved or where water was observed. It is not standard engineering practice to continuously retrieve samples for the full depth of the borings. Therefore, strata boundaries and thicknesses must be inferred to some extent. Additionally, some soils layers present in the ground may not be observed between sampling intervals. If the subsurface conditions encountered at the time of construction differ from those represented by our test borings, it is necessary to contact us so that our recommendations can be reviewed. The variations may result in altering our conclusions or recommendations regarding site preparation or construction procedures, thus, potentially affecting construction costs.

This report is for the exclusive use of the addressee and its representatives for use in design of the proposed project described herein and preparation of construction documents. Without written approval, we assume no responsibility to other parties regarding this report. Our conclusions, opinions and recommendations may not be appropriate for other parties or projects.

STANDARD OF CARE

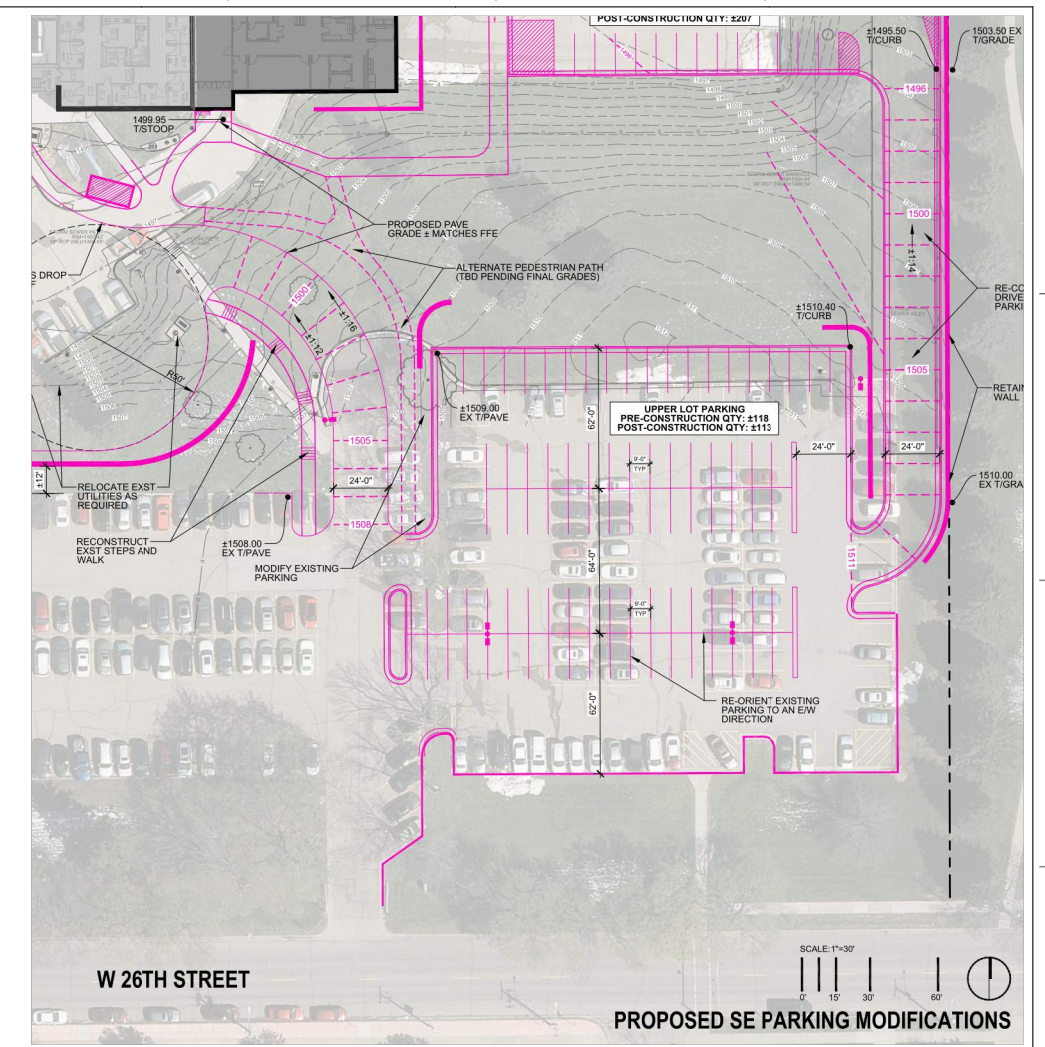
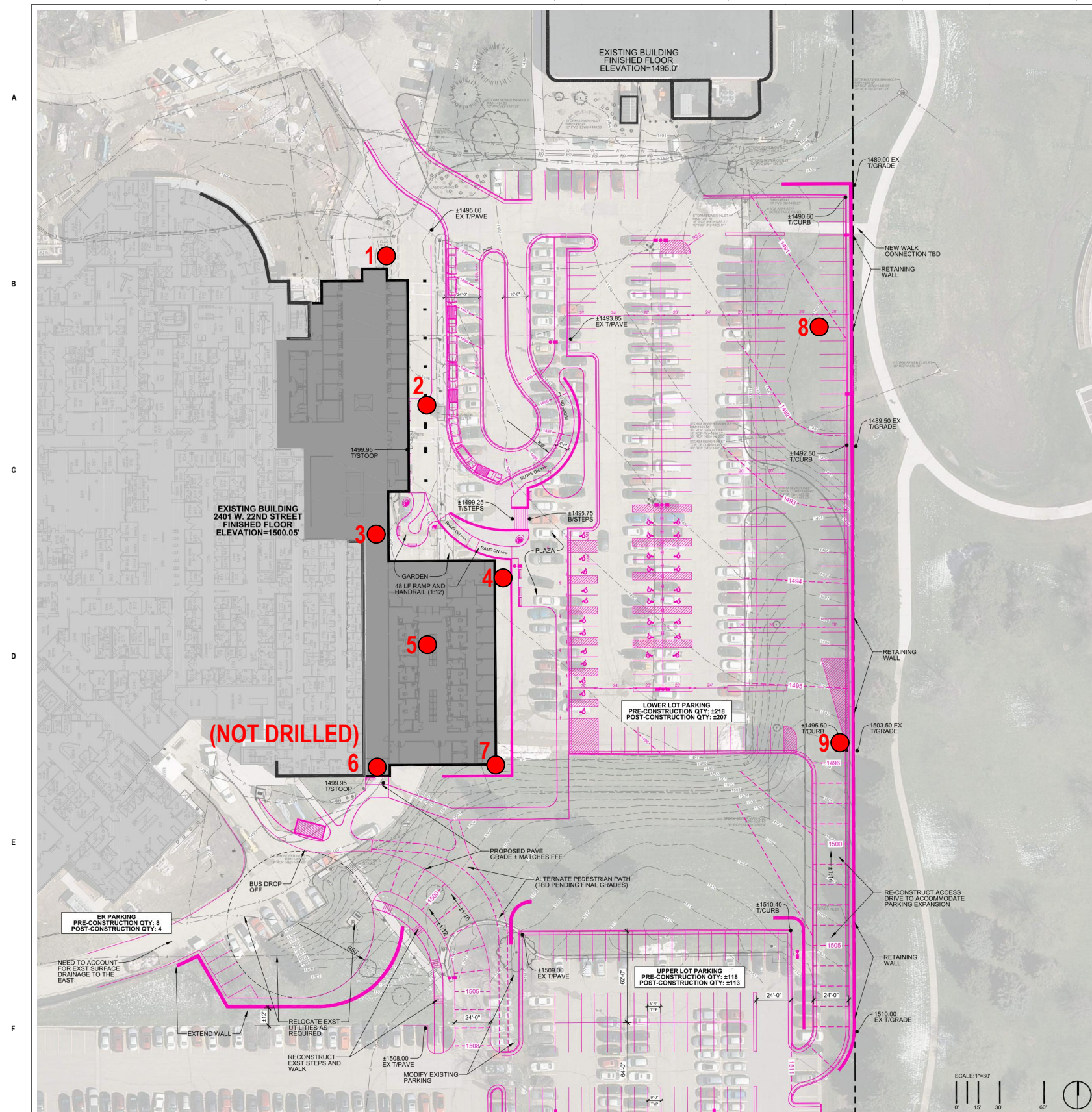
The recommendations submitted in this report represent our professional opinions. Our services for your project were performed in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering profession currently practicing at this time and area.

This report was prepared by:
GeoTek Engineering & Testing Services, Inc.



Shawn Maassen, PE
Project Manager





**FIGURE 1 - SITE MAP
NEW FRONT LOBBY & PRIMARY CARE ADDITION
ROYAL C. JOHNSON VETERANS HOSPITAL
SIOUX FALLS, SD**

Revision#	Description	Date

CONSULTANTS

ARCHITECTURAL: BWBR
30 South South Street, Suite 1100
Minneapolis, MN 55402
Phone: 612-465-7500

CIVIL: EVS
10025 Valley View Road, Suite 140
Eden Prairie, MN 55344
Phone: 952-846-6238

LANDSCAPE ARCHITECTURE: CONFLUENCE
354 North Main Avenue, Suite 201
Sioux Falls, SD 57104
Phone: 605-339-1205

ARCHITECT OF RECORD

A/E: Stone Group Architects
600 E 7th Street
Sioux Falls, SD 57103
605-271-1144

STONE GROUP ARCHITECTS

STAMP

Office of Construction and Facilities Management

VA U.S. Department of Veterans Affairs

PRELIMINARY NOT FOR CONSTRUCTION

Drawing Title: SITE CONCEPT

Phase: TEAM COORDINATION

Approved:

Project Title: NEW FRONT LOBBY AND PRIMARY CARE ADDITION

Location: SIOUX FALLS, SOUTH DAKOTA

Issue Date: 12/18/2020

Checked:

Drawn:

Project Number: VA #438-480
SGA #201909

Building Number: 5

Drawing Number: L-200



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GEOTECHNICAL TEST BORING LOG

GEOTEK # **20-M50**

BORING NO. **1 (1 of 1)**

PROJECT **New Front Lobby & Primary Care Addition, Royal C. Johnson Veterans Hospital, Sioux Falls, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	↓ SURFACE ELEVATION <u>1498.1 ft</u>														
	FILL, MOSTLY LEAN CLAY: brown and black, moist, a 5" layer of rocks at the surface	FILL			1	HSA									
4 1/2	LEAN CLAY: brown, moist, stiff, (CL)	LOESS	8		2	SPT	25	92							
7	LEAN CLAY: brown and gray, moist, firm to stiff, (CL)	LOESS	9		3	SPT	23	104							
					4	SPT	22								
					5	SPT	27								
11	LEAN CLAY: brownish gray, moist, soft, (CL)	LOESS	6		6	SPT	30								
					7	SPT	28								
19	FAT CLAY WITH SAND: a little gravel, brown, moist, stiff to very stiff, (CH)	GLACIAL TILL	4		8	SPT									
					10	SPT									
26	Bottom of borehole at 26 feet.		18		9	SPT									

GEOTECHNICAL TEST BORING 20-M50.GPJ GEOTEKENG.GDT 1/14/21

WATER LEVEL MEASUREMENTS

START 1-7-21 COMPLETE 1-7-21 1:40 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
1-7-21	1:40 pm	26	--	24	None	3.25" ID Hollow Stem Auger
--	--	--	--	--	--	
--	--	--	--	--	--	
--	--	--	--	--	--	CREW CHIEF Roy Hanson



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GEOTECHNICAL TEST BORING LOG

DEPTH in FEET		DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS							
SURFACE ELEVATION <u>1496.0 ft</u>						NO.	TYPE	WC	D	LL	PL	QU			
2		FILL, MOSTLY LEAN CLAY: black, moist, a 5" layer of concrete at the surface	FILL			1	HSA								
7		LEAN CLAY: brown, moist, firm, (CL)	LOESS	6		2	SPT	21	103						
7				7		3	SPT	20	102						
7		LEAN CLAY: brown and gray, moist, soft to firm, (CL)	LOESS	7		4	SPT	24							
				5		5	SPT	29							
				4		6	SPT	31							
16				4		7	SPT	30							
16		Bottom of borehole at 16 feet.													
WATER LEVEL MEASUREMENTS						START	1-7-21		COMPLETE	1-7-21 2:25 pm					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD									
1-7-21	2:25 pm	16	--	14	None	3.25" ID Hollow Stem Auger									
--	--	--	--	--	--										
--	--	--	--	--	--										
--	--	--	--	--	--	CREW CHIEF Roy Hanson									

GEOTECHNICAL TEST BORING - 20-M50.GPJ GEOTEKENG.GDT 1/14/21



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GEOTECHNICAL TEST BORING LOG

GEOTEK # <u>20-M50</u>						BORING NO. <u>3 (1 of 1)</u>					
PROJECT <u>New Front Lobby & Primary Care Addition, Royal C. Johnson Veterans Hospital, Sioux Falls, SD</u>											
DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
	↓ SURFACE ELEVATION <u>1497.5 ft</u>										
	FILL, MOSTLY LEAN CLAY: dark brown and brown, moist, stiff	FILL			1	HSA					
3½	LEAN CLAY: brown, moist, stiff, (CL)	LOESS	9		2	SPT	23	98			
			9		3	SPT	20	104			
7	LEAN CLAY: brown and gray, moist, firm, (CL)	LOESS	8		4	SPT	23				
9½	LEAN CLAY: brownish gray, moist, firm, (CL)	LOESS	5		5	SPT	28				
			5		6	SPT	27				
14½	LEAN CLAY: brown, moist, soft to firm, (CL)	LOESS	5		7	SPT	27				
20½	FAT CLAY WITH SAND: a little gravel, brown, moist, firm, (CH)	GLACIAL TILL	3		8	SPT	26				
21	Bottom of borehole at 21 feet.		5		9	SPT					
WATER LEVEL MEASUREMENTS						START	<u>1-7-21</u>	COMPLETE	<u>1-7-21 3:20 pm</u>		
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD					
1-7-21	3:20 pm	21	--	19	18.0	3.25" ID Hollow Stem Auger					
--	--	--	--	--	--						
--	--	--	--	--	--						
--	--	--	--	--	--	CREW CHIEF Roy Hanson					

GEOTECHNICAL TEST BORING 20-M50.GPJ GEOTEKENG.GDT 1/14/21



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GEOTECHNICAL TEST BORING LOG

GEOTEK # **20-M50**

BORING NO. **4 (1 of 2)**

PROJECT **New Front Lobby & Primary Care Addition, Royal C. Johnson Veterans Hospital, Sioux Falls, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS											
					NO.	TYPE	WC	D	LL	PL	QU							
	↓ SURFACE ELEVATION <u>1495.7 ft</u>																	
	FILL, MOSTLY LEAN CLAY: a trace of gravel, brown and black, moist, stiff, a 5" layer of concrete at the surface	FILL			1	FA												
3½	LEAN CLAY: brown, stiff, (CL)	LOESS	12		2	SPT	23	101										
6	LEAN CLAY: brown and gray, soft to stiff, (CL)	LOESS	9		3	SPT	25	93										
			9		4	SPT	25	100										1900
			7		5	SPT	27											
							33											
			3		6	SPT	29											
19	LEAN CLAY: brown, firm, (CL)	LOESS	5		7	SPT												
24	FAT CLAY WITH SAND: a little gravel, brown, stiff to very stiff, (CH)	GLACIAL TILL	15		8	SPT												

WATER LEVEL MEASUREMENTS

START 1-7-21 COMPLETE 1-7-21 12:10 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
--	--	--	--	--	--	Rotary Mud Drilling
--	--	--	--	--	--	
--	--	--	--	--	--	
--	--	--	--	--	--	CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 20-M50.GPJ GEOTEKENG.GDT 1/14/21



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GEOTECHNICAL TEST BORING LOG

GEOTEK # 20-M50 BORING NO. 4 (2 of 2)
 PROJECT New Front Lobby & Primary Care Addition, Royal C. Johnson Veterans Hospital, Sioux Falls, SD

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	↓ SURFACE ELEVATION <u>1495.7 ft</u>														
	FAT CLAY WITH SAND: a little gravel, brown, stiff to very stiff, (CH) <i>(Continued from previous page)</i>	GLACIAL TILL	15		9	X	SPT								
			17		10	X	SPT								
39	FAT CLAY WITH SAND: a little gravel, brown and gray, very stiff, (CH)	GLACIAL TILL	20		11	X	SPT								
44	CLAYEY SAND: a trace of gravel, medium grained, brown, very dense, (SC)	GLACIAL TILL	32		12	X	SPT								
46	Bottom of borehole at 46 feet.														

WATER LEVEL MEASUREMENTS						START <u>1-7-21</u> COMPLETE <u>1-7-21 12:10 pm</u>
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
--	--	--	--	--	--	Rotary Mud Drilling
--	--	--	--	--	--	
--	--	--	--	--	--	
--	--	--	--	--	--	CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 20-M50.GPJ GEOTEKENG.GDT 1/14/21



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GEOTECHNICAL TEST BORING LOG

GEOTEK # <u>20-M50</u>						BORING NO. <u>5 (1 of 1)</u>										
PROJECT <u>New Front Lobby & Primary Care Addition, Royal C. Johnson Veterans Hospital, Sioux Falls, SD</u>																
DEPTH in FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION <u>1497.4 ft</u>				GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS						
								NO.	TYPE	WC	D	LL	PL	QU		
2	FILL, MOSTLY LEAN CLAY: a trace of gravel, black, moist				FILL			1	HSA							
4 1/2	LEAN CLAY: brown, moist, firm, (CL)				LOESS	7		2	SPT	20	97					
	LEAN CLAY: brown and gray, moist, firm to stiff, (CL)				LOESS	9		3	SPT	22	100					
						8		4	SPT	26						
						8		5	SPT	27						
						7		6	SPT	29						
16						5		7	SPT	29						
Bottom of borehole at 16 feet.																
WATER LEVEL MEASUREMENTS						START	1-8-21		COMPLETE	1-8-21 10:10 am						
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD										
1-8-21	10:10 am	16	--	14	None	3.25" ID Hollow Stem Auger										
--	--	--	--	--	--											
--	--	--	--	--	--											
--	--	--	--	--	--	CREW CHIEF Roy Hanson										

GEOTECHNICAL TEST BORING 20-M50.GPJ GEOTEKENG.GDT 1/14/21



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GEOTECHNICAL TEST BORING LOG

GEOTEK # 20-M50 BORING NO. 7 (1 of 1)
 PROJECT **New Front Lobby & Primary Care Addition, Royal C. Johnson Veterans Hospital, Sioux Falls, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	↓ SURFACE ELEVATION <u>1498.0 ft</u>														
4 1/2	LEAN CLAY: brown, moist, stiff, a 5" layer of topsoil at the surface (CL)	LOESS	11		1	HSA									
					2	SPT	17	98							
	LEAN CLAY: brown and gray, moist, firm to stiff, (CL)	LOESS	9		3	SPT	24	98							
			9		4	SPT	26								
			7		5	SPT	28								
12	LEAN CLAY: brown, moist, firm, (CL)	LOESS	6		6	SPT	30								
			5		7	SPT	28								
			6		8	SPT	28								
24	FAT CLAY WITH SAND: a little gravel, brown, moist, stiff, (CH)	GLACIAL TILL	13		9	SPT									
26	Bottom of borehole at 26 feet.														

WATER LEVEL MEASUREMENTS						START	COMPLETE
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD	
1-7-21	9:50 am	26	--	24	▼ 22.0	3.25" ID Hollow Stem Auger	
--	--	--	--	--	--		
--	--	--	--	--	--		
--	--	--	--	--	--	CREW CHIEF Roy Hanson	

GEOTECHNICAL TEST BORING 20-M50.GPJ GEOTEKENG.GDT 1/14/21



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GEOTECHNICAL TEST BORING LOG

GEOTEK # <u>20-M50</u>						BORING NO. <u>8 (1 of 1)</u>											
PROJECT <u>New Front Lobby & Primary Care Addition, Royal C. Johnson Veterans Hospital, Sioux Falls, SD</u>																	
DEPTH in FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION <u>1488.1 ft</u>					GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS						
									NO.	TYPE	WC	D	LL	PL	QU		
	LEAN CLAY: brown, moist, firm, a 5" layer of topsoil at the surface (CL)						LOESS		1	HSA							
4 1/2	LEAN CLAY: brown and gray, moist, firm, (CL)						LOESS	6	2	SPT	20	102					
7	LEAN CLAY: brownish gray, moist, soft, (CL)						LOESS	5	3	SPT	24	96					
9 1/2	LEAN CLAY: brown and gray, moist, soft to firm, (CL)						LOESS	4	4	SPT	27	100	38	21	400		
							LOESS	3	5	SPT	32						
							LOESS	4	6	SPT	31						
16							LOESS	5	7	SPT	29						
Bottom of borehole at 16 feet.																	
WATER LEVEL MEASUREMENTS						START <u>1-8-21</u> COMPLETE <u>1-8-21 10:50 am</u>											
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD											
1-8-21	10:50 am	16	--	14	None	3.25" ID Hollow Stem Auger											
--	--	--	--	--	--												
--	--	--	--	--	--												
--	--	--	--	--	--	CREW CHIEF Roy Hanson											

GEOTECHNICAL TEST BORING 20-M50.GPJ GEOTEKENG.GDT 1/14/21



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GEOTECHNICAL TEST BORING LOG

DEPTH in FEET		DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS							
SURFACE ELEVATION <u>1502.2 ft</u>						NO.	TYPE	WC	D	LL	PL	QU			
		LEAN CLAY: brown, dry to moist, firm to stiff, a 5" layer of topsoil at the surface (CL)	LOESS			1	HSA								
				7		2	SPT	8	86						
				6		3	SPT	15	88						
						4	BAG								
				7		5	SPT	16							
				9		6	SPT	19							
				9		7	SPT	19							
14½		LEAN CLAY: brown and gray, moist, stiff, (CL)	LOESS	9		8	SPT	26							
16	Bottom of borehole at 16 feet.														
WATER LEVEL MEASUREMENTS						START	<u>1-8-21</u>	COMPLETE	<u>1-8-21 11:35 am</u>						
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD									
1-8-21	11:35 am	16	--	14	None	3.25" ID Hollow Stem Auger									
--	--	--	--	--	--										
--	--	--	--	--	--										
--	--	--	--	--	--	CREW CHIEF Roy Hanson									

GEOTECHNICAL TEST BORING 20-M50.GPJ GEOTEKENG.GDT 1/14/21

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO 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 (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES	
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
	FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			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	
SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
				CH	INORGANIC CLAYS OF HIGH PLASTICITY	
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS AND DESCRIPTIVE TERMINOLOGY**SYMBOLS FOR DRILLING AND SAMPLING**

<u>Symbol</u>	<u>Definition</u>
Bag	Bag sample
CS	Continuous split-spoon sampling
DM	Drilling mud
FA	Flight auger; number indicates outside diameter in inches
HA	Hand auger; number indicates outside diameter in inches
HSA	Hollow stem auger; number indicates inside diameter in inches
LS	Liner sample; number indicates outside diameter of liner sample
N	Standard penetration resistance (N-value) in blows per foot
NMR	No water level measurement recorded, primarily due to presence of drilling fluid
NSR	No sample retrieved; classification is based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit
SH	Shelby tube sample; 3-inch outside diameter
SPT	Standard penetration test (N-value) using standard split-spoon sampler
SS	Split-spoon sample; 2-inch outside diameter unless otherwise noted
WL	Water level directly measured in boring
▼	Water level symbol

SYMBOLS FOR LABORATORY TESTS

<u>Symbol</u>	<u>Definition</u>
WC	Water content, percent of dry weight; ASTM:D2216
D	Dry density, pounds per cubic foot
LL	Liquid limit; ASTM:D4318
PL	Plastic limit; ASTM:D4318
QU	Unconfined compressive strength, pounds per square foot; ASTM:D2166

DENSITY/CONSISTENCY TERMINOLOGY

<u>Density</u>	<u>Consistency</u>
<u>Term</u>	<u>Term</u>
Very Loose	Soft
Loose	Firm
Medium Dense	Stiff
Dense	Very Stiff
Very Dense	Hard

DESCRIPTIVE TERMINOLOGY

<u>Term</u>	<u>Definition</u>
Dry	Absence of moisture, powdery
Frozen	Frozen soil
Moist	Damp, below saturation
Waterbearing	Pervious soil below water
Wet	Saturated, above liquid limit
Lamination	Up to ½" thick stratum
Layer	½" to 6" thick stratum
Lens	½" to 6" discontinuous stratum

PARTICLE SIZES

<u>Term</u>	<u>Particle Size</u>
Boulder	Over 12"
Cobble	3" – 12"
Gravel	#4 – 3"
Coarse Sand	#10 – #4
Medium Sand	#40 – #10
Fine Sand	#200 – #40
Silt and Clay	passes #200 sieve

GRAVEL PERCENTAGES

<u>Term</u>	<u>Range</u>
A trace of gravel	2-4%
A little gravel	5-15%
With gravel	16-50%

SECTION 01 00 00
GENERAL REQUIREMENTS

GENERAL

1.1 SAFETY REQUIREMENTS

- A. Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

1.2 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Design New Front Lobby and Primary Care Addition Project #438-480 as required by drawings and specifications.
- B. Visits to the site by Bidders may be made in accordance with what is listed in the solicitation and at the discretion of the Contracting Officer.
- C. Offices of Stone Group Architects, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- E. Normal working hours for this contract will be from 7:00 AM to 4:30 PM (local time) Monday through Friday except for weekends and established Federal Holidays.
- F. Performing on-site work outside normal working hours will require approval from the Contracting Officer and the COR. Requests shall be submitted via email at least 72 hours prior to the requested date and at no additional cost to the Government. Approvals are subject to the availability of on-site staff.

1.3 STATEMENT OF BID ITEM(S)

- A. ITEM I, GENERAL CONSTRUCTION: BASE BID: Work includes general construction, alterations, roads, walks, grading, drainage, and necessary removal of existing structures and construction and certain other items.

- B. ALTERNATE NO.1: Delete terrazzo flooring (RES-2) and recessed concrete slab at all locations and replace with rubber flooring (RF-2).
- C. ALTERNATE NO.2: Delete illuminated Sky Factory ceiling (LC-1) at Lobby Corridor C55; and replace with acoustical ceiling panels (AT-1).
- D. ALTERNATE NO.3: (Not Applicable).
- E. ALTERNATE NO.4: Revise southeast parking lot from all new concrete pavement (as indicated on sheets C100 and C200) to asphalt patch (as indicated on sheet C101 and C201); revise east parking lot from all new concrete (as indicated on sheet C200) to concrete patch (as indicated on sheet C201); delete the seal coat and re-stripping of the south parking lot(as indicated on sheet C200); and change the stormwater gallery material from Advanced Drainage Systems arched pipe (as indicated on sheet C902) to corrugate metal or polyethylene round pipe as indicated on sheet C903).
- F. ALTERNATE NO.5: Delete the thirty (30) clearstory windows and motorized roller shades on the west side of Lobby C55 and provide solid precast concrete panels and gypsum board walls (reference elevations D1 and F1 on sheet AE203).
- G. ALTERNATE NO.6: Reduce the extent of snowmelt system (as indicated on sheets C200 and MP103) to the extents shown on sheets C202 and MP104).
- H. ALTERNATE NO.7: Delete the enclosed portion of the bus stop (precast concrete walls, associated foundation walls, aluminum storefront, heating, air conditioning, etc. Open canopy structure and lighting to remain under deduct alternate. Reference Sheet AE402.
- I. ALTERNATE NO.8: Delete 3Form panels at Valet Desk (reference elevations A2 and B2 on sheet AE452) and delete 3Form panels at Divider Wall (reference elevation F2/AE452).
- J. ALTERNATE NO.9: Delete motorized roller shades (this does not include the thirty (30) shades deleted in Alternate No. 5).
- K. ALTERNATE NO.10: Delete isolation valves at chilled water system (reference keynote #3 on sheets MP111 and MP112).
- L. ALTERNATE NO.11: Change irrigated turf grass seed mix to non-irrigated turf grass mix and native grass mix as indicated on sheet L-101. Omit irrigation system associated with new turf areas. Irrigation of plant bed below entry canopy and all repairs to existing irrigation system are to be included in both the base bid and alternate. See Irrigation Plan, Sheet L201.

- M. ALTERNATE NO.12: Delete the north two bays of the main entrance canopy (from grid 12.4 to grid 14.5).
- N. ALTERNATE NO.13: Change selectable privacy glass (SPG-1) at the office fronts (Rooms J02 - J17) to monolithic glass (MG3) with vinyl film (AWF-1).

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. Drawings and contract documents may be obtained from the website where the solicitation is posted. Additional copies will be at Contractor's expense.

1.5 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan:
 - 1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
 - 2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
 - 1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
 - 2. Before starting work the General Contractor shall give one week's notice to the Contracting Officer and COR so that arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
 - 3. No photography of VA premises is allowed without written permission of the Contracting Officer. Patients and staff are not to be photographed at any time.
 - 4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.
- C. Key Control:
 - 1. The General Contractor shall provide duplicate keys and lock combinations to the Contracting officers representative (COR) for the purpose of security inspections of every area of project

including tool boxes and parked machines and take any emergency action.

2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

D. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and COR immediately when there is a loss or compromise of "sensitive information".
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
 - a) Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
 - b) "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

1.6 OPERATIONS AND STORAGE AREAS (FAR 52.236-10)

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by

the Contracting Officers Representative. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be in the southwest corner of the Sioux Falls campus (contractorville) or as determined by the COR.
- E. Workers are subject to rules of Medical Center applicable to their conduct.
- F. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.
- G. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly

by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.
2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than five work days. Provide unobstructed access to Medical Center areas required to remain in operation.
3. Where access by Medical personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

H. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at the nearest main line; or, in absence of such indication, where directed by COR . All such actions shall be coordinated with the COR or Utility Company involved:

1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

I. Phasing:

1. The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks.
2. To ensure such executions, Contractor shall furnish the COR with a schedule of approximate, phasing, and dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such

phasing and dates to ensure accomplishment of this work in successive phases mutually agreeable to the COR as follows:

- J. Building(s) will be occupied during performance of work; but immediate areas of alterations will be vacated.
 - 1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. These routes whether access or egress shall be isolated from the construction area by temporary partitions and have walking surfaces, lighting etc. to facilitate patient and staff access. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.
 - 2. Immediate areas of alterations not mentioned in preceding Subparagraph 1 will be temporarily vacated while alterations are performed.
- K. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.
- L. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance therefore:
 - 1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
 - 2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs

or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

- M. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without a detailed work plan, the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY for additional requirements.
 2. Contractor shall submit a request to interrupt any such services to COR, in writing, 7 days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours (after hours or on weekends).
 4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
 5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction

- project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- N. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, shall be removed back to their main line. Those which are indicated to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged at the main, branch or panel they originate from. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- O. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times with approval. Where trenches could remain partially exposed during working hours, steel plates (capable of normal vehicle traffic) will be placed over and anchored in place so that normal traffic can remain during the day.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- P. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR, of buildings or areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:
1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of buildings.
 2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds,

- shades, etc., required by drawings to be either reused or relocated, or both.
3. Shall note any discrepancies between drawings and existing conditions at site.
 4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:
1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workers in executing work of this contract.
- D. Protection: Provide the following protective measures:
1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
 2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
 3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately

protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 DISPOSAL AND RETENTION

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.
 2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
 3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.
 4. PCB Transformers and Capacitors : The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformers and capacitors. The transformers and capacitors shall be taken out of service and handled in accordance with the procedures of the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) as outlined in Code of Federal Regulation (CFR), Titled 40 and 49 respectively. The EPA's Toxic Substance Control Act (TSCA) Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7 also apply. Upon removal of PCB transformers and capacitors for disposal, the "originator" copy of the Uniform Hazardous Waste Manifest (EPA Form 8700-22), along with the Uniform Hazardous Waste Manifest Continuation Sheet (EPA Form 8700-22A) shall be returned to the Contracting Officer who will annotate the contract file and transmit the Manifest to the COR.
 - a) Copies of the following listed CFR titles may be obtained from the Government Printing Office:
 - 40 CFR 261.....Identification and Listing of Hazardous Waste

- 40 CFR 262.....Standards Applicable to Generators of Hazardous Waste
- 40 CFR 263.....Standards Applicable to Transporters of Hazardous Waste
- 40 CFR 761.....PCB Manufacturing, Processing, Distribution in Commerce, and use Prohibitions
- 49 CFR 172.....Hazardous Material tables and Hazardous Material Communications Regulations
- 49 CFR 173.....Shippers - General Requirements for Shipments and Packaging
- 49 CFR 173.....Subpart A General
- 49 CFR 173.....Subpart B Preparation of Hazardous Material for Transportation
- 49 CFR 173.....Subpart J Other Regulated Material; Definitions and Preparation
- TSCA.....Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (FAR 52.236-9)

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workers, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the

Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:
1. Designating areas for equipment maintenance and repair;
 2. Providing waste receptacles at convenient locations and provide regular collection of wastes;
 3. Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
 4. Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
 5. Providing adequately maintained sanitary facilities.

1.10 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall

conform in type and quality to that of original existing construction, except as otherwise shown or specified.

- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workers to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.11 PHYSICAL DATA - SOIL CONDITIONS

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
- B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown diagrammatically on drawings.
- C. A copy of the soil report will be made available for inspection by bidders upon request to the Contracting Officer and COR at the VA Medical Center, Sioux Falls, and shall be considered part of the contract documents.
- D. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

1.12 PROFESSIONAL SURVEYING SERVICES

- A. A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

1.13 AS-BUILT DRAWINGS

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To ensure compliance, as-built drawings shall be made available for the COR review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.14 WARRANTY MANAGEMENT

- A. Warranty Management Plan: Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction at least 30 days before the planned pre-warranty conference, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesman, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was approved. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly invoice for payment. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of the project acceptance and continue for the product warranty period. A joint 4 month and 9 month

warranty inspection will be conducted, measured from time of acceptance, by the Contactor and the Contracting Officer. Include in the warranty management plan, but not limited to, the following:

1. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the company of the Contractor, subcontractors, manufacturers or suppliers involved.
2. Furnish with each warranty the name, address and telephone number of each of the guarantor's representatives nearest project location.
3. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers and for all commissioned systems such as fire protection and alarm systems, sprinkler systems and lightning protection systems, etc.
4. A list for each warranted equipment item, feature of construction or system indicating:
 - a. Name of item.
 - b. Model and serial numbers.
 - c. Location where installed.
 - d. Name and phone numbers of manufacturers and suppliers.
 - e. Name and phone numbers of manufacturers or suppliers.
 - f. Names, addresses and phone numbers of sources of spare parts.
 - g. Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
 - h. Starting point and duration of warranty period.
 - i. Summary of maintenance procedures required to continue the warranty in force.
 - j. Cross-reference to specific pertinent Operation and Maintenance manuals.
 - k. Organizations, names and phone numbers of persons to call for warranty service.
 - l. Typical response time and repair time expected for various warranted equipment.
5. The plans for attendance at the 4 and 9-month post construction warranty inspections conducted by the government.

6. Procedure and status of tagging of all equipment covered by extended warranties.
 7. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- B. Performance & Payment Bonds: The Performance & Payment Bonds must remain effective throughout the construction period.
1. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
 2. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the contractor's expenses, the Contracting Officer will have the right to recoup expenses from the bonding company.
 3. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.
- C. Pre-Warranty Conference: Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/ reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contract will be located within the local service area of the warranted construction, be continuously available and be responsive to Government inquiry on warranty work action and status. This

requirement does not relieve the Contractor of any of its responsibilities in conjunction with other portions of this provision.

D. Contractor's Response to Construction Warranty Service Requirements:

E. Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.

1. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.
2. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.
3. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.
4. The "Construction Warranty Service Priority List" is as follows:
 - a) Code 1-Life Safety Systems
 - 1) Fire suppression systems.
 - 2) Fire alarm system(s).
 - b) Code 1-Air Conditioning Systems
 - 1) Air conditioning leak in part of the building, if causing damage.
 - 2) Air conditioning system not cooling properly.
 - c) Code 1 Doors
 - 1) Overhead doors not operational, causing a security, fire or safety problem.
 - 1) Interior, exterior personnel doors or hardware, not functioning properly, causing security, fire or safety problem.
 - d) Code 3-Doors
 - 1) Overhead doors not operational.

- 2) Interior/exterior personnel doors or hardware not functioning properly.
- e) Code 1-Electrical
 - 1) Power failure (entire area or any building operational after 1600 hours).
 - 2) Security lights.
 - 3) Smoke detectors.
- f) Code 2-Electrical
 - 1) Power failure (no power to a room or part of building).
Receptacle and lights not operational (in a room or part of building).
- g) Code 3-Electrical
 - 1) Exterior lights not operational.
- h) Code 1-Gas
 - 1) Leaks and pipeline breaks.
- i) Code 1-Heat
 - 1) Power failure affecting heat.
- j) Code 1-Plumbing
 - 1) Hot water heater failure.
 - 2) Leaking water supply pipes
- k) Code 2-Plumbing
 - 1) Flush valves not operating properly
 - 2) Fixture drain, supply line or any water pipe leaking.
 - 3) Toilet leaking at base.
- l) Code 3- Plumbing
 - 1) Leaky faucets.
- m) Code 3-Interior
 - 1) Floors damaged.
 - 2) Paint chipping or peeling.
 - 3) Casework damaged.
- n) Code 1-Roof Leaks
 - 1) Damage to property is occurring.
- o) Code 2-Water (Exterior)
 - 1) No water to facility.
- p) Code 2-Water (Hot)
 - 1) No hot water in portion of building listed.
- q) Code 3
 - 1) All work not listed above.

- F. Warranty Tags: At the time of installation, tag each warranted item with a durable, oil and water-resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Warranty Tags
Type of product/material
Model number
Serial number
Contract number
Warranty period from/to
Inspector's signature
Construction Contractor
Address
Telephone number
Warranty Contact
Address
Telephone number
Warranty response time priority code

1.15 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed and restoration performed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.
- C. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at time set for completion of such buildings or parts thereof.

1.16 RESIDENT ENGINEER'S FIELD OFFICE

- A. The Contractor shall, within fifteen (15) days after receipt of Notice to Proceed, provide where shown on the drawings a temporary field office, furniture, and two inch deep gravel surfaced area for use of the COR. Office and furniture shall be new.
- B. The field office shall provide not less than 67 square meters (720 gross square feet) of floor area in one unit. Installation of the office shall meet all local codes.
- C. Provide office with two, 900 mm (three foot) wide exterior doors, including hardware and OSHA approved platform and stairs leading to grade.
- D. Enclose the entire perimeter of the office from the floor to the ground and finish to match exterior. Provide R7 insulation and seal tight to ground with a painted 19 mm (3/4 inch) exterior grade plywood skirt.
- E. Exterior finishes shall be manufacturer's standards.
- F. Provide floor, wall, and roof with not less than R5 insulation.
- G. Interior finishes shall consist of resilient flooring, plywood paneling or painted wallboard on walls, and acoustical tile ceilings. Interior doors may be either painted or stained.
- H. Interior shall be subdivided with full height partitions to provide two offices, one sample room, one toilet. Provide each space with 900 mm (three foot) wide door with master keyed locks. Section off an area with a low partition and counter for the secretary's desk.
- I. Provide 750 mm (2-1/2 feet) wide by 900 mm (3 feet) high operable windows; two in each room (none required in sample room), except provide only one 600 mm (2 foot) high window in toilet room(s). Window openings shall be fitted with security bars to prevent any forced entry. The doors of field office shall have a hasp and padlock and also deadbolts keyed from both sides.
- J. Provide sufficient fluorescent lighting in each room to deliver 750 lux (70 foot-candles) of light at desk top height without the aid of daylight. Provide one light switch in each room.
- K. Provide one duplex receptacle in each wall of each room. If a wall is 3.0 m (10 feet) long or more, provide two receptacles for each 3.0 m (10 feet), or portion thereof, of wall. Provide two duplex receptacles in low partition at secretary's desk.
- L. The Contractor shall provide the following:

1. Electricity, hot and cold water, and necessary utility services (except telephone).
 2. All necessary piping, power circuits network cabling, cat 5e or better cabling for phones and computers, electrical fixtures, lighting, and other items necessary to provide a habitable structure for the purpose intended. The number of network and electrical receptacles will be as per attached drawing of the field office.
 3. Thermostatically controlled, centralized heating and air conditioning system designed to maintain the temperature between 21 and 27 degrees C (70 and 80 degrees F) with 50 percent relative humidity maintained during the air conditioning season.
 4. One water closet, lavatory, mirror, toilet paper dispenser, paper towel dispenser, soap dispenser, towel bar, and two-prong coat hooks for each toilet room.
- M. Contractor shall, for the duration of the COR occupancy, provide the following:
1. Satisfactory conditions in and around the field office and parking area.
 2. Maintenance of gravel surfaced area, including the area for parking, in an acceptable condition for vehicle and foot traffic at all times.
 3. Maintenance of utility services.
 4. Potable water, fuel and electric power for normal office uses, including lights, heating and air conditioning.
- N. The Contractor shall provide the following new items:
- QUANTITY REQUIRED
- 1 workstation with adjustable keying desk or drawer 738 mm H x 1.5 m W x 760 mm D (size 29-1/2" H x 60" W x 30" D)
 - 1 Printer stand 663 mm H x 1.5 m W x 750 mm D (size 26-1/2" H x 60" W x 30" D)
 - 3 Office desks, double pedestal
 - 1 Conference table 900 mm x 1.8 m (size 3' x 6')
 - 1 Plan table 1.2 m x 2.1 m (4' x 7')
 - 3 Work tables 750 mm x 1.8 m (folding 30" x 72")
 - 1 Office chair
 - 4 Swivel chairs with arms
 - 6 Conference chairs (armless & folding)

- 2 Arm Chairs
- 4 Lockable 5 drawer file cabinets, letter size
- 1 Drawing rack, with 12-750 mm (12-30 inch) "Plan Hold" drawing holders, freestanding
- 1 Shelves for sample room, 7 adjustable Shelves, 305 mm W x 900 mm L (12" W x 3' L)
- 3 Bookcases
- 1 Electric water cooler
- 1 Metal storage cabinet, 900 mm x 450 mm x 1.8 m (36" x 18" x 72") with six shelves
- 2 workstations with adjustable keying desk or drawer 738 mm H x 1.5 m W 750 mm D (size 29-1/2" H x 60" W x 30" D)
- 2 Printer stands 738 mm H x 1500 mm W x 750 mm D (size 29-1/2" H x 60" H x 30" D)
- 7 Office desks, double pedestal
- 2 Conference tables 900 mm x 1800 mm (size 3' x 6')
- 1 Plan table 1200 mm x 6 meters (4' x 20')
- 7 Work tables 750 mm x 1800 mm (folding 30" x 72")
- 2 Office chairs
- 7 Swivel chairs with arms
- 12 Conference chairs (armless and folding)
- 7 Arm chairs
- 8 Lockable 5 drawer file cabinets, letter-size
- 2 Drawing racks, each with 12-750 mm (12-30 inch) "Plan Hold" drawing holders, freestanding
- 7 Bookcases
- 1 Electric water cooler
- 4 Shelves for sample 900 mm x 450 mm x 1.8 m (36" x 18" x 72") high, 7 adjustable shelves
- O. At the completion of all work, including the punch list, the COR field office and facilities shall become the property of the Contractor and Contractor shall remove same, including utility connections, from the Medical Center. The site shall be restored to original condition and finished in accordance with contract requirements.
- P. The Contractor shall furnish floor plans for approval by the COR prior to furnishing the field office.

1.17 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to written approval and compliance with the following provisions:
1. Permission to use each unit or system must be given by COR in writing. If the equipment is not installed and maintained in accordance with the written agreement and following provisions, the COR will withdraw permission for use of the equipment.
 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Installation of temporary electrical equipment or devices shall be in accordance with NFPA 70, National Electrical Code, (2014 Edition), Article 590, *Temporary Installations*. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
 5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.
- D. Any damage to the equipment or excessive wear due to prolonged use will be repaired replaced by the contractor at the contractor's expense.

1.18 TEMPORARY USE OF EXISTING ELEVATORS

1. Contractor makes all arrangements with the COR for use of elevators. The COR will ascertain that elevators are in proper condition. Contractor may use elevators Nos. A and B in Building Nos. 5 for exclusive use and for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
2. Contractor covers and provides maximum protection of following elevator components:
 - a) Entrance jambs, heads soffits and threshold plates.
 - b) Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
 - c) Finish flooring.
3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes at the contractors expense.

1.19 TEMPORARY TOILETS

- A. Provide where directed, (for use of all Contractor's workers) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR, provide suitable dry closets where directed. Keep such places clean and free from flies and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.
 1. *Contractor may have for use of Contractor's workers, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workers. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.20 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner, in compliance with code and as satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia and repair restore the infrastructure as required.
- C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
1. Obtain heat by connecting to Medical Center heating distribution system.
- E. Electricity (for Construction and Testing): Furnish all temporary electric services.
1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- F. Water (for Construction and Testing): Furnish temporary water service.
1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each

connection as per code. Water is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR discretion) of use of water from Medical Center's system.
- G. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup, adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished and paid by the Contractor at Contractor's expense.

1.21 NEW TELEPHONE EQUIPMENT

- A. The contractor shall coordinate with the work of installation of telephone equipment by others. This work shall be completed before the building is turned over to VA.

1.22 TESTS

- A. As per specification section 23 05 93 the contractor shall provide a written testing and commissioning plan complete with component level, equipment level, sub-system level and system level breakdowns. The plan will provide a schedule and a written sequence of what will be tested, how and what the expected outcome will be. This document will be submitted for approval prior to commencing work. The contractor shall document the results of the approved plan and submit for approval with the as built documentation.
- B. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- C. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- D. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire system which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply

air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.

- E. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonable period of time during which operating and environmental conditions remain reasonably constant and are typical of the design conditions.
- F. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.23 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a

different model, style, and size than that furnished will not be accepted.

- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The contractor shall submit a course outline with associated material to the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.24 GOVERNMENT-FURNISHED PROPERTY

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Contractor shall be prepared to receive this equipment from Government and store or place such equipment not less than 90 days before Completion Date of project.
1. *Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.
- D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.

1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.
- F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.25 RELOCATED EQUIPMENT / ITEMS

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or "C,C" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, at the main whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and

installation of relocated equipment; and leave such equipment in proper operating condition.

- E. Contractor shall employ services of an installation engineer, who is an authorized representative of the manufacturer of this equipment to supervise assembly and installation of existing remote dictating machine, X-ray, dental, and laundry equipment, required to be relocated.
- F. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.26 CONSTRUCTION SIGN

- A. Provide a Construction Sign where directed by the COR. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.
- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.
- C. Maintain sign and remove it when directed by the COR.
- D. Detail Drawing of construction sign showing required legend and other characteristics of sign is attached hereto and made a part of this specification.

1.27 SAFETY SIGN

- A. Provide a Safety Sign where directed by COR. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.
- C. Maintain sign and remove it when directed by COR.

- D. Drawing details in VA Signage Design Manual, Section 11 Specialty Signs (found on VA TIL) show required legend and other characteristics of sign and are attached hereto and is made a part of this specification. shown on the drawings.
- E. Post the number of accident free days on a daily basis.

1.28 PHOTOGRAPHIC DOCUMENTATION

- A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones including electronic indexing, navigation, storage and remote access to the documentation, as per these specifications. The commercial photographer or the subcontractor used for this work shall meet the following qualifications:
 - 1. Demonstrable minimum experience of three (3) years in operation providing documentation and advanced indexing/navigation systems including a representative portfolio of construction projects of similar type, size, duration and complexity as the Project.
 - 2. Demonstrable ability to service projects throughout North America, which shall be demonstrated by a representative portfolio of active projects of similar type, size, duration and complexity as the Project.
- B. Photographic documentation elements:
 - 1. Each digital image shall be taken with a professional grade camera with minimum size of 6 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
 - 2. Indexing and navigation system shall utilize actual AUTOCAD construction drawings, making such drawings interactive on an on-line interface. For all documentation referenced herein, indexing and navigation must be organized by both time (date-stamped) and location throughout the project.
 - 3. Documentation shall combine indexing and navigation system with inspection-grade digital photography designed to capture actual conditions throughout construction and at critical milestones. Documentation shall be accessible on-line through use of an internet connection. Documentation shall allow for secure multiple-user access, simultaneously, on-line.

4. Before construction, the building pad, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities and adjacent structures surrounding the building pad and site shall be documented. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings. If site work or pad preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.
5. Construction progress for all trades shall be tracked at pre-determined intervals, but not less than once every thirty (30) calendar days ("Progressions"). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.
6. As-built condition of pre-foundation utilities and site utilities shall be documented prior to pouring footers, placing concrete and/or backfilling. This process shall include all underground and in-slab utilities within the building(s) envelope(s) and utility runs in the immediate vicinity of the building(s) envelope(s). This may also include utilities enclosed in slab-on-deck in multi-story buildings. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive site utility plans.
7. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation, sheet rock or dry wall installation. This process shall include all finished systems located in the walls and ceilings of all buildings at the Project. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
8. As-built conditions of exterior skin and elevations shall be documented with an increased concentration of digital photographs as directed by the COR in order to capture pre-determined focal points, such as waterproofing, window flashing, radiused steel work, architectural or Exterior Insulation and Finish Systems (EIFS)

detailing. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive elevations or elevation details.

9. As-built finished conditions of the interior of each building including floors, ceilings and walls shall be documented at certificate of occupancy or equivalent, or just prior to occupancy, or both, as directed by the COR. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
10. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled and inserted into a Section in the navigation structure entitled "Slideshows," allowing this information to be stored in the same "place" as the formal scope.
11. Customizable project-specific digital photographic documentation of other details or milestones. Indexing and navigation accomplished through interactive architectural plans.
12. Monthly (29 max) exterior progressions (360 degrees around the project) and slideshows (all elevations and building envelope). The slideshows allow for the inclusion of Department of Veterans Affairs pictures, aerial photographs, and timely images which do not fit into any regular monthly photopath.
13. Weekly (21 Max) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.
14. Regular (8 max) interior progressions of all walls of the entire project to begin at time of substantial framed or as directed by the COR through to completion.
15. Detailed Exact-Built of all Slabs for all project slab pours just prior to placing concrete or as directed by the COR.
16. Detailed Interior exact built overlapping photos of the entire building to include documentation of all mechanical, electrical and plumbing systems in every wall and ceiling, to be conducted after rough-ins are complete, just prior to insulation and or drywall, or as directed by COR.

17. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by COR prior to occupancy.
 18. In event a greater or lesser number of images than specified above are required by the COR, adjustment in contract price will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4).
- C. Images shall be taken by a commercial photographer and must show distinctly, at as large a scale as possible, all parts of work embraced in the picture.
 - D. Coordination of photo shoots is accomplished through COR. Contractor shall also attend construction team meetings as necessary. Contractor's operations team shall provide regular updates regarding the status of the documentation, including photo shoots concluded, the availability of new Progressions or Exact-Builts viewable on-line and anticipated future shoot dates.
 - E. Contractor shall provide all on-line domain/web hosting, security measures, and redundant server back-up of the documentation.
 - F. Contractor shall provide technical support related to using the system or service.
 - G. Upon completion of the project, final copies of the documentation (the "Permanent Record") with the indexing and navigation system embedded (and active) shall be provided in an electronic media format, typically a DVD or external hard-drive. Permanent Record shall have Building Information Modeling (BIM) interface capabilities. On-line access terminates upon delivery of the Permanent Record.

1.29 FINAL ELEVATION DIGITAL IMAGES

- A. A minimum of four (4) images of each elevation shall be taken with a minimum 6 MP camera, by a professional photographer with different settings to allow the COR to select the image to be printed. All images are provided to the RE on a CD.
- B. Photographs shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day to obtain sufficient detail to show depth and to provide clear, sharp pictures. Pictures shall be 400 mm x 500 mm (16 by 20 inches), printed on regular weight paper, matte finish archival grade photographic paper and produced by a RA4 process from the digital image with a minimum 300 PPI. Identifying data shall be carried on label affixed to back of photograph without damage to

photograph and shall be similar to that provided for final construction photographs.

- C. Furnish six (6) 400 mm x 500 mm (16 by 20 inch) color prints of the following buildings constructed under this project (elevations as selected by the RE from the images taken above). Photographs shall be artistically composed showing full front elevations. All images shall become property of the Government. Each of the selected six prints shall be placed in a frame with a minimum of 2 inches of appropriate matting as a border. Provide a selection of a minimum of 3 different frames from which the SRE will select one style to frame all six prints. Photographs with frames shall be delivered to the COR in boxes suitable for shipping.

1.30 VA TRIRIGA CPMS

- A. VA contractors, selected by award to perform work, are required to get access to the VA TRIRIGA CPMS. The TRIRIGA CPMS is the management and collaborative environment that the VA uses for all Major, Minor and Non-Recurring Maintenance (NRM) projects within the Office of Construction & Facilities Management (CFM), Veterans Health Administration (VHA), National Cemetery Administration (NCA), and the Veterans Benefits Administration (VBA).
- B. The contractor is solely responsible for acquiring access to the VA TRIRIGA CPMS.
- C. To gain access to the VA TRIRIGA CPMS the contractor is encouraged to follow the licensing process outline as specified below:
- D. Requirement: TRIRIGA is the management and collaborative environment that VA uses for all construction projects. VA requires its contractors to procure TRIRIGA access as part of the cost of performance for a VA construction related contract.
- E. Access Request and Payment can be made through the following URL
<https://valicensing.oncfi.com/>
- F. Inquiries or to request additional services, contact the following:
Craig Alsheimer, Federal Account Manager
Computerized Facility Integrations, LLC
18000 West Nine Mile Road
Suite 700
Southfield, MI 48075
Email: calsheimer@gocfi.com
Phone: 248-557-4234 Extension 6010; 410-292-7006

G. Process:

1. Once the contractor has been notified by VA of the award and a unique contract number, the contractor can enter a request for access to TRIRIGA at URL <https://valicensing.oncfi.com/>
2. CFI will process the request for access and payment. CFI will create the USER ID and a password. Security provisions required to align the contractor to the Contract Number will be entered and an email will be generated and submitted to the requestor.
3. CFI will also provide standard terms and conditions related to the transaction and use agreement.

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SECTION 01 32 16.13**NETWORK ANALYSIS SCHEDULES - MAJOR CONSTRUCTION PROJECT****DESIGN-BID-BUILD****PART 1 - GENERAL:****1.1 DESCRIPTION:**

- A. The Contractor shall develop a fully Resource loaded (cost and manpower) Network Analysis System (NAS) plan and computer generated schedule demonstrating fulfillment of the entire contract requirements, shall keep the plan and computer generated schedule up-to-date in accordance with the specification requirements of this section and shall utilize the plan for scheduling, coordinating, mitigating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers) and verification of every Periodic Progress updates and Payment Submittals of the work under this contract. The Contractor's initial NAS Diagram submission will be the basis for their initial project schedule and will be designated as a Day 1 submission. After review and approval by VA, this schedule will be designated as the approved Baseline Schedule.
- B. Conventional Critical Path Method (CPM) Precedence Diagramming Method (PDM) technique shall be utilized to satisfy both time and cost applications. All schedule data and reports required under this specification section shall be based upon total float, not relative or free float schedules. The approved baseline NAS diagram and the schedule becomes the official project schedule of record governing schedule management, oversight and actions on the corresponding contract.

1.2 CONTRACTOR'S REPRESENTATIVE:

- A. The contractor shall designate a representative on the site (Usually the Project Executive or Manager) who will be responsible for the preparation, timeliness, quality and the accuracy of the network diagram, review and report progress of the project with and to the Contracting Officer's representative.
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section and such authority shall not be interrupted throughout the duration of the project.

1.3 CONTRACTOR'S CONSULTANT:

- A. To fulfill all the requirements of this specification section, the Contractor shall engage an **independent CPM consultant** who is skilled in the time and cost application of scheduling using (PDM) network techniques for similar sized construction projects. The cost of which is included in the Contractor's bid proposal price. This consultant shall not have any financial ties, business ties, affiliation with or a subsidiary company of the Contractor. The consultant is expected to provide unbiased professional services to the contractor and to VA's representatives in developing and maintaining the project schedule.
- B. Prior to engaging a consultant, and within 10 calendar days after award of the contract, the Contractor shall submit to the Contracting Officer:
1. The name and address of the proposed consultant and Company.
 2. Sufficient information to show that the proposed consultant has the qualifications to meet the requirements specified in this specification section.
 3. A list of at least three similar prior construction projects, along with selected PDM network diagram samples on current projects which the proposed consultant has performed complete project scheduling services. These network diagram and schedule samples must show complete project planning for a project of similar size and scope as covered under this contract.
- C. The Contracting Officer has the right to approve or disapprove employment of the proposed consultant and will notify the Contractor of the VA decision within seven calendar days from receipt of information. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The contractor must have their CPM Consultant approved prior to Notice to Proceed (NTP).

1.4 PRIOR TO BASELINE SCHEDULE ACCEPTANCE:

- A. At the time of the Pre-Construction Conference, prior to the issuance of the project Notice to Proceed, the Contractor and the Contractor's Scheduling Consultant shall arrange a separate meeting with the Contracting Officer and/or his representative to discuss the requirements of this specification in detail. The Contractor and the Contractor's CPM Consultant shall acknowledge, in writing, their

understanding and compliance with the requirements of this specification.

- B. With exception of bonds, insurance, and limited mobilization cost associated with preparatory work such as site trailers, staging areas, haul roads etc., the approval of the baseline NAS schedule is a condition precedent to:
 - 1. Processing of contractor's pay request(s) for any construction activities/items of work.
 - 2. Review of any schedule updates.
- C. Government review comments on the contractor's schedule shall not relieve the contractor from compliance with requirements of this specification section and the remaining contract documents.

PART 2 - SCHEDULE CRITERIA / DATA REQUIREMENTS:

2.1 COMPUTER PRODUCED SCHEDULE DEVELOPMENT CRITERIA:

- A. The computer produced schedule shall be prepared and maintained using Primavera P6 software.
- B. Work activity/event relationships shall be restricted to Finish-to-Start (FS) and Start-to-Start (SS) only without lead or lag constraints. Note: Some exception may be allowed for lag in SS relationship but must be approved by the VA's contracting officer on case by case basis prior to inclusion in the schedule.
- C. Subsequent schedule updates work activity/event relationships shall reflect planned sequence of work, with actual status of completed or for in-progress work.
- D. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the network diagram shall not excuse the contractor of this requirement.
- E. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events but must have zero duration. The complete computer schedule shall reflect the Contractor's approach to pursuing the entire project.
- F. Intermediate Phasing milestones contained in the contract documents shall be clearly shown in the schedule.

- G. The Contractor's initial Day 1 submission, prior to VA review and approval, in its original form shall reflect the original contract scope of work.
- H. Early Project Completion or "Short Schedule" - VA will not approve any baseline schedule which shows completion date prior to the contract completion date. Also, there should not be any "filler or "contingency" type of activities to fill the entire contract duration. VA has no obligation to accelerate activities to support a proposed early contract completion. However, if the subsequent updates show that early handover is feasible due to "ahead of schedule" situation, VA may accept the facility earlier at no additional cost to the government.
- I. The Baseline Schedule Critical Path of the project shall be limited to:
1. No more than 20% of the work activities shall be on the critical and near-critical path(s). Critical path is defined as activities with zero (0) day total float. Near-Critical path(s) is defined as activities with one (1) to twenty (20) days of total float.
 2. Multiple Critical paths will not be allowed.
- J. The Contractor shall show activities/events for:
1. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
 2. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules samples, template, or similar items with time duration of **no less than 20 workdays**.
 3. Shutdowns or Interruption of VA Medical Center utilities, delivery of Government furnished equipment (GFE), and rough-in drawings, project phasing and any other specification requirements.
 4. VC/VV Equipment - All significant VC (VA furnished and Contractor installed) and VV (VA furnished and VA installed) equipment shall be clearly shown in the schedule. Any smaller VC and VV Equipment shall also be logically grouped together and shown in the schedule.
 5. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
 6. Commissioning (Cx)Activities - Based upon the project specific Commissioning plan and project specification section 01 91 00, the contractor shall include in the Day 1 NAS Diagram all the systems commissioning activities (see systems covered in Division 7, 8, 21,

- 22, 23, 26, 28, 31 and others as specified) such as startup, Pre-functional check list, Pre-test, individual component and system level Functional test, Operator's training, O.& M. Manuals etc.(including any deficiency correction and re-testing). The majority of commissioning activities should be completed as part of the normal construction schedule and finalized prior to the construction contract completion date. To this end, it is imperative that the Commissioning Agent and the Contractor collaborate to integrate commissioning activities into the Contractor's overall construction schedule. All commissioning activities shall be cost loaded as required in the later paragraphs. The Commissioning Plan will identify critical commissioning activities and associated construction/start up tasks that must precede these activities to allow for successful execution of the commissioning activities. To coordinate these activities with the construction schedule, a Commissioning Duration Schedule should be provided by the Commissioning Agent to the VA SRE and the Contractor to provide a rational basis for integration of commissioning into the Day 1 NAS diagram and the construction schedule. The Commissioning Duration Schedule should include the following information:
- a. Description of Commissioning Activity
 - b. Prerequisite Construction Tasks Required to Execute the Cx Activity
 - c. Elapsed Time Duration of Each Activity
 - d. Documentation Associated with Each Task/Document Responsibility
7. Once the duration schedule is delivered to the Contractor, the Contractor will collaborate with the Commissioning Agent to integrate all commissioning activities into the fixed duration construction schedule in accordance with VA NAS requirements for scheduling the project. The Baseline Schedule, as approved by the VA at the beginning, may not have all necessary Cx details, but the contractor is required to subsequently update the commissioning activities as more detailed **Commissioning Duration Schedule** is being developed.
- K. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase. Schedule these activities/events so that only one phase is scheduled

for completion within the same 30 consecutive calendar day period (except for those phases immediately preceding the final acceptance). Maintain this scheduling condition throughout the length of the contract unless waived by the Contracting Officer's representative in writing.

- L. Work activities/events for the asbestos abatement bid item shall have a trade code of ASB.
- M. Bid items other than the Base Bid (ITEM 1) and Asbestos Abatement item shall have trade codes corresponding to the appropriate bid item number (e.g., ITM 3, ITM 4 and other items).
 - 1. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
 - 2. Break up the work into activities/events shall have:
 - a. Duration no longer than 20 work days each, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the Contracting Officer may approve the showing of a longer duration.
 - b. Submittal / Shop Drawings- The duration for VA approval of any required submittal, shop drawing, or other submittals shall not be less than 20 work days. Some long lead items and complex system shop drawings and submittal approval process will require longer than 20 workdays and should be clearly portrayed in the baseline schedule. Refer to drawing CPM-1 for some typical VA approval activities/events which will require minimum duration longer than 20 workdays. The construction time as determined by the CPM schedule from early start to late finish for any sub-phase, phase or the entire project shall not exceed the contract time(s) specified or shown.
 - c. An activity/event shall only reflect the work of one entity (subcontract or craft).
 - d. The activity/event once began can continue unimpeded until the activity/event is complete.
 - 3. Describe work activities/events clearly, so the work is readily identifiable with clear scope for assessment of completion.

Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable (Refer to item 2.1 B above for some exceptions).

4. Uniquely number each activity/event ID with ALPHA-NUMERIC value in ascending order. The network diagram should be generally numbered in such a way to reflect trade discipline, phase or location of the work.

2.2 WORK ACTIVITY/EVENT COST AND TRADE RESOURCE DATA:

- A. Cost Loading - The Contractor shall cost load all work activities/events except procurement activities. The cost loading shall reflect the appropriate level of effort of the work activities/events. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. In the event of disapproval, the Contractor shall revise and resubmit in accordance with Article, THE INITIAL DAY ONE SCHEDULE SUBMITTAL (Item 3.1B below). Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.
- B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in the FAR 52.232 - 5 (PAYMENTS UNDER FIXED-PRICE CONSTRUCTION), Article, and VAAR 852.232 - Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED-PRICE CONSTRUCTION).
- C. The Contractor shall cost load work activities/events for ASBESTOS ABATEMENT. The sum of asbestos abatement work activity/event costs shall equal the value of the asbestos bid item in the Contractors' bid.
- D. The Contractor shall cost load work activities/events for all BID ITEMS. The sum of the cost loading for each bid item work activities/events shall equal the value of the item in the Contractors' bid.

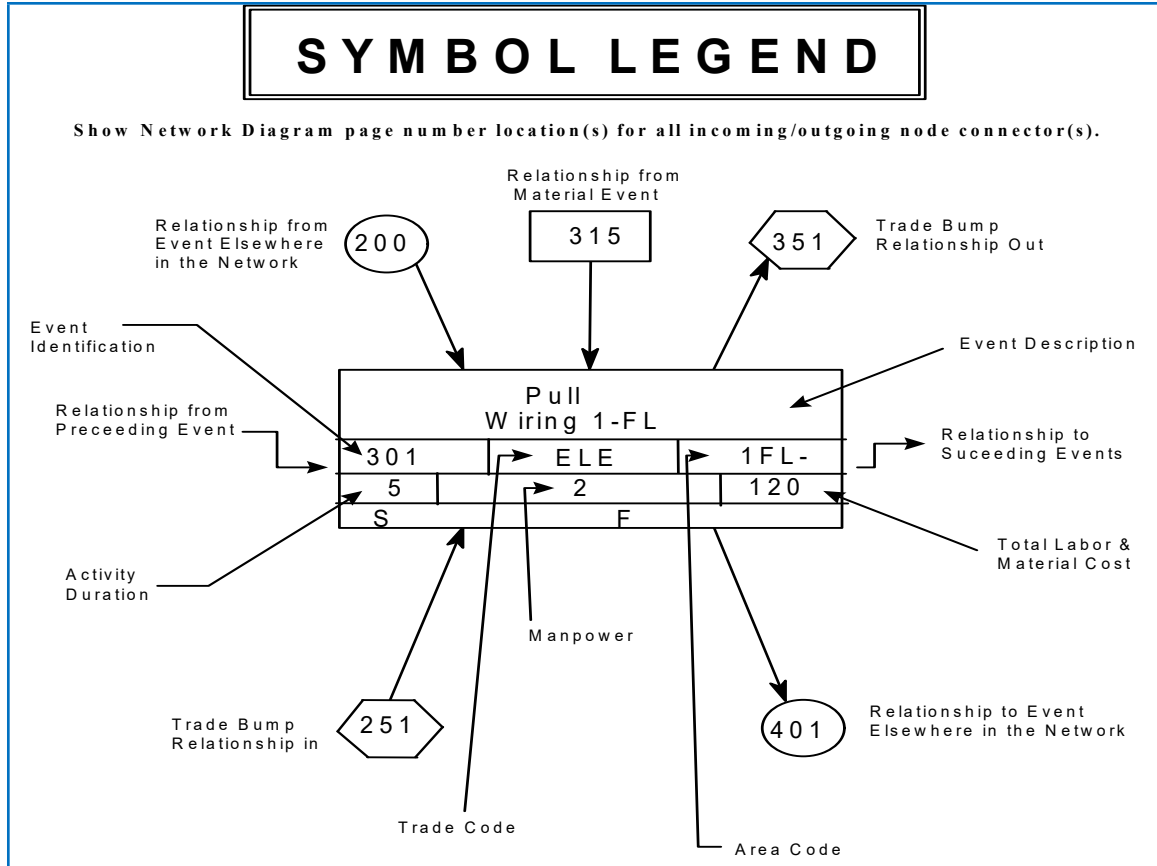
- E. Work activities/events for Contractor bond shall have a trade code and area code of BOND.
- F. General contractor work requirement code - The scope of work activities that will be performed solely by the general contractor must be identified clearly and a unique code assigned to each activity so that it can be sorted and summarized in a report. The purpose is to ascertain that the general contractor is meeting his contractual share of work content (as outlined in the signed contract documents). Care must be taken to estimate individual activity costs realistically, so these are not unreasonably inflated or deflated in the schedule.
- G. Manpower loading - In accordance with Article PERFORMANCE OF WORK BY THE CONTRACTOR in FAR 52.236 - 1 and VAAR 852.236 - 72, the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work. This shall be the basis for the "Resource loading" of the schedule and the contractor shall provide "Manpower loading" reports by trades and the overall Trade manpower requirements, when requested by the contracting officer or his/her representatives.

2.3 NETWORK DIAGRAM (NAS) DATA REQUIREMENTS:

- A. The Day 1 NAS diagram is the logical plan and forms the basis for contractor's baseline schedule. Participation and input of key construction personnel from the General contractor and the major subcontractors is a mandatory requirement in the baseline schedule development. The Day 1 NAS diagram in its original form shall reflect the original contract scope of work and contain no contract changes or delays which may have been incurred during the final NAS diagram and baseline schedule development period and shall reflect the entire contract duration as defined in the bid documents. Show on the NAS diagram the sequence and interdependence of work activities/events required for complete performance of all items of work. In preparing the NAS diagram, the Contractor shall:
1. Exercise sufficient care to produce a clear, legible and accurate network diagram, in pure logical PDM format, refer to the construction document (CD) drawing, CPM-1 (Sample CPM Network). Computer plotted network diagrams shall legibly display and plot all information required by the VA CPM activity/event legend, otherwise

the computer plotted network diagram will not be accepted. If the computer plotted network diagram is not found acceptable by the contracting officer's representative, then the network diagram will need to be created through other means to meet legibility requirements. Provide a key plan on each network diagram sheet showing the project area associated with the work activities/events shown on that sheet. VA will accept electronic version of this legible NAS diagram instead of hard copy, if the contractor so chooses.

2. Show the following on each work activity/event:
 - a. Activity/Event ID number, driven by WBS coding structure.
 - b. Concise description of the work represented by the location and activity/event.
 - c. Activity coding - Provide activity coding (five alpha characters or less) for Trades (GEN, MECH, ELEC, CARP, PLAST, or other acceptable abbreviations), Area, Phasing etc. Provide a dictionary of all coding in the front page of the NAS Diagram.
 - d. Duration (in work days.)
 - e. Cost (in accordance with Article, ACTIVITY/EVENT COST DATA of this section and less than \$9,999,999 per activity).
 - f. Manpower required (average number of workers per day). Load manpower for each and every activity with proper trade codes in the "resource" field of P6 for ease of generating individual Trade and overall manpower profile required to plan and complete the project.
 - g. No open-ended activities will be accepted, except for Notice to Proceed and the Final Completion activities.
 - h. The SYMBOL LEGEND format shown below and, on the drawing, CPM-1 (Sample CPM Network) is mandatory and shall be followed in preparing final network diagrams.



B. To the extent that the network diagram or any revised network diagram shows anything not jointly agreed upon, it shall not be deemed to have been approved by the Contracting Officer. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the Contracting Officer's approval of the network diagram.

C. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA (Senior Resident Engineer and CPM Schedule Analyst) an electronic file(s) containing one file of the data required to produce a Primavera (P6), (PDM) produced schedule, reflecting all the activities/events of the complete project network diagram being submitted.

2.4 CONSTRUCTION SCHEDULE RISK ANALYSIS / MITIGATION PLAN:

A. Schedule Risk Analysis - The contractor shall conduct the statistical schedule risk analysis based on the above detailed construction

activities in the Day 1 approved diagram, identifying major schedule risk areas and recommended risk mitigation plans as outlined below.

- B. The risk analysis shall be conducted by a person or firm skilled in the statistical method of schedule risk analysis based on the (PDM) network techniques for major construction projects, preferably in the major health care related projects. The cost of this service shall be included in the Contractor's proposal.
- C. The Contracting Officer has the right to approve or disapprove the Person or firm designated to perform the risk analysis.

2.5 RISK ANALYSIS FORMAT / DATA REQUIREMENTS:

- A. Conduct Risk Analysis - Based on the approved software / format, the consultant shall perform statistical risk analysis on the detailed approved Day 1 diagram and the baseline schedule. The contractor shall review and utilize any previous Risk analysis performed by the A/E of record based on the "semi-detailed" (yet at an overall level) construction logic and schedule to ensure the continuity of previous schedule risk analysis. The contractor's project manager and Superintendent shall identify the major schedule risk areas and possible risk mitigation strategy/plan and record it in a narrative format, with electronic file submission to the VA as directed by the VA Contracting officer.
- B. The submittal shall include three copies of a computer-produced risk analysis results, predicting the various meaningful probability curves of achieving the contract schedules. It shall also include a detailed narrative list of all major and minor potential and specific schedule and cost risk areas and impact of them on the overall project, and a contractor's recommendations of mitigating the identified risks which must be addressed by the VA Project and Resident engineer teams to maintain the contract schedule.
- C. The contractor shall, as a part of Risk monitoring, prepare a detailed **Project Risk Register (PRR)**, identifying each risk items, risk assessment and its response plan. This PRR, at the discretion of VA SRE and CO, shall be discussed in a monthly risk management meeting for mitigation.

PART 3 - SUBMITTALS, DELIVERABLES, AND UPDATE PROCESS:

3.1 SUBMITTALS:

- A. The independent cpm consultant Submittal: Within 10 calendar days after award of the contract, the Contractor shall submit to the Contracting

Officer for review and approval the qualifications of their proposed independent CPM consultant. The submittal information shall be in accordance with PART 1 GENERAL, ARTICLE 1.3 CONTRACTOR'S CONSULTANT of this Specification.

- B. THE INITIAL Day 1 SCHEDULE SUBMITTAL: Within 30 calendar days (45 calendar days on projects over \$50,000,000) after receipt of Notice to Proceed, the Contractor shall submit the initial Day 1 schedule submittal package for the Contracting Officer's review and approval. This Day 1 schedule submittal shall consist of:
1. Two hard copies of the complete Day One network (NAS) diagram on sheets of paper 765 x 1070 mm (30 x 42 inches) activities sorted by physical work area. Submit also an electronic version of the NAS diagram.
 2. Computerized Schedule;
 - a. An electronic file in a compressed Primavera (P6) computerized schedule, (PDM) format.
 - b. Three hard copies of a computer-produced activity/event ID schedule showing all requirements project duration; phase completion dates; and other data, including event manpower and cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, description, duration, predecessor and successor relationships, trade code, area code, budget amount, manpower, early start date, early finish date, late start date, late finish date and total float. The Contracting Officer's separate approval of the network diagram shall not excuse the contractor of this requirement.
 3. Supporting Data include the following data:
 - a. The proposed number of working days per week.
 - b. The holidays to be observed during the life of the contract (by day, month, and year).
 - c. The planned number of shifts per day.
 - d. The number of hours per shift. List the major construction equipment to be used on the site, describing how each piece relates to and will be used in support of the submitted network diagram work activities/events.
 - e. Provide a typed, doubled spaced description, at least one page in length, of the sequencing plan and contractor's approach to constructing the project.

- f. Failure of the Contractor to include this data will delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. VA RESPONSE TO INITIAL SCHEDULE SUBMITTAL - BASELINE SCHEDULE: Within 30 calendar days after receipt of the complete INITIAL Day 1 SCHEDULE SUBMITTAL Package (3.1.B), the Contracting Officer or his representative will do one or both of the following:
1. Notify the Contractor concerning the acceptability of the Day 1 Schedule Submittal Package and any additional actions, opinions, and objections to the package.
 2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three hard copies of the revised network diagram, three copies of the revised computer-produced activity/event ID schedule and a revised electronic P6 file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.
 3. The contractor submitted NAS diagram, the corresponding computer-produced schedule(s) and the submitted supporting data, when approved, shall constitute the official Baseline Schedule until subsequently revised in accordance with the requirements of this section.
- D. COMPUTER PRODUCED SCHEDULES submittals:
1. Within 7 calendar days of periodic (monthly) update meeting, the contractor shall submit to the VA Senior Resident Engineer (SRE) and CPM Schedule Analyst (simultaneously), computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: electronic file copies of up to five different reports (inclusive of all pages), available within the user defined reports of Primavera (P6), to the contracting officer's representatives; a hard copy listing of all project schedule changes, and associated data, made at the update; an electronic file of this data in Primavera (P6) format; and the resulting monthly updated schedule reports in a compressed electronic file in Primavera (P6), (PDM) format. These schedule reports must be submitted along with the modified Look ahead report

- (with % complete progress) made at the periodic (Monthly) update meeting signed by the contractor and VA); and substantively support the contractor's monthly payment request. The SRE shall identify the five different report formats that the contractor shall provide based upon the monthly schedule updates.
2. The contractor is responsible for the correctness and timeliness of the computer-produced reports. The Contractor is also responsible for the accurate and timely submittal (within 7 calendar days as noted above) of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- E. VA RESPONSES TO COMPUTER PRODUCED SCHEDULE submittals: The VA may report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports, indicating approval or disapproval. In case of disapproval, the Contractor will reprocess the computer-produced reports and associated compact disk(s), when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project. In certain large and complex project, as determined by the Contracting Officer, this periodic (monthly) reporting shall be formal submittal and approval process. The next periodic (month) update shall not proceed without timely submittal and approval of the previous periodic update.
- F. FIRST UPDATE SCHEDULE SUBMITTAL: Within 30 calendar days of VA acceptance of the project baseline schedule, the Contractor shall submit the first update of the schedule. This update shall contain any progress of the work the contractor wishes to receive payment for from contract notice to proceed. Any changes/delays shall be entered at the first update after the final network diagram has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time because of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION. These changes/delays shall be analyzed (entered) at the first update after the final network diagram and baseline schedule have been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time because of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- G. Periodic Progress and payment Submittals: The Contractor is entitled to a periodic (not less than monthly) progress payment upon approval of the resource loaded project schedule.
1. The contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article 3.2, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article FAR 52.232 - 5 (PAYMENTS UNDER FIXED-PRICE CONSTRUCTION), and VAAR 852.232 - Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).
 2. If the Contractor fails or refuses to furnish to the Contracting Officer the information and the associated updated Primavera (P6), (PDM) schedule in electronic format, which, in the sole judgment of the Contracting Officer, is necessary for processing the monthly progress payment, the Contractor shall not be deemed to have provided an estimate and supporting schedule data upon which progress payment may be made.
- H. RISK ANALYSIS PROCEDURE SUBMITTAL: Within 45 calendar days (60 calendar days on projects over \$50,000,000) after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review and approval:
1. The qualifications of a consultant or representative who will be conducting the Risk Analysis.
 2. The software to be utilized.
 3. The methodology of performing the analysis.
 4. The format of presenting the data.
 5. A sample of the reports to be given to VA.
- I. RISK ANALYSIS REPORT SUBMITTAL: Quarterly a risk analysis exercise shall be performed and/or updated and submitted to the VA Contracting Officer. The VA Contracting Officer can request additional risk analysis.
1. The submittal shall include three copies of a computer-produced risk analysis results, predicting the various meaningful probability curves of achieving the contract schedules. It shall also include a detailed narrative list of all major and minor potential and specific schedule and cost risk areas and impact of them on the overall project, and a contractor's recommendations of mitigating

the identified risks which must be addressed by the VA Project and Resident engineer teams to maintain the contract schedule.

2. The Contractor shall, as a part of Risk Analysis Submittal, prepare a detailed **Project Risk Register (PRR)**, identifying each risk items, risk assessment and its response plan. This PRR, at the discretion of the SRE and the CO, shall be discussed in a monthly risk management meeting for mitigation.

3.2 PAYMENT AND PROGRESS REPORTING - SCHEDULE UPDATES:

- A. Schedule update meeting - Monthly job site schedule update meeting shall be held on dates mutually agreed to by the Contracting Officer (or Contracting Officer's representative) and the Contractor. Contractor and his CPM consultant will be required to attend all monthly update meetings. Presence of Subcontractors during update meeting is optional unless required by the Contracting Officer (or Contracting Officer's representative). The Contractor shall update the project schedule and all other data required by this section shall be accurately filled in and completed draft (Pencil copy) prior to the monthly update meeting. The Contractor shall provide this information to the Contracting Officer or the VA representative in completed form three work days in advance of the update meeting. The contractor shall use only approved previous month's schedule to report progress (% complete) in "pencil copy" and shall not change this in any shape or form. Logic or duration changes for future incomplete activities should be entered later and shown in the resulting reports. Job progress will be reviewed to verify:
 1. Actual start and/or finish dates for updated/completed activities/events.
 2. Remaining duration, required to complete each activity/event started, or scheduled to start, but not completed.
 3. Logic, time and cost data for change orders (CO), and supplemental agreements (SA) that are to be incorporated into the network diagram and computer-produced schedule. Submit "Fragnets" for each CO and SA for VA approval prior to monthly parallel run. Changes in activity/event sequence and duration should be made pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
 4. Percentage for completed and partially completed activities/events.
 5. Logic and duration revisions required by this section of the specifications, particularly if the Day 1 logic / sequence have

- changed significantly, which could potentially alter or impact the critical path of the schedule. Highlight and request VA approval prior to making any logic, durations, manpower and cost loading changes.
6. Activity/event duration and percent complete shall be updated independently, meaning that the Remaining Durations (RD) shall be reviewed for all "in-progress" activities and entered manually based on realistic remaining work content, and shall not be left to "auto-calculate" by the software.
 7. Out of sequence progress - Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence progress) are not allowed except on a rare case by case basis, subject to approval by the contracting officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting updated monthly schedule. Correct out of sequence progress that continues for more than two update cycles by logic revision, as approved by the contracting officer. Also, submit complete revised schedule when more than 5% of the remaining activities are out of sequence. Calculate multiple float paths option is not allowed.
 8. Logic changes - Specifically identify and discuss all logic changes pertaining to change orders (see section item 3.2.E below), contractor proposed changes in work plan or sequence, correction to schedule logic for out-of-sequence progress etc. that have been made pursuant to contract provisions. VA will only approve logic revisions to keep the schedule valid in terms of its usefulness in calculating a realistic completion date, correcting erroneous logic ties, and accurately sequencing the work.
- B. Schedule Narrative - The Contractor, in addition to the 5 schedule reports noted earlier, shall submit a narrative report as a part of his monthly update reporting prepared after the update meeting, in a form agreed upon by the Contractor and the Contracting Officer. The narrative report shall be prepared by the contractor's authorized representatives (Project manager, Superintendent or other responsible official, and not by the CPM consultant); shall include, at a minimum, a description of major construction problem areas; current and anticipated delaying factors and their estimated impact on performance of other activities/events and completion dates; and an explanation of

corrective action being taken or proposed. This narrative shall also include:

1) Any forward Logic Revisions; 2) any added or deleted activities; 3) Any cost loading or budget changes; 4) any missed major milestones.

This monthly schedule narrative should also briefly discuss the potential schedule risks / mitigation effort, as required by the item 3.1.G above. This report is in addition to the daily reports pursuant to the provisions of Article, DAILY REPORT OF WORKERS AND MATERIALS in the GENERAL CONDITIONS.

- C. Cash Flow S-curve or Schedule Variance Control (SVC) Diagram - With each schedule submission, provide an SVC diagram showing Scheduled and Actual (earned value) Project cost curve (both incremental and cumulative) based on both projected early and late activity finish dates. Also, revise the Cash Flow S-curve when the contract is modified, or as directed by the Contracting Officer.
- D. After completion of the joint review and the Contracting Officer's approval of all entries, the contractor will generate an updated computer-produced calendar-dated schedule and submit to the contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified. These reports shall be submitted **within 7 calendar days** after the monthly update meeting to the SRE and the VA CPM Schedule analyst simultaneously via electronic media, as noted earlier.
- E. **Parallel Runs / Time Impact Analysis (TIA)** - After completing the monthly schedule update, the contractor's CPM consultant shall rerun **all current period contract change(s) as a batch against the previous month's approved monthly project schedule with the approved "Fragnet"** (Fragments of network or sub-network) logic and durations. **The Change Order Fragnet should be driven by the pure logical ties; and there should not be any "Plug in" date ahead of the data date or at the time of impact.** The analysis shall only include original workday durations and schedule logic previously agreed upon during the update meeting by the contractor and the SRE for the contract change(s), and preferably shall be submitted as a part of the C.O. proposal and before any physical C.O. work is performed. Fragnet logic shall include only relevant procurement and physical C.O. work activities and **shall not include any RFI (Request for Information) or non-work activities time.**
Note: If timely resolution of the RFI is potentially impacting the

contract schedule, in contractor's opinion, the contractor must provide tangible proof with CPM data and immediately submit in writing to the Contracting Officer's review. Only selective RFIs for the CO or SA shall be allowed in the schedule of record only when approved by the contracting officer or his representative.

- F. When there is a disagreement on Fragnet logic and/or durations, the contractor shall use the Fragnet provided and approved by the SRE. The contractor must also allocate cost and average manpower loading to each CO or SA Fragnet activities as required by the section 2.3 - Network Diagram Requirements above. **Note: Insertion of any CO or SA activities into the CPM database (as a placeholder for cost only) with faulty logic ties like NTP (predecessor) and Project complete (successor) and zero (0) duration will not be accepted.** The proper "Fragnet" logic and durations must be used as approved by the SRE, tied to the related physical work area of the schedule. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA SRE and the CPM Analyst in accordance to the requirements listed in articles 3.2.D. This electronic submission is separate from the regular monthly project schedule reports requirements and shall be submitted to the SRE **within fourteen (14) calendar days** of completing the regular schedule update meeting. Before inserting the contract changes durations, care must be taken to ensure that only the original durations of the change will be used for the analysis, not the reported durations (as-built) after the progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.
- G. **RFI activities not allowed - RFIs are only contractor inquiries and not legitimate work activities; and VA does not allow indiscriminate inclusion of any RFIs in any project schedule updates.** The contractor must provide, in advance and in writing, to the contracting officer the valid justification for including any RFIs, on an exception basis, in the project schedule updates; and **must obtain VA approval** prior to its inclusion in the schedule of record.

- H. **Retroactive TIA** - Retroactive TIA long after (generally over 3 months) the initiation of impact with "as-built" logic / duration **will not be accepted as a normal practice**. The contractor is required to perform TIA (as required by Item 3.2.E above) **within a month of VA issued Change or** other directives to proceed with additional work.
- I. **Concurrency in Time Extension delays** - Whenever there are several delays (due to change orders impact or other Government or contractor caused delays) occurring at the same time frame (same point of initiation), the contractor is required to perform one single TIA with individual Fragnets for each change inserted in the same base schedule and determine which one is impacting the critical or longest path. Analyze and **assign responsibilities to each individual changes or other delay (Government or contractor caused) with graphics and narratives to show if and how various delay impacts becoming concurrent**. The VA is only responsible for granting the amount of delay caused by them (apportioned delay) in the longest or critical path, discounting effects of any contractor caused delay that has been occurring concurrently in that time frame. The contractor is required to provide justification narrative, and then submit summary results for VA approval and acceptance.
- J. **Revised NAS Diagram** - After VA acceptance and approval of the final NAS diagram and the schedule, and after each monthly update, the contractor shall submit to the Contracting Officer electronic copies of a revised complete NAS diagram showing all completed and partially completed activities/ events, contract changes and logic changes made on the intervening updates or at the first update on the final diagram. The Contracting Officer **may elect to have the contractor do this on a less frequent basis**, but it shall be done when the Baseline schedule is revised, or when requested by the Contracting Officer.
- K. **Schedule Coordination/ Progress review meeting** - Following approval of the CPM schedule updates, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. This schedule coordination meeting shall be chaired by the VA SRE and will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from the previous schedule update. The main emphasis shall be to address work activities

to avoid slippages of project schedule and to identify any necessary corrective actions required to maintain project schedule during the reporting period. VA representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. **If the project is behind schedule, discussions should concentrate on ways to prevent further slippage as well as ways to improve the project schedule status,** as appropriate. Furthermore, the critical Change Orders that impact the contract schedule, the contractor must include a reasonable **"work-around"** plan or re-planning effort (submit narrative) including revised logic sequence for the downstream base contract work, durations adjustments and crew re-allocation from less critical to the new critical path areas, without adversely impacting the change order cost to the government to minimize/mitigate the impact of the time delay. This should not be implied as a direction to accelerate the schedule, rather a **reasonable mitigation effort within the current work plan.**

- L. **Ownership of Project Float** - Project float is the length of time between the contractor's predicted completion milestone and the contract completion date milestone. Project Float available in the schedule, at any time, shall not be considered for the exclusive use of either the VA or the Contractor.

3.3 RESPONSIBILITY FOR COMPLETION / PROJECT DELAY / RECOVERY:

- A. Whenever it becomes apparent from the current monthly progress review meeting or the monthly schedule update that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
 3. Reschedule the work in conformance with the specification requirements to recover all of the delay for which the contractor is responsible.

- A. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the Contracting Officer for the proposed schedule changes. If such actions are approved, the contractor shall incorporate this **"Recovery schedule"** with all the CPM revisions into the next update, **at no additional cost to the Government.**

3.4 CHANGES TO NETWORK DIAGRAM AND REVISED SCHEDULE:

- B. Within 30 calendar days after VA acceptance and approval of any updated computer-produced schedule, the contractor shall submit a revised network diagram and schedule, the associated compact disk(s), and a list of any activity/event changes including predecessors and successors for any of the following reasons:
1. Delay in completion of any activity/event or group of activities/events; that indicate an extension of the project completion by **20 working days or 10 percent of the remaining project duration**, whichever is less. Such delays which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project is beyond the acceptable limits.
 2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
 3. The schedule **does not represent the actual prosecution and realistic progress of the project, or when more than 5% of the remaining activities are "out of sequence" as noted earlier (Ref. 3.2.A.7).**
 4. When there is, or has been, a substantial revision to the activity/event costs of the network diagram regardless of the cause for these revisions.
- C. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Medical Center, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, must be furnished in writing to the Contracting Officer for approval.
- D. Contracting Officer's approval for the revised NAS diagram and schedule and all relevant data is contingent upon compliance with all other

paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.

- E. The cost of revisions to the network diagram resulting from contract changes will be included in the proposal for changes in work as specified in Article, FAR 52.243 -4 (CHANGES), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- F. The cost of revisions to the network diagram and schedule, not resulting from contract changes is the responsibility of the Contractor.

3.5 ADJUSTMENT OF CONTRACT COMPLETION DATE / TIME EXTENSION DUE TO CHANGES TO THE CONTRACT:

- A. **Contract Time Extension due to Changes to Contract** - The contract completion time will be adjusted only for causes specified in this contract. The contractor shall submit Request for a time extension to the contract within reasonable time frame (**within 1 month of the issuance of the Change order or before signing of the bilateral Supplemental Agreement**) and must provide a justification, CPM data and supporting evidence as the Contracting Officer may deem necessary for determination if the Contractor is entitled to a time extension under the provisions of the contract. Submission of proof based on approved Fragnet; i.e. revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, **do not affect the original or extended contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date.** The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision. The burden of proof to request the time extension is the sole responsibility of the contractor, and the contractor is required to

revise the Time analysis or provide further documentation when requested by the Contracting Officer.

- C. The contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under Article, FAR 52.243 -4 (CHANGES). The contractor shall include, as a part of each change order proposal, a sequence of activities showing all CPM logic revisions (Fragnets), duration (in work days) changes, and cost changes, manpower loading for work in question and its relationship to other activities on the approved network diagram (as specified above in item 3.2.E - Parallel Run /Time Impact Analysis).

3.6 ADJUSTMENT OF CONTRACT COMPLETION DATE / TIME EXTENSION DUE TO WEATHER:

Weather Delays - All delays due to Weather shall be analyzed on a month by month basis. The unusual weather events and its "after-effects" must impact the work activities on or near critical path work to qualify for weather delay extension. Any weather-related delays claimed by the contractor must be "**above and beyond**" the "**normal weather**" pattern (**10-year average**) and shall be supported by the data shown in the National Oceanic and Atmospheric Administration (NOAA) for the region of the country where the project site is located. The weather delay analysis (along with NOAA weather charts) shall be submitted to the VA within 30 calendar days after the weather event has passed. VA considers Time extension due to the weather is "**non-compensable**" time only.

3.7 ADJUSTMENT OF CONTRACT COMPLETION DATE / Non-Work activities/events:

- A. All delays due to non-work activities/events such as RFI's, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis and must be supported with a justification, CPM data and supporting evidence as the Contracting Officer may deem necessary for determination as to whether the Contractor is entitled to an extension of time. Note: As noted earlier, RFI activities are not allowed and VA does not allow indiscriminate inclusion of any RFIs in any project schedule updates.
- B. Actual delays in activities/events which, according to the computer produced calendar dated schedule, do not affect the original or extended contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The burden of proof to request the time extension is the sole responsibility of the contractor.

- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under Article, FAR 52.243 -4 (CHANGES). The Contractor shall include, as a part of each change order proposal, a sequence of activities showing all CPM logic revisions (Fragnets), duration (in work days) changes, and cost changes, manpower loading for work in question and its relationship to other activities on the approved network diagram (as specified above in item 3.2.E - Parallel Run /Time Impact Analysis).
- D. The cost of revisions to the network diagram not resulting from VA actions or inactions is the responsibility of the contractor.

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SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for VA review to establish compliance with the contract documents.
- B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.
- C. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2 DEFINITIONS

- A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.
- B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.
- C. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.
- D. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color

samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.

- E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.
- F. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
- G. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.
- H. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.
- I. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.
- J. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.
- K. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3 SUBMITTAL REGISTER

- A. The submittal register will list items of equipment and materials for which submittals are required by the specifications. This list may not be all inclusive and additional submittals may be required by the specifications. The Contractor is not relieved from supplying submittals required by the contract documents but which have been omitted from the submittal register.

- B. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.
- C. The VA will provide the initial submittal register in electronic format. Thereafter, the Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the VA.
- D. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Contracting Officer.
- E. The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.4 SUBMITTAL SCHEDULING

- A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.
- B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.
- C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.
- D. All submittals are required to be approved prior to the start of the specified work activity.

1.5 SUBMITTAL PREPARATION

- A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.
- B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.
- C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.
- D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain

the excessive amount of irrelevant or unnecessary data will be returned with review.

- E. Provide a transmittal form for each submittal with the following information:
1. Project title, location and number.
 2. Construction contract number.
 3. Date of the drawings and revisions.
 4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
 5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
 6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
 7. Product identification and location in project.
- F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.
- G. Stamp, sign, and date each submittal transmittal form indicating action taken.
- H. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets (s)
SIGNATURE: _____
TITLE: _____
DATE: _____

1.6 SUBMITTAL FORMAT AND TRANSMISSION

- A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer.
- B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.
- C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.

- D. All documents (submittals) shall be sent through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the VA computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.
- E. Provide hard copies of submittals when requested by the Contracting Officer. Up to 3 additional hard copies of any submittal may be requested at the discretion of the Contracting Officer, at no additional cost to the VA.

1.7 SAMPLES

- A. Submit two sets of physical samples showing range of variation, for each required item.
- B. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified.
- C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.
- D. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.
- E. The VA reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.
- F. Physical samples supplied maybe requested back for use in the project after reviewed and approved.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.
- B. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.9 TEST REPORTS

COR may require specific test after work has been installed or completed which could require contractor to repair test area at no additional cost to contract.

1.10 VA REVIEW OF SUBMITTALS AND RFIS

- A. The VA will review all submittals for compliance with the technical requirements of the contract documents. The Architect-Engineer for this project will assist the VA in reviewing all submittals and determining contractual compliance. Review will be only for conformance with the applicable codes, standards and contract requirements.
- B. Period of review for submittals begins when the VA COR receives submittal from the Contractor.
- C. Period of review for each resubmittal is the same as for initial submittal.
- D. VA review period is 15 working days for submittals.
- E. VA review period is 10 working days for RFIs.
- F. The VA will return submittals to the Contractor with the following notations:
 - 1. "Approved": authorizes the Contractor to proceed with the work covered.
 - 2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
 - 3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
 - 4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

1.11 APPROVED SUBMITTALS

- A. The VA approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.
- B. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check,

confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

- C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.
- D. Retain a copy of all approved submittals at project site, including approved samples.

1.12 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

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**SECTION 01 35 26
SAFETY REQUIREMENTS**

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**SECTION 01 35 26
SAFETY REQUIREMENTS**

1.1 APPLICABLE PUBLICATIONS:

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Engineers (ASSE):

A10.1-2011Pre-Project & Pre-Task Safety and Health Planning

A10.34-2012Protection of the Public on or Adjacent to Construction Sites

A10.38-2013Basic Elements of an Employer’s Program to Provide a Safe and Healthful Work Environment
American National Standard Construction and Demolition Operations

C. American Society for Testing and Materials (ASTM):

E84-2013Surface Burning Characteristics of Building Materials

D. The Facilities Guidelines Institute (FGI):

FGI Guidelines-2010Guidelines for Design and Construction of Healthcare Facilities

E. National Fire Protection Association (NFPA):

10-2018Standard for Portable Fire Extinguishers

30-2018Flammable and Combustible Liquids Code

51B-2019Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2020National Electrical Code

70B-2019Recommended Practice for Electrical Equipment Maintenance

70E-2018Standard for Electrical Safety in the Workplace

99-2018Health Care Facilities Code

241-2019Standard for Safeguarding Construction, Alteration, and Demolition Operations

F. The Joint Commission (TJC)

TJC ManualComprehensive Accreditation and Certification Manual

G. U.S. Nuclear Regulatory Commission

10 CFR 20Standards for Protection Against Radiation

H. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1910Safety and Health Regulations for General Industry

29 CFR 1926Safety and Health Regulations for Construction Industry

I. VHA Directive 2005-007

1.2 DEFINITIONS:

- A. Critical Lift. A lift with the hoisted load exceeding 75% of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.
- B. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).
- C. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
- D. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- E. Accident/Incident Criticality Categories:
 - 1. No impact - near miss incidents that should be investigated but are not required to be reported to the VA;
 - 2. Minor incident/impact - incidents that require first aid or result in minor equipment damage (less than \$5000). These incidents must be investigated but are not required to be reported to the VA;
 - 3. Moderate incident/impact - Any work-related injury or illness that results in:
 - a. Days away from work (any time lost after day of injury/illness onset);
 - b. Restricted work;
 - c. Transfer to another job;

- d. Medical treatment beyond first aid;
 - e. Loss of consciousness;
 - 4. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,
 - 5. Any incident that leads to major equipment damage (greater than \$5000).
- F. These incidents must be investigated and are required to be reported to the VA;
- 1 Major incident/impact - Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property damage (greater than \$20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the VA as soon as practical, but not later than 2 hours after the incident.
- G. Medical Treatment: Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

1.3 REGULATORY REQUIREMENTS:

- A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable [federal, state, and local] laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Contracting Officer Representative.

1.4 ACCIDENT PREVENTION PLAN (APP):

- A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the

"controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.

B. The APP shall be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
2. Address both the Prime Contractors and the subcontractors work operations.
3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
4. Address all the elements/sub-elements and in order as follows:
 - a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:
 - 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
 - 2) Plan approver (company/corporate officers authorized to obligate the company);
 - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
 - b. **BACKGROUND INFORMATION.** List the following:
 - 1) Contractor;
 - 2) Contract number;
 - 3) Project name;
 - 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

- c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.
- d. **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:
- 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
 - 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
 - 3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;
 - 4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
 - 5) Requirements for pre-task Activity Hazard Analysis (AHAs);
 - 6) Lines of authority;
 - 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;
- e. **SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:
- 1) Identification of subcontractors and suppliers (if known);
 - 2) Safety responsibilities of subcontractors and suppliers.
- f. **TRAINING.**
- 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
 - 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc.) and any requirements for periodic retraining/recertification are required.

- 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
- 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

g. SAFETY AND HEALTH INSPECTIONS.

- 1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
- 2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

h. ACCIDENT/INCIDENT INVESTIGATION & REPORTING. The Contractor shall conduct mishap investigations of all Moderate and Major as well as all High Visibility Incidents. The APP shall include accident/incident investigation procedure and identify person(s) responsible to provide the following to the Contracting Officer Representative:

- 1) Exposure data (man-hours worked);
- 2) Accident investigation reports;
- 3) Project site injury and illness logs.

i. PLANS (PROGRAMS, PROCEDURES) REQUIRED. Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:

- 1) Emergency response;
- 2) Contingency for severe weather;
- 3) Fire Prevention;
- 4) Medical Support;
- 5) Posting of emergency telephone numbers;
- 6) Prevention of alcohol and drug abuse;
- 7) Site sanitation (housekeeping, drinking water, toilets);

- 8) Night operations and lighting;
- 9) Hazard communication program;
- 10) Welding/Cutting "Hot" work;
- 11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
- 12) General Electrical Safety;
- 13) Hazardous energy control (Machine LOTO);
- 14) Site-Specific Fall Protection & Prevention;
- 15) Excavation/trenching;
- 16) Asbestos abatement;
- 17) Lead abatement;
- 18) Crane Critical lift;
- 19) Respiratory protection;
- 20) Health hazard control program;
- 21) Radiation Safety Program;
- 22) Abrasive blasting;
- 23) Heat/Cold Stress Monitoring;
- 24) Crystalline Silica Monitoring (Assessment);
- 25) Demolition plan (to include engineering survey);
- 26) Formwork and shoring erection and removal;
- 27) PreCast Concrete;
- 28) Public (Mandatory compliance with ANSI/ASSE A10.34-2012).

- C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.
- D. Once accepted by the Contracting Officer Representative, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in accordance with FAR Clause 52.236-13, *Accident Prevention*, until the matter has been rectified.
- E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer Representative. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In

the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public and the environment.

1.5 ACTIVITY HAZARD ANALYSES (AHAS) :

- A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)
- B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.
- C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
 - 1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.
 - 2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
 - a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
 - b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in

writing that he or she has reviewed the AHA and is familiar with current site safety issues.

3. Submit AHAs to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the Contracting Officer Representative.

1.6 PRECONSTRUCTION CONFERENCE:

- A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.
- B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- C. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.7 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b) (2) that will be identified as a CP to administer their individual safety programs.
- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations). However, the SSHO has be a separate qualified individual from the Prime Contractor's Superintendent and/or Quality Control Manager with duties only as the SSHO
- D. The SSHO or an equally qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.
- E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: *Material and Workmanship*, Paragraph (c).

1.8 TRAINING:

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for

the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc. Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.
- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.9 INSPECTIONS:

- A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of their work

operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to the Contracting Officer Representative.

- B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.
1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
 2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
 3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
 4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:

- A. The prime contractor shall establish and maintain an accident reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of a Moderate or Major incidents, High Visibility Incidents, or any weight handling and hoisting equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting

Officer Representative determines whether a government investigation will be conducted.

- B. Conduct an accident investigation for all Minor, Moderate and Major incidents as defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162 (or equivalent) , and provide the report to the Contracting Officer Representative 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.
- D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE) :

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
 - 1. Hard Hats - unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
 - 2. Safety glasses - unless written authorization is given by Contracting Officer Representative in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
 - 3. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the

Contracting Officer Representative in circumstances of no foot hazards.

4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

1.12 INFECTION CONTROL

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner must be controlled.
- B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the or Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the COR. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: **Class III and IV**, however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:
 1. Class I requirements:
 - a. During Construction Work:
 - 1) Notify the Contracting Officer Representative.
 - 2) Execute work by methods to minimize raising dust from construction operations.
 - 3) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.
 - b. Upon Completion:
 - 1) Clean work area upon completion of task
 - 2) Notify the Contracting Officer Representative.

2. Class II requirements:

a. During Construction Work:

- 1) Notify the Contracting Officer Representative.
- 2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
- 3) Water mist work surfaces to control dust while cutting.
- 4) Seal unused doors with duct tape.
- 5) Block off and seal air vents.
- 6) Remove or isolate HVAC system in areas where work is being performed.

b. Upon Completion:

- 1) Wipe work surfaces with cleaner/disinfectant.
- 2) Contain construction waste before transport in tightly covered containers.
- 3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
- 4) Upon completion, restore HVAC system where work was performed
- 5) Notify the Contracting Officer Representative.

3. Class III requirements:

a. During Construction Work:

- 1) Obtain permit from the Contracting Officer Representative.
- 2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
- 5) Contain construction waste before transport in tightly covered containers.

- 6) Cover transport receptacles or carts. Tape covering unless solid lid.
- b. Upon Completion:
- 1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative and thoroughly cleaned by the VA Environmental Services Department.
 - 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
 - 3) Vacuum work area with HEPA filtered vacuums.
 - 4) Wet mop area with cleaner/disinfectant.
 - 5) Upon completion, restore HVAC system where work was performed.
 - 6) Return permit to the Contracting Officer Representative.
4. Class IV requirements:
- a. During Construction Work:
- 1) Obtain permit from the Contracting Officer Representative.
 - 2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
 - 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
 - 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
 - 5) Seal holes, pipes, conduits, and punctures.
 - 6) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.

7) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative with thorough cleaning by the VA Environmental Services Dept.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Contain construction waste before transport in tightly covered containers.
- 4) Cover transport receptacles or carts. Tape covering unless solid lid.
- 5) Vacuum work area with HEPA filtered vacuums.
- 6) Wet mop area with cleaner/disinfectant.
- 7) Upon completion, restore HVAC system where work was performed.
- 8) Return permit to the Contracting Officer Representative.

C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:

1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
 - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the COR and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping
 - b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
 - c. Class III & IV - Seal all penetrations in existing barrier airtight
 - d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris

- e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
 - f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.
- D. Products and Materials:
- 1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
 - 2. Barrier Doors: Self Closing, One-hour fire-rated, solid core wood in steel frame, painted.
 - 3. Dust proof, one-hour fire-rated drywall
 - 4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
 - 5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
 - 6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
 - 7. Disinfectant: Hospital-approved disinfectant or equivalent product
 - 8. Portable Ceiling Access Module
- E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- F. A dust control program will be established and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

- G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
 2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
 3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
 4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
 5. The contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
 6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

I. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

J. Exterior Construction

1. Contractor shall verify that dust will not be introduced into the medical center through intake vents or building openings. HEPA filtration on intake vents is required where dust may be introduced.
2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary
3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.13 TUBERCULOSIS SCREENING

- A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within 90 days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the 90-day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.
1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.
 2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin

screening test is without evidence of active (infectious) pulmonary TB.

3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent statement to the fact on file with the employer before being allowed to return to work on VHA property.

1.14 FIRE SAFETY

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Construction Partitions:
 1. Install and maintain temporary construction partitions to provide smoke-tight separations between the areas that are described in phasing requirements. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire-retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
 2. Install temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
 3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-

penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- J. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident COR.
- K. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.
- L. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with the COR. Obtain permits from the COR at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- M. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.
- N. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate

and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

- O. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- P. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.15 ELECTRICAL

- A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J - General Environmental Controls, 29 CFR Part 1910 Subpart S - Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.
- B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.
- C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstances where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The Contracting Officer Representative with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA and permit specific to energized work activities will be developed, reviewed, and accepted by the VA prior to the start of that activity.
 - 1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.

2. Verification of the absence of voltage after de-energization and lockout/tagout is considered "energized electrical work" (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
 3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative.
- D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alternative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity and permit for energized work has been reviewed and accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
- E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C) (2).

1.16 FALL PROTECTION

- A. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.
1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
 2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.

3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
4. Fall protection while using a ladder will be governed by the OSHA requirements.

1.17 SCAFFOLDS AND OTHER WORK PLATFORMS

- A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.
- B. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) as stated in Section 1.16.
- C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.
 1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.
 2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.
 3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
 4. Emergency descent devices shall not be used as working platforms.
- D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
 1. The Competent Person's name and signature;
 2. Dates of initial and last inspections.
- E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft (6 m) in height, positive fall protection shall be used.

1.18 EXCAVATION AND TRENCHES

- A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations less than 5 feet in depth require evaluation by the contractor's "Competent Person" (CP) for determination of the necessity

of an excavation protective system where kneeling, laying in, or stooping within the excavation is required.

- B. All excavations and trenches 24 inches in depth or greater shall require a written trenching and excavation permit (NOTE - some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet in depth. Each section of the permit shall be provided to the COR prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the COR. The permit shall be maintained onsite and the first section of the permit shall include the following:
1. Estimated start time & stop time
 2. Specific location and nature of the work.
 3. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualifications and signature. Formal course in excavation safety is required by the contractor's CP.
 4. Indication of whether soil or concrete removal to an offsite location is necessary.
 5. Indication of whether soil samples are required to determine soil contamination.
 6. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.
 7. Indication of review of site drawings for proximity of utilities to digging/drilling.
- C. The second section of the permit for excavations greater than five feet in depth shall include the following:
1. Determination of OSHA classification of soil. Soil samples will be from freshly dug soil with samples taken from different soil type layers as necessary and placed at a safe distance from the excavation by the excavating equipment. A pocket penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT² - Type C, 0.5 Tons/FT² to 1.5 Tons/FT² - Type B, greater than 1.5 Tons/FT² - Type A without condition to reduce to Type B).

2. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.
 3. Indication of the spoil pile being stored at least 2 feet from the edge of the excavation and safe access being provided within 25 feet of the workers.
 4. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist. Internal combustion engine equipment is not allowed in an excavation without providing force air ventilation to lower the concentration to below OSHA PELs, providing sufficient oxygen levels, and atmospheric testing as necessary to ensure safe levels are maintained.
- D As required by OSHA 29 CFR 1926.651(b)(1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.
1. The planned dig site will be outlined/marked in white prior to locating the utilities.
 2. Used of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.
 3. 811 will be called two business days before digging on all local or State lands and public Right-of Ways.
 4. Digging will not commence until all known utilities are marked.
 5. Utility markings will be maintained
- E. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 3 to 5 feet of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.

- F. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.

1.19 CRANES

- A. All crane work shall comply with 29 CFR 1926 Subpart CC.
- B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date.
- C. A detailed lift plan for all lifts shall be submitted to the COR 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing and all other elements of a critical lift plan where the lift meets the definition of a critical lift. Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss. The plan must be reviewed and accepted by the General Contractor before being submitted to the VA for review. The lift will not be allowed to proceed without prior acceptance of this document.
- D. Crane operators shall not carry loads
 1. over the general public or VAMC personnel
 2. over any occupied building unless
 - a. the top two floors are vacated
 - b. or overhead protection with a design live load of 300 psf is provided

1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

- A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other VA specific requirements discussed in the section.

1.21 CONFINED SPACE ENTRY

- A. All confined space entry shall comply with 29 CFR 1926, Subpart AA except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].

- B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the COR.

1.22 WELDING AND CUTTING

As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with the COR. Obtain permits from the COR at least 48 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.23 LADDERS

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step Ladders shall not be used in the closed position
- E. Top steps or cap of step ladders shall not be used as a step
- F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
 - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
 - 2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.
- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.24 FLOOR & WALL OPENINGS

- A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.
- B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a

removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.

1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
5. Workers are prohibited from standing/walking on skylights.

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SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA Aluminum Association Inc.
<http://www.aluminum.org>

AABC Associated Air Balance Council
<https://www.aabc.com>

AAMA American Architectural Manufacturer's Association
<http://www.aamanet.org>

AASHTO American Association of State Highway and Transportation Officials
<http://www.aashto.org>

AATCC American Association of Textile Chemists and Colorists
<http://www.aatcc.org>

ACGIH American Conference of Governmental Industrial Hygienists
<http://www.acgih.org>

ACI American Concrete Institute
<http://www.aci-int.net>

ACPA American Concrete Pipe Association
<http://www.concrete-pipe.org>

ACPPA American Concrete Pressure Pipe Association
<http://www.acppa.org>

ADC Air Diffusion Council
<http://flexibleduct.org>

AGA American Gas Association
<http://www.aga.org>

AGC Associated General Contractors of America
<http://www.agc.org>

AGMA American Gear Manufacturers Association, Inc.
<http://www.agma.org>

AH American Hort
<https://www.americanhort.org>

AHAM Association of Home Appliance Manufacturers
<http://www.aham.org>

AIA American Institute of Architects
<http://www.aia.org>

AISC American Institute of Steel Construction
<http://www.aisc.org>

AISI American Iron and Steel Institute
<http://www.steel.org>

AITC American Institute of Timber Construction
<https://aitc-glulam.org>

AMCA Air Movement and Control Association, Inc.
<http://www.amca.org>

ANSI American National Standards Institute, Inc.
<http://www.ansi.org>

APA The Engineered Wood Association
<http://www.apawood.org>

ARI Air-Conditioning and Refrigeration Institute
<http://www.ari.org>

ARPM Association for Rubber Product Manufacturers
<https://arpm.com>

ASABE American Society of Agricultural and Biological Engineers
<https://www.asabe.org>

ASCE American Society of Civil Engineers
<http://www.asce.org>

ASHRAE American Society of Heating, Refrigerating, and
Air-Conditioning Engineers
<http://www.ashrae.org>

ASME American Society of Mechanical Engineers
<http://www.asme.org>

ASSE American Society of Sanitary Engineering International
<http://www.asse-plumbing.org>

ASTM American Society for Testing and Materials International
<http://www.astm.org>

AWI Architectural Woodwork Institute
<https://www.awinet.org>

AWS American Welding Society
<https://www.aws.org>

AWWA American Water Works Association
<https://www.awwa.org>

BHMA Builders Hardware Manufacturers Association
<https://www.buildershardware.com>

BIA The Brick Industry Association
<http://www.gobrick.com>

CAGI Compressed Air and Gas Institute
<https://www.cagi.org>

CGA Compressed Gas Association, Inc.
<https://www.cganet.com>

CI The Chlorine Institute, Inc.
<https://www.chlorineinstitute.org>

CISCA Ceilings and Interior Systems Construction Association
<https://www.cisca.org>

CISPI Cast Iron Soil Pipe Institute
<https://www.cispi.org>

CLFMI Chain Link Fence Manufacturers Institute
<https://www.chainlinkinfo.org>

CPA Composite Panel Association
<https://www.compositepanel.org>

CPMB Concrete Plant Manufacturers Bureau
<https://www.cpm.org>

CRA California Redwood Association
<http://www.calredwood.org>

CRSI Concrete Reinforcing Steel Institute
<https://www.crsi.org>

CTI Cooling Technology Institute
<https://www.cti.org>

DHA Decorative Hardwoods Association
<https://www.decorativehardwoods.org>

DHI Door and Hardware Institute
<https://www.dhi.org>

EGSA Electrical Generating Systems Association
<http://www.egsa.org>

E EI Edison Electric Institute
<https://www.eei.org>

EPA United States Environmental Protection Agency
<https://www.epa.gov>

ETL ETL Testing Services
<http://www.intertek.com>

FAA Federal Aviation Administration
<https://www.faa.gov>

FCC Federal Communications Commission
<https://www.fcc.gov>

FPS Forest Products Society
<http://www.forestprod.org>

GANA Glass Association of North America
<http://www.glasswebsite.com>

FM Factory Mutual Global Insurance
<https://www.fmglobal.com>

GA Gypsum Association
<https://gypsum.org>

GSA General Services Administration
<https://www.gsa.gov>

HI Hydraulic Institute
<http://www.pumps.org>

ICC International Code Council
<https://shop.iccsafe.org>

ICEA Insulated Cable Engineers Association
<https://www.icea.net>

ICAC Institute of Clean Air Companies
<http://www.icac.com>

IEEE Institute of Electrical and Electronics Engineers
<https://www.ieee.org>

IGMA Insulating Glass Manufacturers Alliance
<https://www.igmaonline.org>

IMSA International Municipal Signal Association
<http://www.imsasafety.org>

MBMA Metal Building Manufacturers Association
<https://www.mbma.com>

MSS Manufacturers Standardization Society of the Valve and Fittings Industry
<http://msshq.org>

NAAMM National Association of Architectural Metal Manufacturers
<https://www.naamm.org>

PHCC Plumbing-Heating-Cooling Contractors Association
<https://www.phccweb.org>

NBS National Bureau of Standards
See - NIST

NBBI The National Board of Boiler and Pressure Vessel Inspectors
<https://www.nationalboard.org>

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
<https://www.nema.org>

NFPA National Fire Protection Association
<https://www.nfpa.org>

NHLA National Hardwood Lumber Association
<https://www.nhla.com>

NIH National Institute of Health
<https://www.nih.gov>

NIST National Institute of Standards and Technology
<https://www.nist.gov>

NELMA Northeastern Lumber Manufacturers Association, Inc.
<http://www.nelma.org>

NPA National Particleboard Association
(See CPA, Composite Panel Association)

NSF National Sanitation Foundation
<http://www.nsf.org>

OSHA Occupational Safety and Health Administration
Department of Labor
<https://www.osha.gov>

PCA Portland Cement Association
<https://www.cement.org>

PCI Precast Prestressed Concrete Institute
<https://www.pci.org>

PPI Plastics Pipe Institute
<https://www.plasticpipe.org>

PEI Porcelain Enamel Institute
<http://www.porcelainenamel.com>

PTI Post-Tensioning Institute
<http://www.post-tensioning.org>

RFCI Resilient Floor Covering Institute
<https://www.rfci.com>

RIS Redwood Inspection Service
(See Western Wood Products Association)
<https://www.wwpa.org>

SCMA Southern Cypress Manufacturers Association
<http://www.cypressinfo.org>

SDI Steel Door Institute
<http://www.steeldoor.org>

SJI Steel Joist Institute
<https://www.steeljoist.org>

SMACNA Sheet Metal & Air-Conditioning Contractors'
National Association
<https://www.smacna.org>

SSPC The Society for Protective Coatings
<https://www.sspc.org>

STI Steel Tank Institute
<https://www.steeltank.com>

SWI Steel Window Institute
<https://www.steelwindows.com>

TCNA Tile Council of North America
<https://www.tcnatile.com>

TEMA Tubular Exchanger Manufacturers Association
<http://www.tema.org>

TPI Truss Plate Institute
<https://www.tpinst.org>

UBC The Uniform Building Code
(See ICC)

UL Underwriters' Laboratories Incorporated
<https://www.ul.com>

ULC Underwriters' Laboratories of Canada
<https://www.ulc.ca>

WCLB West Coast Lumber Inspection Bureau
<http://www.wclib.org>

WDMA Window and Door Manufacturers Association
<https://www.wdma.com>

WRCLA Western Red Cedar Lumber Association
<https://www.realcedar.com>

WWPA Western Wood Products Association
<http://www.wwpa.org>

- - - E N D - - -

SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for Contractor Quality Control (CQC) for Design-Bid-Build (DBB) or Design-Build (DB) construction projects. This section can be used for both project types.

1.2 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. ASTM International (ASTM)
 - 1. D3740 - (2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
 - 2. E329 - (2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.3 SUBMITTALS

Government approval is required for all submittals. CQC inspection reports shall be submitted under this Specification section and follow the [Applicable CQC Control Phase (Preparatory, Initial, or Follow-Up)]: [Applicable Specification section] naming convention.

- 1. Preconstruction Submittals
 - a. Interim CQC Plan
 - b. CQC Plan
 - c. Additional Requirements for Design Quality Control (DQC) Plan
- 2. Design Data
 - a. Discipline-Specific Checklists
 - b. Design Quality Control
- 3. Test Reports
 - a. Verification Statement

PART 2 PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Establish and maintain an effective quality control (QC) system. that complies with the FAR Clause 52.246.12 titled "Inspection of Construction". QC consists of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all design and construction

operations, both onsite and offsite, and be keyed to the proposed design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Office or Authorized designee for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CQC PLAN:

- A. Submit the CQC Plan no later than 15 days after receipt of Notice to Proceed (NTP) proposed to implement the requirements of the FAR Clause 52.246.12 titled "Inspection of Construction". The Government will consider an Interim CQC Plan for the first 15 days of operation, which must be accepted within 20 business days of NTP. Design and/or construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an Interim plan applicable to the particular feature of work to be started. Work outside of the accepted Interim CQC Plan will not be permitted to begin until acceptance of a CQC Plan or another Interim CQC Plan containing the additional work scope is accepted.
- B. Content of the CQC Plan: Include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, designers of record consultants, architects/engineers (A/E), fabricators, suppliers, and purchasing agents:
 1. A description of the QC organization, including a chart showing lines of authority and acknowledgement that the CQC staff will implement the three-phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.
 2. The name, qualifications (in resume format) duties, responsibilities, and authorities of each person assigned a CQC function.
 3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities

and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will to the Contracting Officer or Authorized designee. be issued by the CQC System Manager. Furnish copies of these letters

4. Procedures for scheduling, reviewing, certifying, and managing submittals including those of subcontractors, designers of record, consultants, A/E's offsite fabricators, suppliers and purchasing agents. These procedures must be in accordance with Section 01 33 23 Shop Drawings, Product Data, and Samples.
5. Control, verification, and acceptance of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer or Authorized designee are required to be used)
6. Procedures for tracking Preparatory, Initial, and Follow-Up control phases and control, verification, and acceptance tests including documentation.
7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
8. Reporting procedures, including proposed reporting formats.
9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of specifications can generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the Coordination meeting.
10. Coordinate schedule work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections and Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls

for inspections by the Building Official, the Contractor must include the inspections in the CQC Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors.

Include the Special Inspection Plan requirements in the CQC Plan.

- C. Acceptance of Plan: Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in the CQC Plan and operations including removal of personnel as necessary, to obtain the quality specified.
- D. Notification of Changes: After acceptance of the CQC Plan, notify the Contracting Officer or Authorized designee in writing of any proposed change. Proposed changes are subject to acceptance by the Government prior to implementation by the Contractor.

1.3 COORDINATION MEETING:

- A. After the Preconstruction Conference Post-award Conference before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized designee to discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 2 business days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CC operations, design activities (if applicable), control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and Contracting Officer or Authorized designee and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

1.4 QUALITY CONTROL ORGANIZATION:

- A. Personnel Requirements: The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, a Design Quality Manager (if applicable), and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and

Health Manager shall satisfy the requirements of Specification 01 35 26 Safety Requirements and reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer or Authorized designee. Provide adequate office space, filing systems, and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawings submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Government.

- B. CQC System Manager: Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC system Manager is required to be a PM or SRE to determine qualifications based on project complexity at construction review. This CQC System manager is on the site at all times during construction and is employed by the General Contractor. The CQC System Manger is assigned as CQC System Manager but has duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CDQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.
- C. CQC Personnel: In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, civil, structural, environmental, architectural, materials technician submittals clerk, Commissioning Agent/LEED specialist, and low voltage systems. These individuals or specified technical companies are directly employed by the General

Contractor and cannot be employed by a supplier or subcontractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on the specialized personnel's areas of responsibility; have the necessary education or experience in accordance with the Experience Matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel's assigned quality controls duties as described in the CQC Plan. A single person can cover more than one area provided that the single person is qualified to perform QC activities in each designated and that workload allows.

EXPERIENCE MATRIX

Area	Qualifications
Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 years related experience.
Mechanical	Graduate Mechanical Engineer with 2 years experience or construction professional with 5 years of experience supervising mechanical features of work in the field with a construction company.
Electrical	Graduate Electrical Engineer with 2 years related experience or construction professional with 5 years of experience supervising electrical features of work in the field with a construction company.
Structural	Graduate Civil Engineer (with Structural Track or Focus), Structural Engineer, or Construction Manager with 2 years experience or construction professional with 5 years experience supervising structural features of work in the field with a construction company.
Architectural	Graduate Architect with 2 years experience or construction professional with 5 years of related experience.
Environmental	Graduate Environmental Engineer with 3 years experience.
Submittals	Submittal Clerk with 1 year experience.
Concrete, Pavement, and Soils	Materials Technician with 2 years experience for the appropriate area.

Area	Qualifications
Testing, Adjusting, and Balancing (TAB)	Specialist must be a member of AABC or an experienced technician of the firm certified by the NEBB.
Design Quality Control Manager	Registered Architect or Professional Engineer

D. Additional Requirements: In addition to the above experience and education requirements, the CQC System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Construction course. If the CQC System Manager does not have a current specification, obtain the CQM for Contractors course identification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer or Authorized designee for information on the next scheduled class.

E. Organizational Changes: Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer or Authorized designee for acceptance.

1.5 SUBMITTALS AND DELIVERABLES:

A. Submittals have to comply with the requirements in Section 01 33 23 Shop Drawings, Product Data, and Samples. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00 General Commissioning Requirements is included in the contract, the submittals required by the section have to be coordinated with the Section 01 33 23 Shop Drawings, Product Data, and Samples to ensure adequate time is allowed for each type of submittal required.

1.6 CONTROL:

A. CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

1. Preparatory Phase: This phase is performed prior to beginning work on each definable feature of work after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

- a. A review of each paragraph of applicable specifications, references codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
- b. Review of the Contract drawings.
- c. Check to assure that all materials and equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Review Special Inspections required by Section 01 45 35 Special Inspections, that Statement of Special Inspections and the Schedule of Specials Inspections.
- f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
- g. Examination of required materials, equipment, and sample work to assure that they are on hand conform to approved shop drawings or submitted data and are properly stored.
- h. Review of the appropriate Activity Hazard Analysis (AHA) to assure safety requirements are met.
- i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards - contract defined or industry standard if not contract defined - for that feature of work.
- j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- k. Discussion of the initial control phase.
- l. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the Preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the Preparatory phase actions by separate minutes prepared by the CQC System Manager and

attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

- B. Initial Phase: This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:
1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the Preparatory meeting.
 2. Verify adequacy of controls to ensure full contract compliance. Verify the required control inspection and testing is in compliance with the contract.
 3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
 4. Resolve all differences.
 5. Check safety to include compliance with an upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
 6. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the initial phase for definable features of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with Follow-Up phases.
 7. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
 8. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections.
- C. Follow-Up Phase: Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements until the completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final Follow-Up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special

Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections

- D. Additional Preparatory and Initial Phases on the same definable features of work if: the quality ongoing work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

1.7 TESTS

- A. Testing Procedure: Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance test when specified. Procure the services of a Department of Veteran Affairs approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:
1. Verify that testing procedures comply with contract requirements.
 2. Verify that facilities and testing equipment are available and comply with testing standards.
 3. Check test instrument calibration data against certified standards.
 4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
 5. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the unique sequential control number identifying the test. If approved by the Contracting Officer or Authorized designee, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer or Authorized designee. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.
- B. Testing Laboratories: All testing laboratories must be validated through the procedures contained in Specification section 01 45 29 Testing Laboratory Services.

1. Capability Check: The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.
 2. Capability Recheck: If the selected laboratory fails the capability check, the Contractor will be assessed a charge equal to value of recheck to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.
- C. Onsite Laboratory: The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

1.8 COMPLETION INSPECTION

- A. Punch-Out Inspection: Conduct an inspection of the work by the CQC system Manager near the end of the work, or any increment of the work established by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final Inspection.
- B. Pre-Final Inspection: The Government will perform the Pre-Final Inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final Acceptance Inspection with the customer can be scheduled. Correct any items noted on the Pre-Final Inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate construction completion dates.

C. Final Acceptance Inspection: The Contractor's QC Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Authorized designee is required to be in attendance at the Final Acceptance Inspection. Additional Government personnel can also be in attendance. The Final Acceptance Inspection will be formally scheduled by the Contracting Officer's or Authorized designee based upon results of the Pre-Final Inspection. Notify the Contracting Officer through the Resident Engineer office at least 14 days prior to the Final Acceptance Inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date schedule for the Final Acceptance Inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with FAR Clause 52.246-12 titled "Inspection of Construction".

1.9 DOCUMENTATION

A. Quality Control Activities: Maintain current records providing factual evidence that required QC activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

1. The name and area of responsibility of the Contractor/Subcontractor
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
4. Test and control activities performed with results and references to specification/drawing requirements. Identify the Control Phase (Preparatory, Initial, and/or Follow-Up). List deficiencies noted, along with corrective action.
5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specification/drawing requirements.
6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.

7. Offsite surveillance activities, including actions taken.
 8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
 9. Instructions given/received and conflicts in plans and specifications.
 10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Reviewer (ITR) team, the ITR review comments, responses, and the record of resolution of the comments.
- B. Verification Statement: Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government daily with 1 week after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit on report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate QC personnel within the CQC System Manager Report.

1.10 SAMPLE FORMS

- A. Templates of various quality control reports can be found on the Whole Building Design Guide website at [https://www.wbdg.org/FFC/NAVGRAPH/01%2045%2000.00%2020 quality control reports.pdf](https://www.wbdg.org/FFC/NAVGRAPH/01%2045%2000.00%2020%20quality%20control%20reports.pdf)

1.11 NOTIFICATION OF NONCOMPLIANCE

- A. The Contracting Officer or Authorized designee will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor should take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of

the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

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**SECTION 01 45 29
TESTING LABORATORY SERVICES**

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the General Contractor.

1.2 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-11Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006)Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-10Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2007)Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-10Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

T191-02 (R2006)Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method

T310-13Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):

506.4R-94 (R2004)Guide for the Evaluation of Shotcrete

D. American Society for Testing and Materials (ASTM):

A370-12Standard Test Methods and Definitions for Mechanical Testing of Steel Products

A416/A416M-10Standard Specification for Steel Strand,
Uncoated Seven-Wire for Prestressed Concrete

C31/C31M-10Standard Practice for Making and Curing
Concrete Test Specimens in the Field

C33/C33M-11aStandard Specification for Concrete Aggregates

C39/C39M-12Standard Test Method for Compressive Strength
of Cylindrical Concrete Specimens

C109/C109M-11bStandard Test Method for Compressive Strength
of Hydraulic Cement Mortars

C136-06Standard Test Method for Sieve Analysis of Fine
and Coarse Aggregates

C138/C138M-10bStandard Test Method for Density (Unit Weight),
Yield, and Air Content (Gravimetric) of
Concrete

C140-12Standard Test Methods for Sampling and Testing
Concrete Masonry Units and Related Units

C143/C143M-10aStandard Test Method for Slump of Hydraulic
Cement Concrete

C172/C172M-10Standard Practice for Sampling Freshly Mixed
Concrete

C173/C173M-10bStandard Test Method for Air Content of freshly
Mixed Concrete by the Volumetric Method

C330/C330M-09Standard Specification for Lightweight
Aggregates for Structural Concrete

C567/C567M-11Standard Test Method for Density Structural
Lightweight Concrete

C780-11Standard Test Method for Pre-construction and
Construction Evaluation of Mortars for Plain
and Reinforced Unit Masonry

C1019-11Standard Test Method for Sampling and Testing
Grout

C1064/C1064M-11Standard Test Method for Temperature of Freshly
Mixed Portland Cement Concrete

C1077-11cStandard Practice for Agencies Testing Concrete
and Concrete Aggregates for Use in Construction
and Criteria for Testing Agency Evaluation

C1314-11aStandard Test Method for Compressive Strength
of Masonry Prisms

D422-63(2007)Standard Test Method for Particle-Size Analysis
of Soils

D698-07e1Standard Test Methods for Laboratory Compaction
Characteristics of Soil Using Standard Effort

D1140-00(2006)Standard Test Methods for Amount of Material in
Soils Finer than No. 200 Sieve

D1143/D1143M-07e1Standard Test Methods for Deep Foundations
Under Static Axial Compressive Load

D1188-07e1Standard Test Method for Bulk Specific Gravity
and Density of Compacted Bituminous Mixtures
Using Coated Samples

D1556-07Standard Test Method for Density and Unit
Weight of Soil in Place by the Sand-Cone Method

D1557-09Standard Test Methods for Laboratory Compaction
Characteristics of Soil Using Modified Effort
(56,000ft lbf/ft³ (2,700 KNm/m³))

D2166-06Standard Test Method for Unconfined Compressive
Strength of Cohesive Soil

D2167-08)Standard Test Method for Density and Unit
Weight of Soil in Place by the Rubber Balloon
Method

D2216-10Standard Test Methods for Laboratory
Determination of Water (Moisture) Content of
Soil and Rock by Mass

D2974-07aStandard Test Methods for Moisture, Ash, and
Organic Matter of Peat and Other Organic Soils

D3666-11Standard Specification for Minimum Requirements
for Agencies Testing and Inspecting Road and
Paving Materials

D3740-11Standard Practice for Minimum Requirements for
Agencies Engaged in Testing and/or Inspection
of Soil and Rock as used in Engineering Design
and Construction

D6938-10Standard Test Method for In-Place Density and
Water Content of Soil and Soil-Aggregate by
Nuclear Methods (Shallow Depth)

E94-04(2010)Standard Guide for Radiographic Examination

E164-08	.....Standard Practice for Contact Ultrasonic Testing of Weldments
E329-11c	.....Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
E543-09	.....Standard Specification for Agencies Performing Non-Destructive Testing
E605-93 (R2011)	.....Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members
E709-08	.....Standard Guide for Magnetic Particle Examination
E1155-96 (R2008)	.....Determining FF Floor Flatness and FL Floor Levelness Numbers
F3125/F3125M-15	.....Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

E. American Welding Society (AWS):

D1.D1.1M-10Structural Welding Code-Steel
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1.3 REQUIREMENTS:

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.

- C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to the COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
 - 1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to the COR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 - 2. Provide part time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 - 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:
 - 1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
 - 2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556 or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field

- conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.
- a. Building Slab Subgrade: At least one test of subgrade for every 185 m² (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m² (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
 - b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
 - c. Pavement Subgrade: One test for each 335 m² (400 square yards), but in no case fewer than two tests.
 - d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
 - e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
 - f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to COR. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- E. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

3.2 FOUNDATION PILES:

- A. Witness load test procedure for conformance with ASTM D1143 and interpret test data to verify geotechnical recommendations for pile capacity. Submit load test report in accordance with ASTM D1143.
- B. Review Contractor's equipment, methods, and procedures prior to starting any work on site. Provide continuous inspection of pile installation. Maintain a record of all pertinent phases of operation for submittal to Resident Engineer.

- C. Auger-Placed Piles: Take and test samples of grout in accordance with ASTM C109 for conformance with specified strength requirements. Not less than six cubes shall be made for each day of casting. Test three cubes at 7 days and three at 28 days.

3.3 LANDSCAPING:

- A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
1. Test for organic material by using ASTM D2974.
 2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.
- B. Submit laboratory test report of topsoil to COR.

3.4 ASPHALT CONCRETE PAVING:

- A. Aggregate Base Course:
1. Determine maximum density and optimum moisture content for aggregate base material in accordance with ASTM D1557, Method D.
 2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with ASTM D1556.
 3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.
- B. Asphalt Concrete:
1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
 2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
 3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.5 SITE WORK CONCRETE:

- A. Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.6 CONCRETE:

- A. Batch Plant Inspection and Materials Testing:
1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of the COR with concurrence of

Contracting Officer and perform periodic inspections thereafter as determined by COR.

2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m³ (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. The COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the

- beginning of each day's pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m³ (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m³ (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
 6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
 7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
 8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
 9. Verify that specified mixing has been accomplished.
 10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
 11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
 12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
 13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.

14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
 15. Observe preparations for placement of concrete:
 - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.
 16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
 17. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
 18. Measure concrete flatwork for levelness and flatness as follows:
 - a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
 19. Other inspections:
 - a. Grouting under base plates.
 - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by the COR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
 2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.

3. Furnish certified compression test reports (duplicate) to the COR.
In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in MPa (psi).
 - e. Weight of lightweight structural concrete in kg/m³ (pounds per cubic feet).
 - f. Weather conditions during placing.
 - g. Temperature of concrete in each test cylinder when test cylinder was molded.
 - h. Maximum and minimum ambient temperature during placing.
 - i. Ambient temperature when concrete sample in test cylinder was taken.
 - j. Date delivered to laboratory and date tested.

3.7 REINFORCEMENT:

- A. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- B. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- C. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.8 PRESTRESSED CONCRETE:

- A. Inspection at Plant: Forms, placement and concrete cover of reinforcing steel and tendons, placement and finishing of concrete, and tensioning of tendons.
- B. Concrete Testing: Test concrete including materials for concrete required in Article, CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
- C. Test tendons for conformance with ASTM A416 and furnish report to the COR.
- D. Inspect members to insure that specification requirements for curing and finishes have been met.

3.9 ARCHITECTURAL PRECAST CONCRETE:

- A. Inspection at Plant: Forms, placement of reinforcing steel, concrete cover, and placement and finishing of concrete.

- B. Concrete Testing: Test concrete including materials for concrete as required in Article CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
- C. Inspect members to insure specification requirements for curing and finishes have been met.

3.10 STRUCTURAL STEEL:

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
 - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
 - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
 - 3. Approve welder qualifications by certification or retesting.
 - 4. Approve procedure for control of distortion and shrinkage stresses.
 - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
 - 1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.

- 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
 - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Verify that correction of rejected welds are made in accordance with AWS D1.1.
 - i. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM F3125 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM F3125 Bolts. Inspect all bolts in connection when one or more are rejected.
 - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM F3125 Bolts. Inspect all bolts in connection when one or more are rejected.
 - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.

- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to the COR.

3.11 STEEL DECKING:

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to the COR.

3.12 SHEAR CONNECTOR STUDS:

- A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.
- B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.
- C. Submit inspection reports, certification, and instances of noncompliance to the COR.

- - - E N D - - -

**SECTION 01 45 35
SPECIAL INSPECTIONS**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This guide specification will be applicable to both new buildings and existing building rehabilitations/renovations. In addition to the Special Inspection and testing specified requirements, a registered design professional must perform structural observations during construction. All observed deficiencies will be immediately reported to the Contracting Officer. The registered design professional performing these observations will be a representative of the Designer of Record (DOR) for the building being constructed.

1.2 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE)
 - 1. ASCE 7 - (2010; Errata 2011; Supp 2 2013) Minimum Design Loads for Buildings and Other Structures
- C. International Code Council (ICC)
 - 2. ICC IBC - (2015) International Building Code

1.3 GENERAL REQUIREMENTS

- A. Perform Special Inspections in accordance with Chapter 17 of ICC IBC. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the prime contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.
- B. Structural observations will be performed by the Government. The contractor must provide notification to the Contracting Officer 14 days prior to points of construction that structural observations need to occur.

1.4 DEFINITIONS

- A. Continuous Special Inspections - The constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.
- B. Periodic Special Inspections - Special Inspections by the special inspector who is intermittently present where the work to be inspected has been or is being performed. Specific time interval on a specific Special Inspection should be indicated on the Schedule of Special Inspections.
- C. Perform - Perform these Special Inspections tasks for each welded joint or member.
- D. Observe - Observe these Special Inspections items on a random daily basis. Operations need not be delayed pending these inspections.
- E. Special Inspector (SI) - A qualified person retained by the contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.
- F. Associate Special Inspector (ASI) - A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and cannot perform inspections without the SI on site.
- G. Third Party - A third party inspector must not be company employee of the Contractor or any Sub-Contractor performing the work to be inspected.
- H. Contracting Officer - The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).
- I. Contractor's Quality Control (QC) Manager - An individual retained by the prime contractor and qualified in accordance with the Section 01 45 00.00 10 QUALITY CONTROL having the overall responsibility for the contractor's QC organization.
- J. Designer of Record (DOR) - A registered design professional is contracted by the Government as an A/E responsible for the overall design and review of submittal documents prepared by others. The DOR is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in state in which the design professional works. The

DOR is also referred to as the Engineer of Record (EOR) in design code documents.

QUALIFICATIONS

Area	Special Inspector	Associated Special Inspector	SIOR
Steel Construction and High Strength Bolting	ICC Structural Steel and Bolting Special Inspector certificate with one year of related experience, or Registered Professional Engineer with related experience.	Engineer-In-Training with one year of related experience.	
Welding Structural Steel (For highly complex steel use only AWS Certified Welding Inspectors)	ICC Welding Special Inspector certificate with one year of related experience or AWS Certified Welding Inspector	AWS Certified Associate Welding Inspector	
Nondestructive Testing of Welds	NDT Level II Certificate	NDT Level II Certificate plus one year of related experience	
Concrete Construction	ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or ACI Concrete Construction Special Inspector, or NICET Concrete Technician Level III Certificate in Construction Materials Testing, or, Registered Professional Engineer with related experience	ACI Concrete Construction Special Inspector in Training, or Engineer-In-Training with one year of related experience	
Verification of Site Soil Condition, Fill Placement, and	ICC Soils Special Inspector Certificate with one year of related experience, or NICET Soils	NICET Soils Technician Level I Certificate in Construction Material Testing with one year	

Area	Special Inspector	Associated Special Inspector	SIOR
Load-Bearing Requirements	Technician Level II Certificate in Construction Material Testing, or NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or Geologist-In-Training with one year of related experience, or Registered Professional Engineer with related experience	of related experience, or NICET Geotechnical Engineering Technician Level I Construction, or Generalist Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Deep Foundations	NICET Soils Technician Level II Certificate in Construction Material Testing, or NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or Geologist-In-Training with one year of related experience, or Registered Professional Engineer with related experience	NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or NICET Geotechnical Engineering Technician Level I Construction or Generalist Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Fire-Resistant Penetrations and Joints	Passed the UL Firestop Exam with one year of related experience, or Passed the FM Firestop Exam with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	

PART 2 - PRODUCTS

2.1 FABRICATORS SPECIAL INSPECTION

- A. Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the applicable certification(s) from the following list to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.
- B. The following certifications meet the requirements for fabricator approval in accordance with paragraph 1704.2.5.2 of IBC:
 - 1. American Institute of Steel Construction (AISC) Certified Fabrication Plant, Category STD.
 - 2. International Accreditation Service, AC472 Accreditation Steel Joist Institute Membership
 - 3. Precast Concrete Institute (PCI) Certified Plant, Group C
- C. At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special **Inspections, stating that the materials supplied and work performed by the fabricator are in accordance the construction documents.**

PART 3 - EXECUTION

3.1 RESPONSIBILIES MATRIX

Inspector	Responsibility	Condition
QC Manager	a. If there is no SIOR, QC Manager must Supervise all Special Inspectors required by the contract documents and the IBC; Verify the qualifications of all of the Special Inspectors; Verify the qualifications of fabricators; Maintain a 3-ring binder for the Special Inspector's daily and biweekly reports. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR.	Applicable when SIOR is not required
	b. Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.	n/a

Inspector	Responsibility	Condition
Special Inspectors	<ul style="list-style-type: none"> a. Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections. b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect. 	
	<ul style="list-style-type: none"> c. Submit a copy of the daily reports to the QC Manager. d. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report. e. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following: <ul style="list-style-type: none"> 1. A brief summary of the work performed during the reporting time frame 2. Changes and/or discrepancies with the drawings, specifications, and mechanical or electrical component certification if they require seismic systems that were observed during the reporting period. 3. Discrepancies which were resolved or corrected. 4. A list of nonconforming items requiring resolution. 5. All applicable test result including nondestructive testing reports. i. For large, complex projects, at the completion of each Definable Feature of Work (DFOW) requiring Special Inspections, submit an interim final report of Special Inspections that documents the Special Inspections completed for that DFOW and corrections of all discrepancies noted in the daily reports. The interim final report of Special Inspections must be signed, dated and bear the seal of the SIOR.]. j. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of 	Applicable when SIOR is not required

Inspector	Responsibility	Condition
	Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.	

3.2 DEFECTIVE WORK

- A. Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Government to accept such work.

-- End of Section -

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely affect human health or welfare,
 2. Unfavorably alter ecological balances of importance to human life,
 3. Effect other species of importance to humankind, or;
 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328Definitions

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer's Representative (COR) to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.
 - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control,

noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
 - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
 - h. Permits, licenses, and the location of the solid waste disposal area.
 - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
 - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
 - l. Inclusion of "best management practices" and methodologies.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut,

deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted. Provide erosion control plans, in phases where required.

1. **Work Area Limits:** Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. **Protection of Landscape:** Protect trees, shrubs, vines, grasses, landforms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. **Reduction of Exposure of Unprotected Erodible Soils:** Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. **Temporary Protection of Disturbed Areas:** Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
 - a. **Sediment Basins:** Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 50 (design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.

- b. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
 - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
 6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
 7. Manage and control spoil areas on and off Government property to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the COR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to

control water pollution by the listed construction activities that are included in this contract.

1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
 3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of South Dakota and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
 2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.

4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:

a. Maintain maximum permissible construction equipment noise levels at 15 meter (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	//__//
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

b. Use shields or other physical barriers to restrict noise transmission.

c. Provide soundproof housings or enclosures for noise-producing machinery.

- d. Use efficient silencers on equipment air intakes.
 - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - f. Line hoppers and storage bins with sound deadening material.
 - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the COR noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the COR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 58 16
TEMPORARY INTERIOR SIGNAGE

PART 1 GENERAL**DESCRIPTION**

This section specifies temporary interior signs.

PART 2 PRODUCTS**2.1 TEMPORARY SIGNS**

- A. Fabricate from 50 Kg (110 pound) mat finish white paper.
- B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.
- C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.
- D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.
- E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

PART 3 EXECUTION**3.1 INSTALLATION**

- A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.
- B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.
- C. Identify room with numbers as designated on floor plans.

3.2 LOCATION

- A. Install on doors that have room, corridor, and space numbers shown.
- B. Doors that do not require signs are as follows:
 - 1. Corridor barrier doors (cross-corridor) in corridor with same number.
 - 2. Folding doors or partitions.
 - 3. Toilet or bathroom doors within and between rooms.
 - 4. Communicating doors in partitions between rooms with corridor entrance doors.
 - 5. Closet doors within rooms.
- C. Replace missing, damaged, or illegible signs.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
- D. Waste Management Plan development and implementation.
- E. Techniques to minimize waste generation.
- F. Sorting and separating of waste materials.
- G. Salvage of existing materials and items for reuse or resale.
- H. Recycling of materials that cannot be reused or sold.
- I. At a minimum the following waste categories shall be diverted from landfills:
- J. Soil.
- K. Inerts (eg, concrete, masonry and asphalt).
- L. Clean dimensional wood and palette wood.
- M. Green waste (biodegradable landscaping materials).
- N. Engineered wood products (plywood, particle board and I-joists, etc).
- O. Metal products (eg, steel, wire, beverage containers, copper, etc).
- P. Sheathings
- Q. Cardboard, paper and packaging.
- R. Bitumen roofing materials.
- S. Plastics (eg, ABS, PVC).
- T. Carpet and/or pad.
- U. Gypsum board.
- V. Insulation.
- W. Paint.
- X. Fluorescent lamps.

1.2 RELATED WORK

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.
- C. D. Division 1 Sustainability specifications

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
 2. Packaging used for construction products.
 3. Poor planning and/or layout.
 4. Construction error.
 5. Over ordering.
 6. Weather damage.
 7. Contamination.
 8. Mishandling.
 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
1. Procedures to be used for debris management.
 2. Techniques to be used to minimize waste generation.
 3. Analysis of the estimated job site waste to be generated:
 - a. List of each material and quantity to be salvaged, reused, recycled.
 - b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.
 - a. On site: Material separation, storage, protection where applicable.
 - b. Off site: Transportation means and destination. Include list of materials.
 - 1) Description of materials to be site-separated and self-hauled to designated facilities.
 - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
 - a) The names and locations of mixed debris reuse and recycling facilities or sites.
 - b) The names and locations of trash disposal landfill facilities or sites.
 - c) Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.
- E. Target waste diversion rate by material and an overall diversion rate.
- F. Final report documenting the results of implementation of the preconstruction waste management plan.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC): LEED Green Building Rating System for New Construction
 1. Green Building Initiative (GBI): Green Globes for New Construction 2019

1.7 RECORDS

- A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall

be kept in accordance with the Green Globes for New Construction 2019 Technical Reference Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. List of each material and quantity to be salvaged, recycled, reused.
- A. List of each material and quantity proposed to be taken to a landfill.
- B. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping

fees, manifests, invoices. Include the net total costs for each disposal.

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SECTION 01 81 13
SUSTAINABLE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section describes general requirements and procedures to comply with federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable construction.
- B. The Design Professional has selected materials and utilized integrated design processes that achieve the Government's objectives. Contractor is responsible to maintain and support these objectives in developing means and methods for performing work and in proposing product substitutions or changes to specified processes. Obtain approval from Contracting Officer for all changes and substitutions to materials or processes. Proposed changes must meet, or exceed, materials or processes specified.

1.2 RELATED WORK

- A. Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.
- B. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.
- C. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

1.3 DEFINITIONS

- A. Recycled Content: Recycled content of materials is defined according to Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260). Recycled content value of a material assembly is determined by weight. Recycled fraction of assembly is multiplied by cost of assembly to determine recycled content value.
 - 1. "Post-Consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Pre-Consumer" material is defined as material diverted from waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
- B. Biobased Products: Biobased products are derived from plants and other renewable agricultural, marine, and forestry materials and provide an alternative to conventional petroleum derived products. Biobased

products include diverse categories such as lubricants, cleaning products, inks, fertilizers, and bioplastics.

- C. Low Pollutant-Emitting Materials: Materials and products which are minimally odorous, irritating, or harmful to comfort and well-being of installers and occupants.
- D. Volatile Organic Compounds (VOC): Chemicals that are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects.

1.4 REFERENCE STANDARDS

- A. Carpet and Rug Institute Green Label Plus program.
- B. U.S. Department of Agriculture BioPreferred program (USDA BioPreferred).
- C. U.S. Environmental Protection Agency Comprehensive Procurement Guidelines (CPG).
- D. U.S. Environmental Protection Agency WaterSense Program (WaterSense).
- E. U.S. Environmental Protection Agency ENERGY STAR Program (ENERGY STAR).
- F. U. S. Department of Energy Federal Energy Management Program (FEMP).
- G. Green Electronic Council EPEAT Program (EPEAT).

1.5 SUBMITTALS

- A. All submittals to be provided by contractor to COR.
- B. Sustainability Action Plan:
 - 1. Submit documentation as required by this section; provide additional copies of typical submittals required under technical sections when sustainable construction requires copies of record submittals.
 - 2. Within 30 days after Preconstruction Meeting provide a narrative plan for complying with requirements stipulated within this section.
 - 3. Sustainability Action Plan must:
 - a. Make reference to sustainable construction submittals defined by this section.
 - b. Address all items listed under PERFORMANCE CRITERIA.
 - c. Indicate individual(s) responsible for implementing the plan.
- C. Low Pollutant-Emitting Materials Tracking Spreadsheet: Within 30 days after Preconstruction Meeting provide a preliminary Low Pollutant-Emitting Materials Tracking Spreadsheet. The Low Pollutant-Emitting Materials Tracking Spreadsheet must be an electronic file and include all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.

D. Construction Indoor Air Quality (IAQ) Management Plan:

1. Not more than 30 days after Preconstruction Meeting provide a Construction IAQ Management Plan as an electronic file including descriptions of the following:
 - a. Instruction procedures for meeting or exceeding minimum requirements of ANSI/SMACNA 008-2008, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
 - b. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
 - c. Schedule of submission of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
 - d. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.
 - e. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit.
 - f. Instruction procedures and schedule for implementing building flush-out.

E. Product Submittals:

1. Recycled Content: Submit product data from manufacturer indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content (excluding MEP systems equipment and components).
2. Biobased Content: Submit product data for products to be installed or used which are included in any of the USDA BioPreferred program's product categories. Data to include percentage of biobased content and source of biobased material.
3. Low Pollutant-Emitting Materials: Submit product data confirming compliance with relevant requirements for all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.
4. For applicable products and equipment, submit product documentation confirming ENERGY STAR label, FEMP certification, WaterSense, and/or EPEAT certification.

- F. Closeout Submittals: Within 14 days after Substantial Completion provide the following:
1. Final version of Low Pollutant-Emitting Materials Tracking Spreadsheet.
 2. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed air handling units are used during construction.
 3. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for final filtration media in air handling units.
 4. Minimum 18 construction photographs including six photographs taken on three different occasions during construction of ANSI/SMACNA 008-2008, Chapter 3 approaches employed, along with a brief description of each approach, documenting implementation of IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 5. Flush-out Documentation:
 - a. Product data for filtration media used during flush-out.
 - b. Product data for filtration media installed immediately prior to occupancy.
 - c. Signed statement describing building air flush-out procedures including dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.

1.6 QUALITY ASSURANCE

- A. Preconstruction Meeting: After award of Contract and prior to commencement of Work, schedule and conduct meeting with COR/Resident Engineer and Architect to discuss the Project Sustainable Action Plan content as it applies to submittals, project delivery, required Construction Indoor Air Quality (IAQ) Management Plan, and other Sustainable Construction Requirements. The purpose of this meeting is to develop a mutual understanding of the Sustainable Construction Requirements and coordination of contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.
- B. Construction Job Conferences: Status of compliance with Sustainable Construction Requirements of these specifications will be an agenda

item at regular job meetings conducted during the course of work at the site.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
- C. Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
- D. Green Seal Standard GC-36, Commercial Adhesives, October 19, 2000.
- E. South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
- F. South Coast Air Quality Management District (SCAQMD) Rule 1168, July 1, 2005 and rule amendment date of January 7, 2005.
- G. Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition (ANSI/SMACNA 008-2008), Chapter 3.
- H. California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, Emission Testing method for California Specification 01350 (CDPH Standard Method V1.1-2010).
- I. Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260).
- J. ASHRAE Standard 52.2-2007.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

- A. Construction waste diversion from landfill disposal must comprise at least 50 percent of total construction waste, excluding land clearing debris and soil. Alternative daily cover (ADC) does not qualify as material diverted from disposal.
- B. Low Pollutant-Emitting Materials:
 - 1. Adhesives, sealants and sealant primers applied on site within the weatherproofing membrane must comply with VOC limits of SCAQMD Rule 1168:

a. Flooring Adhesives and Sealants:

- 1) Indoor carpet adhesives: 50 g/L.
- 2) Rubber Floor Adhesives: 60 g/L.
- 3) Subfloor Adhesives: 50 g/L.
- 4) Ceramic Tile Adhesives and Grout: 65 g/L.
- 5) Cove Base Adhesives: 50 g/L.
- 6) Multipurpose Construction Adhesives: 70 g/L.
- 7) Porous Material (Except Wood) Substrate: 50 g/L.
- 8) Wood Substrate: 30 g/L.
- 9) Architectural Non-Porous Sealant Primer: 250 g/L.
- 10) Architectural Porous Sealant Primer: 775 g/L.
- 11) Other Sealant Primer: 750 g/L.
- 12) Structural Wood Member Adhesive: 140 g/L.
- 13) Sheet-Applied Rubber Lining Operations: 850 g/L.
- 14) Top and Trim Adhesive: 250 g/L.
- 15) Architectural Sealant: 250 g/L.
- 16) Other Sealant: 420 g/L.

b. Non-Flooring Adhesives and Sealants:

- 1) Drywall and Panel Adhesives: 50 g/L.
- 2) Multipurpose Construction Adhesives: 70 g/L.
- 3) Structural Glazing Adhesives: 100 g/L.
- 4) Metal-to-Metal Substrate Adhesives: 30 g/L.
- 5) Plastic Foam Substrate Adhesive: 50 g/L.
- 6) Porous Material (Except Wood) Substrate Adhesive: 50 g/L.
- 7) Wood Substrate Adhesive: 30 g/L.
- 8) Architectural Non-Porous Sealant Primer: 250 g/L.
- 9) Architectural Porous Sealant Primer: 775 g/L.
- 10) Other Sealant Primer: 750 g/L.
- 11) PVC Welding Adhesives: 510 g/L.
- 12) CPVC Welding Adhesives: 490 g/L.
- 13) ABS Welding Adhesives: 325 g/L.
- 14) Plastic Cement Welding Adhesives: 250 g/L.
- 15) Adhesive Primer for Plastic: 550 g/L.
- 16) Contact Adhesive: 80 g/L.
- 17) Special Purpose Contact Adhesive: 250 g/L.
- 18) Structural Wood Member Adhesive: 140 g/L.
- 19) Sheet Applied Rubber Lining Operations: 850 g/L.

- 20) Top and Trim Adhesive: 250 g/L.
 - 21) Architectural Sealants: 250 g/L.
 - 22) Other Sealants: 420 g/L.
2. Paints and coatings applied on site within the weatherproofing membrane must comply with the following criteria:
- a. VOC content limits for paints and coatings established in Green Seal Standard GS-11.
 - b. VOC content limit for anti-corrosive and anti-rust paints applied to interior ferrous metal substrates of 250 g/L established in Green Seal GC-03.
 - c. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed VOC content limits established in SCAQMD Rule 1113.
 - d. Comply with the following VOC content limits:
 - 1) Anti-Corrosive/Antirust Paints: 250 g/L.
 - 2) Floor Coating: 100 g/L.
 - 3) Interior Flat Paint, Coating or Primer: 50 g/L.
 - 4) Interior Non-Flat Paint, Coating or Primer: 150 g/L.
 - 5) Sealers and Undercoaters: 200 g/L.
 - 6) Concrete Curing Compounds: 350 g/L.
 - 7) Waterproofing Sealers: 250 g/L.
 - 8) Low-Solids Coatings: 120 g/L.
3. Carpet installed in building interior must comply with one of the following:
- a. Meet testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
 - b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at the 14 day time point.
4. Each non-carpet flooring element installed in building interior which is not inherently non-emitting (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) must comply with one of the following:
- a. Meet requirements of the FloorScore standard as shown with testing by an independent third-party.
 - b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at 14 day time point.

5. Composite wood and agrifiber products used within the weatherproofing membrane must contain no added urea-formaldehyde resins.
6. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde.

C. Recycled Content:

1. Any products being installed or used that are listed on EPA Comprehensive Procurement Guidelines designated product list must meet or exceed the EPA's recycled content recommendations. The EPA Comprehensive Procurement Guidelines categories include:
 - a. Building insulation.
 - b. Cement and concrete.
 - c. Consolidated and reprocessed latex paint.
 - d. Floor tiles.
 - e. Nonpressure pipe.
 - f. Roofing materials.
 - g. Shower and restroom dividers/partitions.
 - h. Structural fiberboard.
 - i. Compost and fertilizer made from recovered organic materials.
 - j. Hydraulic mulch.
 - k. Lawn and garden edging.

D. Biobased Content:

1. Materials and equipment being installed or used that are listed on the USDA BioPreferred program product category list must meet or exceed USDA's minimum biobased content threshold. Refer to individual specification sections for detailed requirements applicable to that section.
 - a. USDA BioPreferred program categories include:
 - 1) Adhesive and Mastic Removers.
 - 2) Carpets.
 - 3) Cleaners.
 - 4) Composite Panels.
 - 5) Corrosion Preventatives.
 - 6) Erosion Control Materials.
 - 7) Dust Suppressants.
 - 8) Fertilizers.
 - 9) Floor Cleaners and Protectors.

- 10) Floor Coverings (Non-Carpet).
- 11) Glass Cleaners.
- 12) Hydraulic Fluids.
- 13) Industrial Cleaners.
- 14) Interior Paints and Coatings.
- 15) Mulch and Compost Materials.
- 16) Multipurpose Cleaners.
- 17) Multipurpose Lubricants.
- 18) Packaging Films.
- 19) Paint Removers.
- 20) Plastic Insulating Foam.
- 21) Pneumatic Equipment Lubricants.
- 22) Roof Coatings.
- 23) Wastewater Systems Coatings.
- 24) Water Tank Coatings.
- 25) Wood and Concrete Sealers.

E. Materials, products, and equipment being installed which fall into a category covered by the WaterSense program must be WaterSense-labeled or meet or exceed WaterSense program performance requirements, unless disallowed for infection control reasons.

1. WaterSense categories include:

- a. Bathroom Faucets
- b. Commercial Toilets
- c. Irrigation Controllers
- d. Urinals

F. Materials, products, and equipment being installed which fall into any of the following product categories must be Energy Star-labeled.

1. Applicable Energy Star product categories as of 09/14/2017 include:

a. Appliances:

- 1) Air Purifiers and Cleaners.
- 2) Dehumidifiers.

b. Electronics and Information Technology:

- 1) Audio/Video Equipment.
- 2) Computers.
- 3) Data Center Storage.
- 4) Digital Media Player.
- 5) Enterprise Servers.
- 6) Monitors.

- 7) Professional Displays.
 - 8) Set-Top and Cable Boxes.
 - 9) Uninterruptible Power Supplies.
 - 10) Voice over Internet Protocol (VoIP) Phones.
- c. Food Service Equipment (Commercial):
- d. Heating and Cooling Equipment:
- 1) Boilers.
 - 2) Water Heaters.
 - 3) Light Commercial Heating and Cooling Equipment.
- e. Other:
- 1) Decorative Light Strings.
 - 2) Light Bulbs.
 - 3) Light Fixtures.
 - 4) Roof Products.
 - 5) Water Coolers.
 - 6) Windows, Doors, and Skylights.
- G. Materials, products, and equipment being installed which fall into any of the following categories must be FEMP-designated. FEMP-designated product categories as of 09/14/2017 include:
1. Boilers (Commercial).
 2. Electric Chillers, Air-Cooled (Commercial).
 3. Electric Chillers, Water-Cooled (Commercial).
 4. Exterior Lighting.
 5. Light Emitting Diode (LED) Luminaires.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Construction Indoor Air Quality Management:
1. During construction, meet or exceed recommended control measures of ANSI/SMACNA 008-2008, Chapter 3.
 2. Protect stored on-site and installed absorptive materials from moisture damage.
 3. If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.
 4. Perform building flush-out as follows:

- a. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it must be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or design minimum outside air rate determined until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space. During each day of flush-out period, ventilation must begin a minimum of three hours prior to occupancy and continue during occupancy.
5. Provide construction dust control to comply with SCAQMD Rule 403.

-----END-----

SECTION 01 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 COMMISSIONING DESCRIPTION

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 22, Division 23, and Division 26 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 22, Division 23, and Division 26 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction and post-occupancy

phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.
 2. Verify and document proper integrated performance of equipment and systems.
 3. Verify that Operations & Maintenance documentation is complete.
 4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
 5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
 6. Document the successful achievement of the commissioning objectives listed above.
- F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

1.2 CONTRACTUAL RELATIONSHIPS

- A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Resident Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer.
- B. In this project, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the Resident Engineer and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the Resident Engineer.
- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties

(Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc.) is essential to the success of the Commissioning effort.

- D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and Resident Engineer. Thus, the procedures outlined in this specification must be executed within the following limitations:
1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
 2. Commissioning Issues identified by the Commissioning Agent will be delivered to the Resident Engineer and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.
 3. In the event that any Commissioning Issues and suggested resolutions are deemed by the Resident Engineer to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or Resident Engineer will issue an official directive to this effect.
 4. All parties to the Commissioning Process shall be individually responsible for alerting the Resident Engineer of any issues that they deem to constitute a potential contract change prior to acting on these issues.
 5. Authority for resolution or modification of design and construction issues rests solely with the Contracting Officer or Resident Engineer, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

1.3 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 32 16.01 ARCHITECTURAL AND ENGINEERING CPM SCHEDULES

- C. Section 01 32.16 NETWORK ANALYSIS SCHEDULES
- D. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- E. Section 01 81 13 SUSTAINABLE CONSTRUCTION REQUIREMENTS
- F. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
- G. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
- H. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.

1.4 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.
- C. The commissioning activities have been developed to support the United States Green Building Council's (USGBC) LEED™ rating program and to support delivery of project performance in accordance with the VA requirements developed for the project to support the following credits:
 - 1. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" and the prerequisite of "Fundamental Building Systems Commissioning."
 - 2. Activities and documentation for the LEED™ section on "Measurement and Verification" requirements for the Measurement and Verification credit.

1.5 ACRONYMS

List of Acronyms	
Acronym	Meaning
A/E	Architect / Engineer Design Team
AHJ	Authority Having Jurisdiction
ASHRAE	Association Society for Heating Air Condition and Refrigeration Engineers
BOD	Basis of Design
BSC	Building Systems Commissioning
CCTV	Closed Circuit Television
CD	Construction Documents
CMMS	Computerized Maintenance Management System
CO	Contracting Officer (VA)

List of Acronyms	
Acronym	Meaning
COR	Contracting Officer's Representative (see also VA-RE)
COBie	Construction Operations Building Information Exchange
CPC	Construction Phase Commissioning
Cx	Commissioning
CxA	Commissioning Agent
CxM	Commissioning Manager
CxR	Commissioning Representative
DPC	Design Phase Commissioning
FPT	Functional Performance Test
GBI-GG	Green Building Initiative - Green Globes
HVAC	Heating, Ventilation, and Air Conditioning
LEED	Leadership in Energy and Environmental Design
NC	Department of Veterans Affairs National Cemetery
NCA	Department of Veterans Affairs National Cemetery Administration
NEBB	National Environmental Balancing Bureau
O&M	Operations & Maintenance
OPR	Owner's Project Requirements
PFC	Pre-Functional Checklist
PFT	Pre-Functional Test
SD	Schematic Design
SO	Site Observation
TAB	Test Adjust and Balance
VA	Department of Veterans Affairs
VAMC	VA Medical Center
VA CFM	VA Office of Construction and Facilities Management
VACO	VA Central Office
VA PM	VA Project Manager
VA-RE	VA Resident Engineer
USGBC	United States Green Building Council

1.6 DEFINITIONS

Acceptance Phase Commissioning: Commissioning tasks executed after most construction has been completed, most Site Observations and Static Tests have been completed and Pre-Functional Testing has been completed

and accepted. The main commissioning activities performed during this phase are verification that the installed systems are functional by conducting Systems Functional Performance tests and Owner Training.

Accuracy: The capability of an instrument to indicate the true value of a measured quantity.

Back Check: A back check is a verification that an agreed upon solution to a design comment has been adequately addressed in a subsequent design review

Basis of Design (BOD): The Engineer's Basis of Design is comprised of two components: the Design Criteria and the Design Narrative, these documents record the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines.

Benchmarks: Benchmarks are the comparison of a building's energy usage to other similar buildings and to the building itself.. For example, ENERGY STAR Portfolio Manager is a frequently used and nationally recognized building energy benchmarking tool.

Building Information Modeling (BIM): Building Information Modeling is a parametric database which allows a building to be designed and constructed virtually in 3D, and provides reports both in 2D views and as schedules. This electronic information can be extracted and reused for pre-populating facility management CMMS systems. Building Systems Commissioning (BSC): NEBB acronym used to designate its commissioning program.

Calibrate: The act of comparing an instrument of unknown accuracy with a standard of known accuracy to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the tested instrument.

CCTV: Closed circuit Television. Normally used for security surveillance and alarm detections as part of a special electrical security system.

COBie: Construction Operations Building Information Exchange (COBie) is an electronic industry data format used to transfer information developed during design, construction, and commissioning into the Computer Maintenance Management Systems (CMMS) used to operate facilities. See the Whole Building Design Guide website for further information (<http://www.wbdg.org/resources/cobie.php>)

Commissionability: Defines a design component or construction process that has the necessary elements that will allow a system or component to be effectively measured, tested, operated and commissioned

Commissioning Agent (CxA): The qualified Commissioning Professional who administers the Cx process by managing the Cx team and overseeing the Commissioning Process. Where CxA is used in this specification it means the Commissioning Agent, members of his staff or appointed members of the commissioning team. Note that LEED uses the term Commissioning Authority in lieu of Commissioning Agent.

Commissioning Checklists: Lists of data or inspections to be verified to ensure proper system or component installation, operation, and function. Verification checklists are developed and used during all phases of the commissioning process to verify that the Owner's Project Requirements (OPR) is being achieved.

Commissioning Design Review: The commissioning design review is a collaborative review of the design professionals design documents for items pertaining to the following: owner's project requirements; basis of design; operability and maintainability (O&M) including documentation; functionality; training; energy efficiency, control systems' sequence of operations including building automation system features; commissioning specifications and the ability to functionally test the systems.

Commissioning Issue: A condition identified by the Commissioning Agent or other member of the Commissioning Team that adversely affects the commissionability, operability, maintainability, or functionality of a system, equipment, or component. A condition that is in conflict with the Contract Documents and/or performance requirements of the installed systems and components. (See also - Commissioning Observation).

Commissioning Manager (CxM): A qualified individual appointed by the Contractor to manage the commissioning process on behalf of the Contractor.

Commissioning Observation: An issue identified by the Commissioning Agent or other member of the Commissioning Team that does not conform to the project OPR, contract documents or standard industry best practices. (See also Commissioning Issue)

Commissioning Plan: A document that outlines the commissioning process, commissioning scope and defines responsibilities, processes, schedules, and the documentation requirements of the Commissioning Process.

Commissioning Process: A quality focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems, components, and assemblies are planned, designed, installed, tested, can be operated, and maintained to meet the Owner's Project Requirements.

Commissioning Report: The final commissioning document which presents the commissioning process results for the project. Cx reports include an executive summary, the commissioning plan, issue log, correspondence, and all appropriate check sheets and test forms.

Commissioning Representative (CxR): An individual appointed by a sub-contractor to manage the commissioning process on behalf of the sub-contractor.

Commissioning Specifications: The contract documents that detail the objective, scope and implementation of the commissioning process as developed in the Commissioning Plan.

Commissioning Team: Individual team members whose coordinated actions are responsible for implementing the Commissioning Process.

Construction Phase Commissioning: All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

Contract Documents (CD): Contract documents include design and construction contracts, price agreements and procedure agreements. Contract Documents also include all final and complete drawings, specifications and all applicable contract modifications or supplements.

Construction Phase Commissioning (CPC): All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

Coordination Drawings: Drawings showing the work of all trades that are used to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances. On mechanical projects, coordination drawings include structural steel, ductwork, major piping and electrical conduit and show the elevations and locations of the above components.

Data Logging: The monitoring and recording of temperature, flow, current, status, pressure, etc. of equipment using stand-alone data recorders.

Deferred System Test: Tests that cannot be completed at the end of the acceptance phase due to ambient conditions, schedule issues or other conditions preventing testing during the normal acceptance testing period.

Deficiency: See "Commissioning Issue".

Design Criteria: A listing of the VA Design Criteria outlining the project design requirements, including its source. These are used during the design process to show the design elements meet the OPR.

Design Intent: The overall term that includes the OPR and the BOD. It is a detailed explanation of the ideas, concepts, and criteria that are defined by the owner to be important. The design intent documents are utilized to provide a written record of these ideas, concepts and criteria.

Design Narrative: A written description of the proposed design solutions that satisfy the requirements of the OPR.

Design Phase Commissioning (DPC): All commissioning tasks executed during the design phase of the project.

Environmental Systems: Systems that use a combination of mechanical equipment, airflow, water flow and electrical energy to provide heating, ventilating, air conditioning, humidification, and dehumidification for the purpose of human comfort or process control of temperature and humidity.

Executive Summary: A section of the Commissioning report that reviews the general outcome of the project. It also includes any unresolved issues, recommendations for the resolution of unresolved issues and all deferred testing requirements.

Functionality: This defines a design component or construction process which will allow a system or component to operate or be constructed in a manner that will produce the required outcome of the OPR.

Functional Test Procedure (FTP): A written protocol that defines methods, steps, personnel, and acceptance criteria for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

Industry Accepted Best Practice: A design component or construction process that has achieved industry consensus for quality performance

and functionality. Refer to the current edition of the NEBB Design Phase Commissioning Handbook for examples.

Installation Verification: Observations or inspections that confirm the system or component has been installed in accordance with the contract documents and to industry accepted best practices.

Integrated System Testing: Integrated Systems Testing procedures entail testing of multiple integrated systems performance to verify proper functional interface between systems. Typical Integrated Systems Testing includes verifying that building systems respond properly to loss of utility, transfer to emergency power sources, re-transfer from emergency power source to normal utility source; interface between HVAC controls and Fire Alarm systems for equipment shutdown, interface between Fire Alarm system and elevator control systems for elevator recall and shutdown; interface between Fire Alarm System and Security Access Control Systems to control access to spaces during fire alarm conditions; and other similar tests as determined for each specific project.

Issues Log: A formal and ongoing record of problems or concerns - and their resolution - that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

Lessons Learned Workshop: A workshop conducted to discuss and document project successes and identify opportunities for improvements for future projects.

Maintainability: A design component or construction process that will allow a system or component to be effectively maintained. This includes adequate room for access to adjust and repair the equipment. Maintainability also includes components that have readily obtainable repair parts or service.

Manual Test: Testing using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the 'observation').

Owner's Project Requirements (OPR): A written document that details the project requirements and the expectations of how the building and its systems will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

Peer Review: A formal in-depth review separate from the commissioning review processes. The level of effort and intensity is much greater

than a typical commissioning facilitation or extended commissioning review. The VA usually hires an independent third-party (called the IDIQ A/E) to conduct peer reviews.

Precision: The ability of an instrument to produce repeatable readings of the same quantity under the same conditions. The precision of an instrument refers to its ability to produce a tightly grouped set of values around the mean value of the measured quantity.

Pre-Design Phase Commissioning: Commissioning tasks performed prior to the commencement of design activities that includes project programming and the development of the commissioning process for the project

Pre-Functional Checklist (PFC): A form used by the contractor to verify that appropriate components are onsite, correctly installed, set up, calibrated, functional and ready for functional testing.

Pre-Functional Test (PFT): An inspection or test that is done before functional testing. PFT's include installation verification and system and component start up tests.

Procedure or Protocol: A defined approach that outlines the execution of a sequence of work or operations. Procedures are used to produce repeatable and defined results.

Range: The upper and lower limits of an instrument's ability to measure the value of a quantity for which the instrument is calibrated.

Resolution: This word has two meanings in the Cx Process. The first refers to the smallest change in a measured variable that an instrument can detect. The second refers to the implementation of actions that correct a tested or observed deficiency.

Site Observation Visit: On-site inspections and observations made by the Commissioning Agent for the purpose of verifying component, equipment, and system installation, to observe contractor testing, equipment start-up procedures, or other purposes.

Site Observation Reports (SO): Reports of site inspections and observations made by the Commissioning Agent. Observation reports are intended to provide early indication of an installation issue which will need correction or analysis.

Special System Inspections: Inspections required by a local code authority prior to occupancy and are not normally a part of the commissioning process.

Static Tests: Tests or inspections that validate a specified static condition such as pressure testing. Static tests may be specification or code initiated.

Start Up Tests: Tests that validate the component or system is ready for automatic operation in accordance with the manufactures requirements.

Systems Manual: A system-focused composite document that includes all information required for the owners operators to operate the systems.

Test Procedure: A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

Testing: The use of specialized and calibrated instruments to measure parameters such as: temperature, pressure, vapor flow, air flow, fluid flow, rotational speed, electrical characteristics, velocity, and other data in order to determine performance, operation, or function.

Testing, Adjusting, and Balancing (TAB): A systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are referred to as "Testing, Adjusting, and Balancing" and are described in the Procedural Standards for the Testing, Adjusting and Balancing of Environmental Systems, published by NEBB or AABC.

Thermal Scans: Thermographic pictures taken with an Infrared Thermographic Camera. Thermographic pictures show the relative temperatures of objects and surfaces and are used to identify leaks, thermal bridging, thermal intrusion, electrical overload conditions, moisture containment, and insulation failure.

Training Plan: A written document that details, in outline form the expectations of the operator training. Training agendas should include instruction on how to obtain service, operate, startup, shutdown and maintain all systems and components of the project.

Trending: Monitoring over a period of time with the building automation system.

Unresolved Commissioning Issue: Any Commissioning Issue that, at the time that the Final Report or the Amended Final Report is issued that has not been either resolved by the construction team or accepted by the VA. **Validation:** The process by which work is verified as complete and operating correctly:

1. First party validation occurs when a firm or individual verifying the task is the same firm or individual performing the task.
2. Second party validation occurs when the firm or individual verifying the task is under the control of the firm performing the task or has other possibilities of financial conflicts of interest in the resolution (Architects, Designers, General Contractors and Third Tier Subcontractors or Vendors).
3. Third party validation occurs when the firm verifying the task is not associated with or under control of the firm performing or designing the task.

Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

Warranty Phase Commissioning: Commissioning efforts executed after a project has been completed and accepted by the Owner. Warranty Phase Commissioning includes follow-up on verification of system performance, measurement and verification tasks and assistance in identifying warranty issues and enforcing warranty provisions of the construction contract.

Warranty Visit: A commissioning meeting and site review where all outstanding warranty issues and deferred testing is reviewed and discussed.

Whole Building Commissioning: Commissioning of building systems such as Building Envelope, HVAC, Electrical, Special Electrical (Fire Alarm, Security & Communications), Plumbing and Fire Protection as described in this specification.

1.7 SYSTEMS TO BE COMMISSIONED

- A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. The following systems will be commissioned as part of this project:

Systems To Be Commissioned	
System	Description
Plumbing	
Domestic Water Distribution	Backflow preventers
Domestic Hot Water Systems	Semi-instantaneous steam domestic water heat exchangers, circulation pumps
Wastewater Pump Systems	Sump pumps
HVAC	
Direct Digital Control System	Operator Interface Computer, Operator Workstation (including graphics, point mapping, trends, alarms), Network Communications Modules and Wiring, Integration Panels. [DDC Control panels will be commissioned with the systems controlled by the panel]
Chilled Water System	Air-Cooled Chiller, existing pumps & VFDs associated with chilled water system components, DDC Control Panels
HVAC Air Handling Systems	Air handling Units, Computer room AC Unit, humidifiers, DDC control panels
HVAC Ventilation/Exhaust Systems	General exhaust
Steam Systems	Pressure driven condensate return pumps,
HVAC Energy Recovery Systems	Heat Recovery Loops
HVAC Terminal Unit Systems	VAV Terminal Units, fan coil units, fin-tube radiation, unit heaters, air curtains
Humidity Control Systems	Humidifiers, controls, interface with facility DDC
Hydronic Distribution Systems	Pumps, DDC control panels, shell and tube heat exchangers, brazed plate heat exchanger, snow melt system
Electrical	

Systems To Be Commissioned	
System	Description
Medium-Voltage Electrical Distribution Systems	Medium-Voltage Switchgear, Medium-Voltage Switches
Grounding & Bonding Systems	Witness 3rd party testing, review reports
Electric Power Monitoring Systems	Metering, sub-metering, power monitoring systems, PLC control systems
Electrical System Protective Device Study	Review reports, verify field settings consistent with Study
Secondary Unit Substations	Medium-voltage components, transformers, low-voltage distribution, verify breaker testing results (injection current, etc)
Low-Voltage Distribution System	Normal power distribution system, Life-safety power distribution system, critical power distribution system, equipment power distribution system, switchboards, distribution panels, panelboards, verify breaker testing results (injection current, etc)
Lighting & Lighting Control Systems	Emergency lighting, occupancy sensors, lighting control systems, architectural dimming systems, exterior lighting and controls
Lightning Protection System	Witness 3rd party testing, review reports

1.8 COMMISSIONING TEAM

A. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, schedulers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.

B. Members Appointed by Contractor:

1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process.
2. Contractor' Commissioning Manager: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
3. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions.

C. Members Appointed by VA:

1. User: Representatives of the facility user and operation and maintenance personnel.
2. A/E: Representative of the Architect and engineering design professionals.

1.9 VA'S COMMISSIONING RESPONSIBILITIES

- A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
 1. Coordination meetings.
 2. Training in operation and maintenance of systems, subsystems, and equipment.
 3. Testing meetings.
 4. Witness and assist in Systems Functional Performance Testing.
 5. Demonstration of operation of systems, subsystems, and equipment.
- B. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

1.10 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

- A. Appoint an individual, company or firm to act as the Commissioning Agent
- B. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.
- C. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.

- D. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
1. Participate in commissioning coordination meetings.
 2. Conduct operation and maintenance training sessions in accordance with approved training plans.
 3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
 4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
 5. Review and comment on commissioning documentation.
 6. Participate in meetings to coordinate Systems Functional Performance Testing.
 7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
 8. Provide information to the Commissioning Agent for developing commissioning plan.
 9. Participate in training sessions for VA's operation and maintenance personnel.
 10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

1.11 COMMISSIONING AGENT'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to

- operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
 - E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.
 - F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
 - G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
 - H. Coordinate Systems Functional Performance Testing schedule with the Contractor.
 - I. Witness selected systems startups.
 - J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
 - K. Witness and document Systems Functional Performance Testing.
 - L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
 - M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.
 - N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.

- O. Prepare commissioning Field Observation Reports.
- P. Prepare the Final Commissioning Report.
- Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
- R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

1.12 COMMISSIONING DOCUMENTATION

- A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
 - 2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
 - 3. Identification of systems and equipment to be commissioned.
 - 4. Schedule of Commissioning Coordination meetings.
 - 5. Identification of items that must be completed before the next operation can proceed.
 - 6. Description of responsibilities of commissioning team members.
 - 7. Description of observations to be made.
 - 8. Description of requirements for operation and maintenance training.
 - 9. Schedule for commissioning activities with dates coordinated with overall construction schedule.

10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
 11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
 12. Preliminary Systems Functional Performance Test procedures.
- B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:
1. Name and identification code of tested system.
 2. Test number.
 3. Time and date of test.
 4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
 5. Dated signatures of the person performing test and of the witness, if applicable.
 6. Individuals present for test.
 7. Observations and Issues.
 8. Issue number, if any, generated as the result of test.
- C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.
- D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance

Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data.

Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.

F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.

1. Creating a Commissioning Issues Log Entry:

- a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
- b. Assign a descriptive title for the issue.
- c. Identify date and time of the issue.
- d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
- e. Identify system, subsystem, and equipment to which the issue applies.
- f. Identify location of system, subsystem, and equipment.
- g. Include information that may be helpful in diagnosing or evaluating the issue.
- h. Note recommended corrective action.
- i. Identify commissioning team member responsible for corrective action.

- j. Identify expected date of correction.
 - k. Identify person that identified the issue.
2. Documenting Issue Resolution:
- a. Log date correction is completed or the issue is resolved.
 - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
 - c. Identify changes to the Contract Documents that may require action.
 - d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
 - e. Identify person(s) who corrected or resolved the issue.
 - f. Identify person(s) verifying the issue resolution.
- G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:
- 1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
 - 2. Commissioning plan.
 - 3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
 - 4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
 - 5. Commissioning Issues Log.
 - 6. Listing of deferred and off-season test(s) not performed, including the schedule for their completion.

H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:

1. Documentation of deferred and off season test(s) results.
2. Completed Systems Functional Performance Test Procedures for off season test(s).
3. Documentation that unresolved system performance issues have been resolved.
4. Updated Commissioning Issues Log, including status of unresolved issues.
5. Identification of potential Warranty Claims to be corrected by the Contractor.

I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:

1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
2. Reference to Final Commissioning Plan.
3. Reference to Final Commissioning Report.
4. Approved Operation and Maintenance Data as submitted by the Contractor.

1.13 SUBMITTALS

A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:

1. The Commissioning Team: A list of commissioning team members by organization.
2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the

- Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
 4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
 5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
 6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
 7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.
- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final

Systems Functional Test Procedures to be used in Systems Functional Performance Testing.

- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA Resident Engineer with copies to the Contractor and Architect.
- G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.
- H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.
- I. Data for Commissioning:
 - 1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
 - 2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

1.14 COMMISSIONING PROCESS

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within //14// days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CxM) to manage and lead the commissioning effort on behalf of the Contractor. The

Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.

- C. Within //14// days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CXR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

1.15 QUALITY ASSURANCE

- A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.16 COORDINATION

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner

- in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
 - D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
 - E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
 - F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure sensors

shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES

A. The following table outlines the roles and responsibilities for the Commissioning Team members during the Construction Phase:

Construction Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Construction Commissioning Kick Off meeting	L	A	P	P	O	
	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Controls Meeting	L	A	P	P	O	
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support the OPR and BOD.	L	A	P	P	N/A	
Cx Plan & Spec	Final Commissioning Plan	L	A	R	R	O	
Schedules	Duration Schedule for Commissioning Activities	L	A	R	R	N/A	
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O	
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O	

Construction Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Document Reviews	TAB Plan Review	L	A	R	R	O	
	Submittal and Shop Drawing Review	R	A	R	L	O	
	Review Contractor Equipment Startup Checklists	L	A	R	R	N/A	
	Review Change Orders, ASI, and RFI	L	A	R	R	N/A	
Site Observations	Witness Factory Testing	P	A	P	L	O	
	Construction Observation Site Visits	L	A	R	R	O	
Functional Test Protocols	Final Pre-Functional Checklists	L	A	R	R	O	
	Final Functional Performance Test Protocols	L	A	R	R	O	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	

B. The following table outlines the roles and responsibilities for the Commissioning Team members during the Acceptance Phase:

Acceptance Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional	
Commissioning Roles & Responsibilities								
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes	
Meetings	Commissioning Meetings	L	A	P	P	O		
	Project Progress Meetings	P	A	P	L	O		
	Pre-Test Coordination Meeting	L	A	P	P	O		
	Lessons Learned and Commissioning Report Review Meeting	L	A	P	P	O		
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support OPR and BOD	L	P	P	P	O		
Cx Plan & Spec	Maintain/Update Commissioning Plan	L	A	R	R	O		
Schedules	Prepare Functional Test Schedule	L	A	R	R	O		
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O		
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O		
Document Reviews	Review Completed Pre-Functional Checklists	L	A	R	R	O		
	Pre-Functional Checklist Verification	L	A	R	R	O		

Acceptance Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
	Review Operations & Maintenance Manuals	L	A	R	R	R	
	Training Plan Review	L	A	R	R	R	
	Warranty Review	L	A	R	R	O	
	Review TAB Report	L	A	R	R	O	
Site Observations	Construction Observation Site Visits	L	A	R	R	O	
	Witness Selected Equipment Startup	L	A	R	R	O	
Functional Test Protocols	TAB Verification	L	A	R	R	O	
	Systems Functional Performance Testing	L	A	P	P	P	
	Retesting	L	A	P	P	P	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
	Systems Training	L	S	R	P	P	
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	
	Final Commissioning Report	L	A	R	R	R	
	Prepare Systems Manuals	L	A	R	R	R	

C. The following table outlines the roles and responsibilities for the Commissioning Team members during the Warranty Phase:

Warranty Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Post-Occupancy User Review Meeting	L	A	O	P	P	
Site Observations	Periodic Site Visits	L	A	O	O	P	
Functional Test Protocols	Deferred and/or seasonal Testing	L	A	O	P	P	
Technical Activities	Issues Resolution Meetings	L	S	O	O	P	
	Post-Occupancy Warranty Checkup and review of Significant Outstanding Issues	L	A		R	P	
Reports and Logs	Final Commissioning Report Amendment	L	A		R	R	
	Status Reports	L	A		R	R	

3.2 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
 - a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
 - b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
 2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
 - a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
 - b. The full startup plan shall at a minimum consist of the following items:
 - 1) The Pre-Functional Checklists.
 - 2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - 3) The manufacturer's normally used field checkout sheets.
 - c. The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.

- d. The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
3. Sensor and Actuator Calibration
- a. All field installed temperature, relative humidity, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 22, Division 23, and Division 26 specifications.
 - b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup
- a. //Four// //4// weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
 - b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
 - c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
 - d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.3 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP

- A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.
- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall

correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.

- C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

3.4 PHASED COMMISSIONING

- A. The project may require startup and initial checkout to be executed in phases. This phasing shall be planned and scheduled in a coordination meeting of the VA, Commissioning Agent, and the Contractor. Results will be added to the master construction schedule and the commissioning schedule.

3.5 DDC SYSTEM TRENDING FOR COMMISSIONING

- A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.
- B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers - Critical, Priority, and Maintenance.
 1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
 2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
 3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report

automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.

- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.
- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Resident Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:
 - 1. Pre-testing, Testing, and Post-testing - Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the Resident Engineer. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Resident Engineer, prior to the execution of Systems Functional Performance Testing.
 - 2. Dynamic plotting - The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.

3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.
4. The following tables indicate the points to be trended and alarmed by system. The Operational Trend Duration column indicates the trend duration for normal operations. The Testing Trend Duration column indicates the trend duration prior to Systems Functional Performance Testing and again after Systems Functional Performance Testing. The Type column indicates point type: AI = Analog Input, AO = Analog Output, DI = Digital Input, DO = Digital Output, Calc = Calculated Point. In the Trend Interval Column, COV = Change of Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
OA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Humidity	AI	15 Min	24 hours	3 days	P	>60% RH	10 min
Mixed Air Temp	AI	None	None	None	N/A		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Supply Fan Speed	AI	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AI	15 Min	24 hours	3 days	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
RA Pre-Filter Status	AI	None	None	None	N/A		
OA Pre-Filter Status	AI	None	None	None	N/A		
After Filter Status	AI	None	None	None	N/A		
SA Flow	AI	15 Min	24 hours	3 days	C	±10% from SP	10 min
OA Supply Temp	AI	15 Min	24 hours	3 days	P	±5°F from SP	10 min
RA Supply Temp	AI	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
RA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
Initial UVC Intensity (%)	AI	None	None	None	N/A		
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
CO2 Level	AI	15 Min	24 hours	3 days	P	±10% from SP	10 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 1	DI	COV	24 hours	3 days	C	True	10 min
Freeze Stat Level 2	DI	COV	24 hours	3 days	C	True	5 min

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Freeze Stat Level 3	DI	COV	24 hours	3 days	P	True	1 min
Fire/Smoke Damper Status	DI	COV	24 hours	3 days	P	Closed	1 min
Emergency AHU Shutdown	DI	COV	24 hours	3 days	P	True	1 min
Exhaust Fan #1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #2 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
OA Alarm	DI	COV	24 hours	3 days	C	True	10 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
UVC Emitter Alarm	DI	COV	24 hours	3 days	P	True	10 min
CO2 Alarm	DI	COV	24 hours	3 days	P	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AO	15 Min	24 hours	3 days	N/A		
Supply Fan S/S	DO	COV	24 hours	3 days	N/A		
Return Fan S/S	DO	COV	24 hours	3 days	N/A		
Fire/Smoke Dampers	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
AHU Energy	Calc	1 Hour	30 day	N/A	N/A		

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Space Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Air Flow	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Local Setpoint	AI	15 Min	12 hours	3 days	M	±10°F from SP	60 min
Space Humidity	AI	15 Min	12 hours	3 days	P	> 60% RH	5 min
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		

Fan Coil Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Pre-Filter Status	AI	None	None	None	M	> SP	1 hour
Water Sensor	DI	COV	12 hours	3 days	M	N/A	30 Min
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Fan Coil Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Unit Heater Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Heating Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Unit Heater ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Steam Condensate Pumps Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Condensate Pump Run Hours	AI	15 Minutes	12 hours	3 days	N/A		
High Water Level Alarm	DI	COV	12 hours	3 days	C	True	5 Min
Condensate Pump Start/Stop	DO	COV	12 hours	3 days	P	Status <> Command	10 min

Domestic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Domestic HW Setpoint WH-1	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Setpoint WH-2	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	C	> 135 °F	10 Min
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	P	±5°F from SP	10 Min
Dom. Circ. Pump #1 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min

Domestic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Dom. Circ. Pump #2 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Dom. Circ. Pump #2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Domestic HW Start/Stop	DO	COV	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
System HWS Temperature	AI	15 min	12 hours	3 days	C	±5°F from SP	10 Min
System HWR Temperature	AI	15 min	12 hours	3 days	M	±15°F from SP	300 Min
HX-1 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-1 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
System Flow (GPM)	AI	15 min	12 hours	3 days	N/A		
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min
Energy Recovery Pump Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pumps 1, 2 & 3 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Snowmelt Pump Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Energy Recovery Pump VFD Speed	AO	15 Min	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
HW Pumps 1,2 & 3VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
All HW Pumps Start/Stop	DO	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Emergency Shutdown	DI	COV	12 Hours	3 days	P	True	1 Min
Chiller Enable	DO	COV	12 Hours	3 days	N/A		
Chiller Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified

after submission shall be recorded and resubmitted to the Resident Engineer and Commissioning Agent.

1. Point-to-Point checkout documentation;
2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

SYSTEM		
Sensor	Calibration Frequency	O&M Calibration Procedure Reference
Discharge air temperature	Once a year	Volume I Section D.3.aa
Discharge static pressure	Every 6 months	Volume II Section A.1.c

4. Loop tuning documentation and constants for each loop of the building systems. The documentation shall be submitted in outline or table separated by system, control type (e.g. heating valve temperature control); proportional, integral and derivative constants, interval (and bias if used) for each loop. The following table is a sample that can be used as a template for submission.

AIR HANDLING UNIT AHU-1				
Control Reference	Proportional Constant	Integral Constant	Derivative Constant	Interval
Heating Valve Output	1000	20	10	2 sec.

3.6 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.

- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
- C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.
- D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms

developed by the Commissioning Agent will include, but not be limited to, the following information:

1. System and equipment or component name(s)
 2. Equipment location and ID number
 3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment
 4. Date
 5. Project name
 6. Participating parties
 7. A copy of the specification section describing the test requirements
 8. A copy of the specific sequence of operations or other specified parameters being verified
 9. Formulas used in any calculations
 10. Required pretest field measurements
 11. Instructions for setting up the test.
 12. Special cautions, alarm limits, etc.
 13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
 14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
 15. A section for comments.
 16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.
- E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.
1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
 2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall

be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers, and devices shall have been calibrated.

3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
 4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
 5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.
- F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.
- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and

testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.

- H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.
- J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.
- K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

3.7 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

- A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to

the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.

- B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.
1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
 2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
 3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
 4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
 - a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.
 - b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
 5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:

- a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
 - b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
 - c. The Commissioning Agent will document the resolution process.
 - d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.
- C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:
1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
 2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not

significantly exceed the specification requirements of the original installation.

3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
 4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
 5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

3.8 DEFERRED TESTING

- A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.
- B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred

Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

3.9 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Resident Engineer, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.
- B. The Contractor shall provide training and demonstration as required by other Division 22, Division 23, and Division 26 sections. The Training and Demonstration shall include, but is not limited to, the following:
 - 1. Review the Contract Documents.
 - 2. Review installed systems, subsystems, and equipment.
 - 3. Review instructor qualifications.
 - 4. Review instructional methods and procedures.
 - 5. Review training module outlines and contents.
 - 6. Review course materials (including operation and maintenance manuals).
 - 7. Review and discuss locations and other facilities required for instruction.
 - 8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
 - 9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
 - 1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.

2. Qualification Data: Submit qualifications for facilitator and/or instructor.
3. Attendance Record: For each training module, submit list of participants and length of instruction time.
4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
5. Demonstration and Training Recording:
 - a. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
 - b. Video Format: Provide high quality color DVD color on standard size DVD disks.
 - c. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
 - d. Narration: Describe scenes on video recording by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - e. Submit two copies within seven days of end of each training module.
6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

D. Quality Assurance:

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01

Section "Quality Requirements," experienced in operation and maintenance procedures and training.

3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

E. Training Coordination:

1. Coordinate instruction schedule with VA's operations. Adjust schedule as required to minimize disrupting VA's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the VA.

F. Instruction Program:

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 - a. Fire protection systems, including fire alarm, and fire suppression systems.
 - b. Intrusion detection systems.
 - c. Conveying systems, including elevators.
 - d. Medical equipment, including medical gas equipment and piping.
 - e. Laboratory equipment, including laboratory air and vacuum equipment and piping.
 - f. Heat generation, including pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
 - g. Refrigeration systems, including chillers, pumps, and distribution piping.
 - h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
 - i. HVAC instrumentation and controls.
 - j. Electrical service and distribution, including switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
 - k. Lighting equipment and controls.

- m. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
- G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following:
- 1. Basis of System Design, Operational Requirements, and Criteria:
Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - H, Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:

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

1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
 2. Instruction:
 - a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.
 - b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2) The VA will furnish an instructor to describe VA's operational philosophy.
 - 3) The VA will furnish the Contractor with names and positions of participants.
 3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
 4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, or a written, performance-based test.
 5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.
- I. Demonstration and Training Recording:
1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.

2. Video Format: Provide high quality color DVD color on standard size DVD disks.
3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

----- END -----

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

1.2 RELATED WORK:

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished Section 31 20 00, EARTH MOVING .
- B. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.
- I. Infectious Control: Section 01 35 26, SAFETY REQUIREMENTS.

1.3 PROTECTION:

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

- D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.
- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
1. No wall or part of wall shall be permitted to fall outwardly from structures.
 2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
 3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works.

Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.

- H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS and Section 01 35 26, SAFETY REQUIREMENTS.

1.4 UTILITY SERVICES:

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION:

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
 - 1. As required for installation of new utility service lines.
 - 2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Resident Engineer. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. Remove and legally dispose of all materials, other than earth to remain as part of project work. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code

covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

3.2 CLEAN-UP:

- A. On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include off the Medical Center disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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**SECTION 02 84 16
HANDLING & DISPOSAL OF FLUORESCENT TUBES AND BATTERIES**

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 1910.1000	Air Contaminants
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 273	Standards For Universal Waste Management
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 178	Specifications for Packagings

1.2 PROJECT REQUIREMENTS

Removal and disposal of the mercury containing fluorescent light tubes and batteries in the backup/emergency/exit light fixtures in the renovation areas of Building 5.

1.3 DEFINITIONS

1.3.1 UNIVERSAL WASTE

Universal Waste means any of the following hazardous wastes

that are managed under the universal waste requirements 40 CFR 273:

- (1) Batteries as described in Sec. 273.2 of this chapter;
- (2) Lamps as described in Sec. 273.5 of this chapter.

1.4 QUALITY ASSURANCE

1.4.1 REGULATORY REQUIREMENTS

Perform work in accordance with 40 CFR 761 and perform mercury-containing lamps storage and transport in accordance with 40 CFR 261, 40 CFR 264, 40 CFR 265, and 40 CFR 273.

1.4.2 TRAINING

Certified industrial hygienist (CIH) shall instruct and certify the training of all persons involved in the removal of batteries and mercury-containing lamps. The instruction shall include: The dangers of mercury exposure, decontamination, safe work practices, and applicable OSHA and EPA regulations. The CIH shall review and approve the Battery and Mercury-Containing Lamp Removal Work Plans.

1.4.3 REGULATION DOCUMENTS

Maintain at all times one copy each at the office and one copy each in view at the job site of 29 CFR 1910.1000, 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 265, 40 CFR 268, 40 CFR 270, and 40 CFR 273, and of the Contractor removal work plan and disposal plan for PCB and for associated mercury-containing lamps.

1.5 SUBMITTALS

Certificates

- Training Certification
- Removal Work Plan
- Disposal Plan

Closeout Submittals

Certificate of Disposal and/or recycling. Submit to the Government before application for payment within 30 days of the date that the disposal of the batteries and mercury-containing lamp waste identified on the manifest was completed.

1.6 ENVIRONMENTAL REQUIREMENTS

Use special clothing:

- a. Disposable gloves (polyethylene)
- b. Eye protection
- c. PPE as required

1.7 SCHEDULING

Notify the Contracting Officer 20 days prior to the start of removal work.

1.8 QUALITY ASSURANCE

1.8.1 WORK PLAN

Submit a job-specific plan within 20 calendar days after award of contract of the work procedures to be used in the removal, packaging, and storage of batteries and mercury-containing lamps. Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures. The plan shall be approved and signed by the Certified Industrial Hygienist. Obtain approval of the plan by the Contracting Officer prior to the start of removal work.

1.8.2 DISPOSAL/RECYCLING PLAN

Submit a battery and lamp Disposal or Recycling Plan with 45 calendar days after award of contract. The Plan shall comply with applicable requirements of federal, state, and local regulations and address:

- a. Estimated quantities of wastes to be generated, disposed of, and/or recycled.
- b. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Furnish two copies of EPA and state mercury-containing lamp waste permit applications and EPA identification numbers, as required.
- c. Names and qualifications (experience and training) of personnel who will be working on-site with wastes.
- d. Spill prevention, containment, and cleanup contingency measures to be implemented.
- e. Work plan and schedule for waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerize daily.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the removal of batteries and mercury-containing fluorescent lamps, in accordance with local, state, or federal regulations. Do not expose lamps or batteries to open flames or other high temperature sources

since toxic decomposition by-products may be produced. Do not break mercury containing fluorescent lamps or battery casings.

3.1.1 Work Operations

Ensure that work operations or processes involving Universal Waste materials are conducted in accordance with 40 CFR 761, 40 CFR 262 40 CFR 263, and the applicable requirements of this section, including but not limited to:

- a. Obtaining suitable storage sites.
- b. Notifying Contracting Officer prior to commencing the operation.
- c. Reporting leaks and spills to the Contracting Officer.
- d. Cleaning up spills.
- e. Inspecting Universal Waste items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.
- f. Maintaining inspection, inventory and spill records.

3.3 REMOVAL

3.3.1 Lighting Lamps

Remove lighting tubes/lamps from the lighting fixture and carefully place (unbroken) into appropriate containers (original transport boxes or equivalent). In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as universal waste as specified herein.

3.3.2 Batteries

Remove batteries from the fixtures and carefully place into appropriate containers for transportation to an EPA licensed recycling facility.

3.4 STORAGE FOR DISPOSAL

3.4.1 Storage Containers for Batteries

Store batteries in containers approved by DOT in accordance with 40 CFR 761.

3.4.2 Storage Containers for lamps

Store mercury containing lamps in appropriate DOT containers. The boxes shall be stored and labeled for transport in accordance with 40 CFR 273.

3.4.3 Labeling of Waste Containers

Label with the following:

- a. Date the item was placed in storage and the name of the cognizant activity/building.

- b. Label mercury-containing lamp waste in accordance with 40 CFR 273.
Affix labels to all lighting waste containers.

3.5 DISPOSAL

Dispose of off Government property in accordance with EPA, DOT, and local regulations at a permitted site.

3.5.1 Identification Number

For mercury containing lamp removal, Federal regulations 40 CFR 273 require that large quantity handlers of Universal waste (LQHUU) must provide notification of universal waste management to the appropriate EPA Region (or state director in authorized states), obtain an EPA identification number, and retain for three years records of off-site shipments of universal waste. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Universal Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work.

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK

- A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction.
- B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS
- C. Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS: Concrete roads, walks, and similar exterior site work.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN

- A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by COR. For all other testing, refer to Section 01 45 29 Testing Laboratory Services.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).
- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:

1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

1.5 REGULATORY REQUIREMENTS

- A. ACI SP-66 - ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 - Standard Specifications for Structural Concrete.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Cast-in-place insulated concrete sandwich panels: Quality Assurance:
 1. Test Reports
 2. Manufacturer's installation instructions
- D. Construction/Control Joint Plan for all slabs on grade
- E. Specifications for power trowels to be used on elevated slabs
- F. Mill Test Reports:
 1. Reinforcing Steel.
 2. Cement.
- G. Manufacturer's Certificates:
 1. Abrasive aggregate.
 2. Air-entraining admixture.
 3. Chemical admixtures, including chloride ion content.
 4. Waterproof paper for curing concrete.
 5. Liquid membrane-forming compounds for curing concrete.
 6. Non-shrinking grout.
 7. Liquid hardener.
 8. Waterstops.
 9. Adhesive binder.
- H. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active

participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology and copy of report of latest CCRL, Inspection of Laboratory.

- I. Test Report for Concrete Mix Designs: Trial mixes including water-cement fly ash ratio curves, concrete mix ingredients, and admixtures.

1.7 PRE-CONCRETE CONFERENCE

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
 - 1. Submittals.
 - 2. Coordination of work.
 - 3. Availability of material.
 - 4. Concrete mix design including admixtures.
 - 5. Methods of placing, finishing, and curing.
 - 6. Finish criteria required to obtain required flatness and levelness.
 - 7. Timing of floor finish measurements.
 - 8. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; admixture manufacturers; COR; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.
- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
 - 117-10Specifications for Tolerances for Concrete Construction and Materials and Commentary
 - 211.1-91 (R2009)Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 - 211.2-98 (R2004)Standard Practice for Selecting Proportions for Structural Lightweight Concrete

- 214R-11 (R2019)Guide to Evaluation of Strength Test Results of
Concrete
- 301-16Specifications for Structural Concrete
- 304R-00 (R2009)Guide for Measuring, Mixing, Transporting, and
Placing Concrete
- 305.1-14Specification for Hot Weather Concreting
- 306.1-90 (R2002)Standard Specification for Cold Weather
Concreting
- 308.1-11Specification for Curing Concrete
- 309R-05Guide for Consolidation of Concrete
- 318/318-19Building Code Requirements for Structural
Concrete and Commentary
- 347R-14Guide to Formwork for Concrete
- SP-66-04ACI Detailing Manual
- C. American National Standards Institute and American Hardboard
Association (ANSI/AHA):
- A135.4-2012Basic Hardboard
- D. ASTM International (ASTM):
- A615/A615M-20Standard Specification for Deformed and Plain
Carbon Steel Bars for Concrete Reinforcement
- A653/A653M-20Standard Specification for Steel Sheet, Zinc
Coated (Galvanized) or Zinc Iron Alloy Coated
(Galvannealed) by the Hot Dip Process
- A706/A706M-16Standard Specification for Deformed and Plain
Low-Alloy Steel Bars for Concrete Reinforcement
- A767/A767M-19Standard Specification for Zinc Coated
(Galvanized) Steel Bars for Concrete
Reinforcement
- A775/A775M-19Standard Specification for Epoxy Coated Steel
Reinforcing Bars
- A820/820M-16Standard Specification for Steel Fibers for
Fiber Reinforced Concrete
- A996/A996M-16Standard Specification for Rail Steel and Axle
Steel Deformed Bars for Concrete Reinforcement
- A1064/A1064M-18aStandard Specification for Carbon-Steel Wire
and Welded Wire Reinforcement, Plain and
Deformed, for Concrete

C31/C31M-19aStandard Practice for Making and Curing
 Concrete Test Specimens in the field
 C33/C33M-18Standard Specification for Concrete Aggregates
 C39/C39M-20Standard Test Method for Compressive Strength
 of Cylindrical Concrete Specimens
 C94/C94M-19aStandard Specification for Ready Mixed Concrete
 C143/C143M-20Standard Test Method for Slump of Hydraulic
 Cement Concrete
 C150C150M-20Standard Specification for Portland Cement
 C171-16Standard Specification for Sheet Materials for
 Curing Concrete
 C172C172M-17Standard Practice for Sampling Freshly Mixed
 Concrete
 C173/C173M-16...Standard Test Method for Air Content of Freshly
 Mixed Concrete by the Volumetric Method
 C192/C192M-19Standard Practice for Making and Curing
 Concrete Test Specimens in the Laboratory
 C231/C231M-17aStandard Test Method for Air Content of Freshly
 Mixed Concrete by the Pressure Method
 C260/C260M-10a (2016) ...Standard Specification for Air Entraining
 Admixtures for Concrete
 C309-19Standard Specification for Liquid Membrane
 Forming Compounds for Curing Concrete
 C330/C330M-17aStandard Specification for Lightweight
 Aggregates for Structural Concrete
 C494/C494M-19Standard Specification for Chemical Admixtures
 for Concrete
 C618-19Standard Specification for Coal Fly Ash and Raw
 or Calcined Natural Pozzolan for Use in
 Concrete
 C666/C666M-15Standard Test Method for Resistance of Concrete
 to Rapid Freezing and Thawing
 C881/C881M-20Standard Specification for Epoxy Resin Base
 Bonding Systems for Concrete
 C1107/1107M-20Standard Specification for Packaged Dry,
 Hydraulic-Cement Grout (Non-shrink)

- C1315-19Standard Specification for Liquid Membrane
Forming Compounds Having Special Properties for
Curing and Sealing Concrete
- D6/D6M-95 (2018)Standard Test Method for Loss on Heating of Oil
and Asphaltic Compounds
- D297-15 (2019)Standard Test Methods for Rubber Products
Chemical Analysis
- D412-16Standard Test Methods for Vulcanized Rubber and
Thermoplastic Elastomers - Tension
- D1751-18Standard Specification for Preformed Expansion
Joint Filler for Concrete Paving and Structural
Construction (Non-extruding and Resilient
Bituminous Types)
- D4263-83 (2018)Standard Test Method for Indicating Moisture in
Concrete by the Plastic Sheet Method.
- E1155-20Standard Test Method for Determining F_F Floor
Flatness and F_L Floor Levelness Numbers
- F1249-20Standard Test Method for Water Vapor
Transmission Rate Through Plastic Film and
Sheeting Using a Modulated Infrared Sensor
- F1869-16aStandard Test Method for Measuring Moisture
Vapor Emission Rate of Concrete Subfloor Using
Anhydrous Calcium Chloride.
- E. American Welding Society (AWS):
- D1.4/D1.4M-18Structural Welding Code - Steel Reinforcing
Bars
- F. Concrete Reinforcing Steel Institute (CRSI):
Handbook 2008
- G. National Cooperative Highway Research Program (NCHRP):
Report OnConcrete Sealers for the Protection of Bridge
Structures
- H. U. S. Department of Commerce Product Standard (PS):
PS 1-07Structural Plywood
PS 20-20American Softwood Lumber Standard
- I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
- CRD C513Rubber Waterstops
CRD C572Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS

2.1 FORMS

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.
- F. Form Lining:
 - 1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
 - 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
 - 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.
- G. Concrete products shall comply with following standards for biobased materials:

Material Type	Percent by Weight
Concrete Penetrating Liquid	79 percent biobased material
Concrete form Release Agent	87 percent biobased material
Concrete Sealer	11 percent biobased material

The minimum-content standards are based on the weight (not the volume) of the material.

- H. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal

closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS

- A. Portland Cement: ASTM C150 Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent. Do not exceed more than 25 percent total cementitious content by weight.
- C. Coarse Aggregate: ASTM C33.
 - 1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
 - 2. Coarse aggregate for interior slabs on grade shall conform to the following:
 - a. Dense or well graded aggregate.
 - 1) Percent retained on each sieve below the top size and above the No. 100 sieve:
 - a) 8 to 18 percent for 1-1/2 inches (38 mm) top size.
 - b) 8 to 22 percent for 3/4 or 1 inch (19 or 25 mm) top size.
 - 2) The above requirements may be deviated from based on locally available material.
 - a) One or two non-adjacent sieves sizes may fall outside of the limits set above.
 - b) Percent retained on two adjacent sieves sizes shall not be less than 5 percent of the above required.
 - c) Percent retained on three adjacent sieve sizes shall not be less than 8 percent of the above required.
 - d) When the percent retained on each of two adjacent sieve sizes is less than 8 percent the total percent retained on either of these sieves and the adjacent outside sieve should be at least 13 percent (for example, if both the No. 4 and No. 8 (4.75 and 2.36 mm) sieves have 6 percent retained on each item then: 1. the total retained on the 3/8 inch and No. 4 (9.5 and 4.75 mm) sieves should be at least 13 percent, and 2. the total retained on the No. 8 and No. 16 (2.36 and 1.18 mm) sieves should be at least 13 percent.
 - 3. Coarse aggregate for and metal pan stair fill shall be Size 7.

4. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- D. Mixing Water: Fresh, clean, and potable.
- E. Admixtures:
1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water. Use of superplasticizer requires COR approval.
 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
 5. Air Entraining Admixture: ASTM C260.
 6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
 7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- F. Vapor Barrier: ASTM F1249, 0.38 mm (15 mil) WVT 0.007 foot/hour.
- G. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- H. Welded Wire Fabric: ASTM A185.
- I. Reinforcing Bars to be Welded: ASTM A706.
- J. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m² (1.5 pounds per square yard), or square mesh at .6Kg/m² (1.17 pounds per square yard).
- K. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- L. Sheet Materials for Curing Concrete: ASTM C171.

- M. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- N. Liquid Hardener and Dustproofer: Fluosilicate solution of magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer. Use only on exposed slab. Do not use where floor is covered with resilient flooring, paint or other finish coating.
- O. Moisture Vapor Emissions & Alkalinity Control Sealer: 100 percent active colorless aqueous silicate solution concrete surface.
1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34 percent solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.
 2. MVE 15-Year Warranty:
 - a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.
- P. Non-Shrink Grout:
1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
 2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout

when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

Q. Adhesive Binder: ASTM C881.

R. Waterstops:

1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Bentonite Waterstop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 pounds per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).
4. Non-Metallic Hydrophilic: Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in in 70 deg water shall be 3 to 1 minimum.

S. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).

T. Fibers:

1. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m³ (1.5 lb. per cubic yard). Product shall have a UL rating.
2. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m³ (30 lb. per cubic yard).

U. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.

V. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

W. Rigid Insulation for Concrete Sandwich Panels:

- a. Provide extruded polystyrene rigid board insulation having the physical properties defined by ASTM C 578 for Type IV material with provisions as follows:
- b. Compressive resistance: 25 psi minimum at yield or at 10 percent deformation per ASTM D 1621.
- c. Water Absorption: 0.1 percent maximum by volume per ASTM C 272.

- d. ISR R-Value: $5.0^{\circ}\text{F}\cdot\text{ft}^2\cdot\text{h}/\text{Btu}$ per inch at 75°F minimum per ASTM C 518. Warranted R-Value to retain minimum of 90 percent of its published R-value for 15 years.
- e. Manufactured with a blowing agent that provides at least a 90 percent reduction in potential for ozone depletion as compared to standard CFC blowing agents.
- f. Pre-installed, high-strength, polymer twist-lock retainers, designed to position the fiber composite connector within the pre-fabricated insulation sheets. The retainers are factory set tightly against the surface of the insulation boards in a pre-engineered pattern to transfer lateral and gravity loads from the exterior layer to the structural layer.
- g. Follow the manufacturer's instructions on storing and handling the insulation:
 - 1) Store insulation system in original system manufacturer's wrapping. Store in a secure dry area, covered with u.v. rated polyethylene or in a location protected from direct sunlight to prevent surface oxidation. Protect insulation from wind damage.
 - 2) Protect insulation from open flame and heat sources greater than 165°F .
 - 3) Avoid contact with petroleum-based solvents.

X. CONNECTORS FOR CONCRETE SANDWICH WALL PANELS

- 1. Provide fiber composite connectors having the following physical properties and attributes:
 - a. Non-conductive, non-corrosive, fiber-composite connectors having a minimum tensile strength of 120,000 psi, minimum glass fiber content of 76% (by weight), in a thermoset vinyl-ester resin matrix.
 - b. Upon request, connector supplier shall provide documentation of alkali resistance of connector and long-term shear capacity of connector.
 - c. Coefficient of thermal expansion: 3.90×10^{-6} in/in/ $^{\circ}\text{F}$, nominal.
 - d. Central body of connector shall be provided with a flange to limit insertion depth into insulation.
 - e. Central body of connector shall have serrated profile to provide interference fit with pre-formed holes in the insulation so as to

prevent connector from backing out of insulation after installation.

- f. Thermal Conductivity: 6.9 Btu/ ($^{\circ}\text{F}\cdot\text{ft}^2\cdot\text{h}$) per inch of length.
- g. The wythe ties comprise of a fiber-composite connector with a polymer wing that controls the position of the connector within the twist-lock retainer and provides leverage during connector installation. The pre-installed twist-lock retainers provide a friction fit with the pre-formed holes in the insulation eliminating concrete flow-through while the buttons structurally support the insulation at the designed location in the forms.
- h. Proven accelerated aging testing. Provide reports showing compliance with ASTM C 581

2.3 CONCRETE MIXES

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
 - 1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
 - 2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per m^3 (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement-fly ash ratio, and consistency of each cylinder in terms of slump.
 - 3. Prepare a curve showing relationship between water-cement-fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
 - 4. If the field experience method is used, submit complete standard deviation analysis.
- B. Fly Ash Testing: Submit certificate verifying conformance with ASTM 618 initially with mix design and for each truck load of fly ash delivered from source. Submit test results performed within 6 months of submittal date. Notify the COR immediately when change in source is anticipated.
 - 1. Testing Laboratory used for fly ash certification/testing shall participate in the Cement and Concrete Reference Laboratory (CCRL) program. Submit most recent CCRL inspection report.

- C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of the COR or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash , providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. The COR may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.
- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with maximum of 25 percent replacement by weight in all structural work. Fly ash shall not be used in high-early mix design.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete Strength		Non-Air-Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio
35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
25 (3000)1,2	300 (500)	See 4 below	310 (520)	See 4 below

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.

- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, MM (INCHES)

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	75 mm (3 inches)
Slabs, Beams, Reinforced Walls, and Building Columns	100 mm (4 inches)	100 mm (4 inches)

- F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches). This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.
- G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Determine air content by either ASTM C173 or ASTM C231.

**TABLE III - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm (Inches) Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- J. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. For air content requirements see Table III.
- K. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below

required values, the COR may require any one or any combination of the following corrective actions, at no additional cost to the Government:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
2. Require additional curing and protection.
3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, the COR may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, the COR may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the COR.

2.4 BATCHING AND MIXING

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38 degrees C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

PART 3 - EXECUTION

3.1 FORMWORK

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.

1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and the COR approves their reuse.
 2. Provide forms for concrete footings unless the COR determines forms are not necessary.
 3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than $1/270$ of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.
- F. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.

1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- G. Inserts, Sleeves, and Similar Items: Steel strips, anchors, grounds, inserts, sleeves, drains, guard angles, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.
1. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
 2. Do not install sleeves in piers except where shown or permitted by the COR. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the COR, and require no structural changes, at no additional cost to the Government.
 3. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
 4. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.
- H. Construction Tolerances:
1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
 2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances

specified which are applicable to surface irregularities of structural elements.

3.2 PLACING REINFORCEMENT

- A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
 - 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
 - 2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
 - 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
 - 1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
 - 2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
 - a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.

- b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
 - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by the COR.
3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (fy) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of the COR, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
 - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by the COR.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
 - 1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
 - 2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
 - 3. Patch punctures and tears.
 - 4. Where slabs abut foundation walls, extend vapor barrier up wall 2" and seal; with compatible pressure-sensitive tape.

5. Seal around all penetrations with pressure-sensitive tape.

3.4 SLABS RECEIVING RESILIENT COVERING

- A. Slab shall be allowed to cure for 6 weeks minimum prior to placing resilient covering. After curing, slab shall be tested by the Contractor for moisture in accordance with ASTM D4263 or ASTM F1869. Moisture content shall be less than 3 pounds per 1000 sf, or less if required by flooring manufacturer, prior to placing covering.
- B. In lieu of curing for 6 weeks, Contractor has the option, at his own cost, to utilize the Moisture Vapor Emissions & Alkalinity Control Sealer as follows:
 - 1. Sealer is applied on the day of the concrete pour or as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, epoxy coatings and overlays.
 - 2. Manufacturer's representative will be on the site the day of concrete pour to install or train its application and document. He shall return on every application thereafter to verify that proper procedures are followed.
 - a. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
 - b. Spray apply Sealer at the rate of 20 m² (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
 - c. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply Sealer product to these areas as soon as weather condition permits.

3.5 CONSTRUCTION JOINTS

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by the COR.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance

equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

- C. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.6 CONTRACTION JOINTS

- A. Provide contraction (control) joints in floor slabs as indicated on the contract drawings. Joints shall be either formed or saw cut, to the indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.7 PLACING CONCRETE

- A. Preparation:
 - 1. Remove hardened concrete, wood chips, shavings and other debris from forms.
 - 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
 - 3. Have forms and reinforcement inspected and approved by the COR before depositing concrete.
 - 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete is subject to approval of the COR.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
 - 1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
 - 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.

3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
 4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
 5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
 6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
 7. Concrete on metal deck:
 - a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
 - 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.

1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.8 HOT WEATHER

- A. Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by the COR.

3.9 COLD WEATHER

- A. Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by the COR.

3.10 PROTECTION AND CURING

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by the COR.
 1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m²/L (400 square feet per gallon) on steel troweled surfaces and 7.5m²/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
 2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and

overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.

3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
 2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

3.12 CONCRETE SURFACE PREPARATION

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches)

surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.13 CONCRETE FINISHES

A. Vertical and Overhead Surface Finishes:

- 1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.

B. Slab Finishes:

- 1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to the COR and floor consultant for evaluation and recommendations for subsequent placements.
- 2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless the COR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds

are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.

3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct

- high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
 10. Power Trowel Finish: Submit specifications for power trowels to be used on elevated slabs for approval.
 11. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by the COR from sample panel.
 12. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
 - a. Areas covered with carpeting, or not specified otherwise in b. below:
 - 1) Slab on Grade:

a) Specified overall value	F _F 25/F _L 20
b) Minimum local value	F _F 17/F _L 15
 - 2) Level suspended slabs (shored until after testing) and topping slabs:

a) Specified overall value	FF 25/FL 20
b) Minimum local value	FF 17/FL 15
 - 3) Unshored suspended slabs:

a) Specified overall value	FF 25
b) Minimum local value	FF 17
 - 4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
 - b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
 - 1) Slab on grade:

- a) Specified overall value FF 36/FL 20
- b) Minimum local value FF 24/FL 15
- 2) Level suspended slabs (shored until after testing) and topping slabs
 - a) Specified overall value FF 30/FL 20
 - b) Minimum local value FF 24/FL 15
- 3) Unshored suspended slabs:
 - a) Specified overall value FF 30
 - b) Minimum local value FF 24
- 4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

- c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
- d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

13. Measurements

- a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by the COR, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.
- b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the

finish as it progresses in order to achieve the specific flatness and levelness numbers.

14. Acceptance/ Rejection:

- a. If individual slab section measures less than either of specified minimum local F_F/F_L numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
- b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall F_F/F_L numbers, then whole slab shall be rejected and remedial measures shall be required.

15. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by the COR, until a slab finish constructed within specified tolerances is accepted.

3.14 SURFACE TREATMENTS:

- A. Use on exposed concrete floors and concrete floors to receive carpeting, except those specified to receive non-slip finish.
- B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.

3.17 RETAINING WALLS

- A. Use air-entrained concrete.
- B. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.
- C. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.
- D. Place porous backfill as shown.

3.18 SANDWICH WALLS

- A. Set formwork in accordance with standard assembly practices, including form ties.
- B. Before installation of the insulation sheets in the forms, tape the individual sheets together per the drawings supplied by Thermomass. Install the tape on both sides of the insulation. Apply the tape only to clean, dry surfaces.
- C. Install the insulation assembly in the form.
- D. Install the Thermomass connectors.

1. Insert the connector in the rectangular hole in the twist-lock assembly.
 2. Push the connector through the thickness of the insulation until the wing comes to rest against the face of the twist-lock assembly.
 3. Using the wing for leverage, use the thumb and index finger to twist the connector in the directions indicated by the arrows on the face of the twist-lock assembly. Note that the connectors will rotate 90 degrees until internal detent in the retainer stops the rotation.
 4. Continue this process for all of the connectors for a panel.
- E. Using the notches on the fiber composite connectors, the sufficient connectors to the structural reinforcing bars to hold the insulation in place. Alternately, the connectors can be pre-installed, and the insulation system can be pre-wired to the reinforcing cage before installation in the form.
- F. Place the reinforcing for the remaining concrete layer and the ties to the connectors as needed. Verify that the insulation is properly located in the form and close the form.
- G. During concrete placement, use accepted practice for concrete mix design and placement procedures for thin wall sections. If multiple walls intersect, start the concrete placement at the insulated walls. Ensure that the concrete is placed on both sides of the insulation with a maximum differential head of approximately one foot.
- H. In installations with form-liners, maintain a positive differential head on the liner side to push the insulation and the connectors away from the liner.

- - - E N D - - -

SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section includes the performance criteria, materials, production, and erection of architectural precast concrete cladding units. The work performed under this section includes all design, labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete work shown on the construction documents.

1.2 RELATED WORK

- A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction.
- B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.
- C. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete.
- D. Section 07 92 00, JOINT SEALANTS: Sealants and Caulking.
- E. Section 09 06 00, SCHEDULE FOR FINISHES: Size, Type and Color of Aggregate for Exposed Aggregate Finish and Matrix Color.
- F. Section 09 91 00, PAINTING: Repair of Abraded Galvanized and Painted Surfaces.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that complies with PCI MNL 117 and the following requirements and is experienced in producing units similar to those indicated for this Project and with a record of successful in-service performance:
1. Provide engineering units to comply with performance requirements.
Furnish Comprehensive Engineering Analysis, performed by a Professional Structural Engineer registered in the state of the project with a minimum of 5 years experience in providing engineering services of the kind indicated.
 2. Participates in PCI's Plant Certification program at the time of bidding and is designated a PCI-certified plant for Group A, Category A1- Architectural Cladding and Load Bearing Units. Submit PCI certification.
 3. Fabricator must have a minimum of three (3) years' experience in Precast Architectural Concrete work comparable to that shown and specified in not less than three (3) projects of similar scope // with the Government determining the suitability of experience //.

B. Erector Qualifications:

1. A precast concrete erector Qualified by the Precast/Prestressed Concrete Institute (PCI) prior to beginning work at the project site. Submit a current Certificate of Compliance furnished by PCI designating qualification in Category A (Architectural Systems) for non-load-bearing members . Submit qualifications.

C. Testing Laboratory Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority. Submit a copy of the Certificate of Accreditation and Scope of Accreditation.

D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117.

E. Sample Panels: Before fabricating units, produce a minimum of two (2) sample panels approximately 1.5 sq. m. (16 sq. feet) in size for review by the Contracting Officer Representative (COR). Incorporate full scale details of architectural features, finishes, textures, and transitions in the sample panels. Approved sample panel will be used for mockup and range sample.

1. Locate panels where indicated or, if not indicated, as directed by COR.
2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
3. After acceptance of repair technique by COR, maintain one (1) sample panel at the manufacturer's plant and one (1) at the project site in an undisturbed condition as a standard for judging the completed work.
4. When back face of precast concrete unit is to be exposed, show samples of the workmanship, color, and texture of the backup concrete as well as the facing.
5. Demolish and remove sample panels only when directed by COR.

F. Range Samples: After sample panel approval and before production of units for installation, produce a minimum of three (3) samples, approximately 1.5 sq. m. (16 sq. feet) in size, representing anticipated range of color and texture of project. Following range sample acceptance by the COR, maintain samples at the manufacturer's plant and the Project site as color and texture acceptability reference.

G. Mockups: After sample panel and range sample approval but before production of units, construct full sized mockups to verify selections and to demonstrate aesthetic effects and qualities of materials and execution.

Mockup to be representative of the finished work in all respects including glass, aluminum framing, sealants and architectural precast concrete complete with all anchors, connections, flashings, and joint fillers as approved on the final shop drawings. Build mockups to comply with the following requirements, using materials indicated for the completed work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by COR.
2. Notify COR in advance of dates and times when mockups will be constructed.
3. Obtain COR's approval of mockups before starting fabrication.
4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
5. Demolish and remove mockups when directed by COR.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01, GENERAL REQUIREMENTS.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide units and connections capable of withstanding: the design criteria specified on the construction documents, self-weights and weights of materials supported or attached, for the conditions indicated.

1. Design Standards: Comply with ACI 318/ACI 318M and the design recommendations of PCI MNL 120 and PCI MNL 122 applicable to types of units indicated.
2. Limit deflection of precast members as follows:
 - a. Vertical live load - $\text{Span} / 360$.
 - b. Wind load - $\text{Height} / 400$.
3. Physical Security Mission Critical Facilities:
 - a. Precast concrete panels to meet or exceed the design and construction standards as provided in the Physical Security Design Manual for VA Facilities: Mission Critical Facilities.
 - 1) Blast Resistance: Design level vehicle threat (W1) located at the standoff distance, but not greater than GP2. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years experience in design of blast resistant systems. The magnitudes of the design threats W1 and GP2 are defined in the Physical Security Design Standards Data Definitions which is a document separate from the referenced VA Security Design Manual. The Physical Security Design Standards Data Definitions are on a need to know basis by the

blast/structural engineer performing the blast design on VA projects. It is the responsibility of the engineer of blast resistant system to request and obtain the Physical Security Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor

- B. Design concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live load deflection, shrinkage and creep of primary building structure, and other building movements.
- C. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 49 degrees C (120 degrees F).

1.5 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to Section 01 45 29, TESTING LABORATORY SERVICES and PCI MNL 117 requirements respectively. If using self-consolidating concrete also test and inspect according to PCI TR-6.
- B. Testing: When determined by the COR that there is evidence that the concrete strength of precast concrete units may be deficient, employ an independent testing agency at Contractor's expense to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to PCI MNL 117:
 - 1. Submit test results in writing on the same day that tests are performed, with copies to COR, Contractor, and precast concrete fabricator. Include the information required in Section 01 45 29, TESTING LABORATORY SERVICES and the following:
 - a. Identification mark and type of precast concrete units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- C. Defective or Damaged Work: Units that do not comply with acceptability requirements, including concrete strength, manufacturing tolerances, and color and texture range are unacceptable. Chipped, spalled or cored units may be repaired, if repaired units match the visual mock-up. The COR will reject units that do not match the accepted samples and visual mock-up. Remove unacceptable units from the site and replace with precast concrete units that comply with requirements.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals, as described below:
 - 1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
- C. Design Mixes: For each concrete mix along with compressive strength and water-absorption tests.
- D. Shop (Erection) Drawings: Detail fabrication and installation of units.
 - 1. Indicate member locations with distinctive marks that match marks placed on the panels. Provide plans, elevations, dimensions, corner details, shapes, cross sections and relationships to adjacent materials.
 - 2. Indicate aesthetic characteristics including joints, reveals, and extent and location of each surface finish.
 - 3. Indicate separate face and backup mix locations, and thicknesses. Indicate locations, extent and treatment of dry joints if two-stage casting is proposed.
 - 4. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, and connections.
 - 5. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 6. Indicate sequence of erection.
 - 7. Indicate locations and details of facing materials, anchors, and joint widths.
 - 8. Design Modifications:
 - a. If design modifications are necessary to meet the performance requirements and field conditions, submit design calculations and drawings. Do not adversely affect the appearance, durability or strength of units when modifying details or materials and maintain the general design concept.
- E. Comprehensive Engineering Analysis: Submit calculations signed and sealed by a Professional Structural Engineer responsible for the product design who is registered in the state where the work is located. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate design criteria and loads. Indicate the location, type, magnitude and direction of all imposed loadings from the precast system to the building structural frame.
- F. Samples: Design reference samples for initial verification of design intent, approximately 305 by 305 by 50 mm (12 by 12 by 2 inches),

representative of finishes, color, and textures of exposed surfaces of units.

- G. Samples for each facing unit required, showing the full range of color and texture expected. Supply sketch of each corner or special shape with dimensions. Supply sample showing color and texture of joint treatment.
- H. Welding Certificates: Copies of certificates for welding procedure specifications (WPS) and personnel.
- I. Qualification Data for fabricator, erector, and professional engineer: List of completed projects with project names and addresses, names and addresses of COR and owners, and PCI Certification documentation.
- J. Testing laboratory accreditations.
- K. Material Test Reports: From an accredited testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Concrete strengths and mix designs.
- L. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
 - 1. Cementitious materials.
 - 2. Reinforcing materials and prestressing tendons.
 - 3. Admixtures.
 - 4. Bearing pads.
 - 5. Structural-steel shapes and hollow structural sections.
 - 6. Insulation
 - 7. Facing units.
 - 8. Anchors.
- M. Certificate of Compliance.
- N. Erectors Post Audit Declaration.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Comply with product handling requirements of PCI MNL 117 at the plant and project site.
- B. Deliver all units to the project site in such quantities and at such times to assure compliance with the agreed project schedule and proper setting sequence so as to limit unloading units temporarily on the ground.
- C. Lift and support units only at designated points shown on the shop drawings.
- D. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

E. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil to prevent staining, and to prevent cracking, distortion, warping, and other physical damage. Place stored units so identification marks are clearly visible for inspection.

1.8 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

1.9 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International (ASTM):

- A27/A27M-20Standard Specification for Steel Castings, Carbon, for General Application
- A36/A36M-19Standard Specification for Carbon Structural Steel
- A47/A47M-99(2018)e1Standard Specification for Ferritic Malleable Iron Castings
- A108-18Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- A123/A123M-17Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- A153/A153M-16aStandard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- A184/A184M-19Standard Specification for Welded Deformed Steel Bar mats for Concrete Reinforcement
- A240/A240M-20.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and For General Applications
- A276/A276M-17Standard Specification for Stainless Steel Bars and Shapes
- A283/A283M-18Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
- A307-14e1Standard Specifications for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
- A416/A416M-18Standard Specification for Low-relation, Seven-Wire Steel Strand for Prestressed Concrete
- A500/A500M-20Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

A563-15Standard Specification for Carbon and Alloy Steel
Nuts

A563M-07 (R2013)Carbon and Alloy Steel Nuts (Metric)

A572/A572M-18Standard Specification for High-Strength Low-Alloy
Columbium-Vanadium Structural Steel

A615/A615M-20Standard Specification for Deformed and Plain
Carbon Steel Bars for Concrete Reinforcement

A666-15Standard Specification for Annealed or Cold-Worked
Austenitic Stainless Steel Sheet, Strip, Plate,
and Flat Bar

A675/A675M-14 (2019)Standard Specification for Steel Bars, Carbon,
Hot-Wrought, Special Quality, Mechanical
Properties

A706/A706M-16Standard Specification for Deformed and Plain Low-
Alloy Steel Bars for Concrete Reinforcement

A767/A767M-19Standard Specification for Zinc Coated
(Galvanized) Steel Bars for Concrete Reinforcement

A775/A775M-19Standard Specification for Epoxy Coated Steel
Reinforcing Bars

A780/A780M-20Standard Practice for Repair of Damaged and
Uncoated Areas of Hot-Dip Galvanized Coatings

A884/A884M-19Standard Specification for Epoxy-Coated Steel Wire
and Welded Wire Fabric for Reinforcement

A934/A934M-19Standard Specification for Epoxy-Coated
Prefabricated Steel Reinforcing Bars

A1064/A1064M-18aStandard Specification for Carbon-Steel Wire and
Welded Wire Reinforcement, Plain and Deformed, for
Concrete

B633-19Standard Specification for Electrodeposited
Coatings of Zinc on Iron and Steel

C33/C33M-18Standard Specification for Concrete Aggregates

C40/C40M-20Standard Test Method for Organic Impurities in
Fine Aggregate for Concrete

C144-18Standard Specification for Aggregate for Masonry
Mortar

C150/C150M-20Standard Specification for Portland Cement

C260/C260M-10a (2016) ...Standard Specification for Air Entraining
Admixtures for Concrete

C330/C330M-17aStandard Specification for Lightweight Aggregates
for Structural Concrete

C373-18Standard Test Methods for Determination of Water
Absorption and Associated Properties by Vacuum
method for Pressed Ceramic Tiles and Glass Tiles
and Boil Method for Extruded Ceramic Tiles and
Non-tile Fired ceramic Whiteware Products

C494/C494M-19Standard Specification for Chemical Admixtures for
Concrete

C618-19Standard Specification for Coal Fly Ash and Raw or
Calcined Natural Pozzolan for Use in Concrete

C881/C881M-20Standard Specification for Epoxy Resin Base
Bonding Systems for Concrete

C920-18Standard Specification for Elastomeric Joint
Sealants

C979/C979M-16Standard Specification for Pigments for Integrally
Colored Concrete

C989/C989M-18aStandard Specification for Slag Cement for Use in
Concrete and Mortars.

C1017/C1017M-13e1Standard Specification for Chemical Admixtures for
Use in Producing Flowing Concrete

C1107/1107M-20Standard Specification for Packaged Dry,
Hydraulic-Cement Grout (Non-shrink)

C1218/C1218M-20Standard Test Method for Water-Soluble Chloride in
Mortar and Concrete

C1240-20Standard Specification for Silica Fume Used in
Cementitious Mixtures

C1354/C1354M-15Standard Test Method for Strength of Individual
Stone Anchorages in Dimension Stone

D412-16Standard Test Methods for Vulcanized Rubber and
Thermoplastic Elastomers - Tension

D2240-15e1Standard Test Method for Rubber Property—Durometer
Hardness

D4397-16Standard Specification for Polyethylene Sheeting
for Construction, Industrial, and Agricultural
Applications

E165/E165M-18Standard Practice for Liquid Penetrant Testing for
General Industry

- E488/E488M-18Standard Test Methods for Strength of Anchors in
Concrete Elements
- E709-15Standard Guide for Magnetic Particle Testing
- F436/F436M-19Standard Specification for Hardened Steel Washers,
Inch and Metric Dimensions
- F593-17Standard Specification for Stainless Steel Bolts,
Hex Cap Screws, and Studs
- F844-07a(R2013)Standard Specification for Washers, Steel, Plain
(Flat), Unhardened for General Use
- F3125/F3125M-19e1Standard Specification for High Strength
Structural Bolts, Steel and Alloy Steel, Heat
Treated, 120ksi (830MPa) and 150ksi (1040MPa)
Minimum Tensile Strength, Inch and Meter
Dimensions
- C. American Concrete Institute (ACI):
- 211.1-91(R2009)Standard Practice for Selecting Proportions for
Normal, Heavyweight, and Mass Concrete
- 211.2-98(R2004)Standard Practice for Selecting Proportions for
Structural Lightweight Concrete
- 318/318R-19Building Code Requirements for Structural
Concrete and Commentary
- D. American Association of State Highway and Transportation Officials
(AASHTO):
- AASHTO LRFD-2017LRFD Bridge Design Specifications, U.S., 8th
Edition
- AASHTO M251-06Elastomeric Bearings
- E. American Welding Society (AWS):
- C5.4-93Recommended Practices for Stud Welding
- D1.1/D1.1M-20Structural Welding Code - Steel
- D1.4-18Structural Welding Code - Steel Reinforcing Bars
- F. American National Standards Institute (ANSI):
- A108/A118/A136-19Installation of Ceramic Tile
- A137.1-19Ceramic Tile
- G. Precast/Prestressed Concrete Institute (PCI):
- Architectural Precast Concrete - Color and Texture Selection Guide
- MNL-117-13Quality Control for Plants and Production of
Architectural Precast Concrete Products
- MNL-120-17Design Handbook - Precast and Prestressed Concrete
- MNL-122-07Architectural Precast Concrete

MNL-124-11Design for Fire Resistance of Precast Prestressed Concrete

MNL-127-99Erector’s Manual - Standards and Guidelines for the Erection of Precast Concrete Products

MNL-135-00Tolerance Manual for Precast and Prestressed Concrete Construction

TR-6-15-EGuidelines For The Use of Self-Consolidating Concrete In Precast/Prestressed Concrete

H. Military Specifications (MIL. Spec):

MIL-C882E-89Cloth, Duck, Cotton or Cotton-Polyester Blend Synthetic Rubber, Impregnated, and Laminated, Oil Resistant

I. Department of Veterans Affairs:

Physical Security Design Manual for VA Mission Critical Facilities-January 2015

PART 2 - PRODUCTS

A. As submitted and approved by Architect and Structural Engineer.

2.2 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; non-reactive with concrete and suitable for producing required finishes:

1. Mold-Release Agent: Commercially produced form-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.3 REINFORCING MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (Grade 420), deformed.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

C. Weldable Reinforcing Bars: ASTM A706/A706M, deformed.

1. Steel Bar Mats: ASTM A184/A184M, assembled with clips.

a. Plain-Steel Welded Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.

b. Deformed-Steel Welded Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening

reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or III.
 - 1. Standard gray Portland cement may be used for non-exposed backup concrete.
- B. Supplementary Cementitious Materials for unexposed surfaces (backup concrete) only.
 - 1. Fly Ash Admixture: ASTM C618, Class C or F with maximum loss on ignition of 3 percent.
 - 2. Metakaolin Admixture: ASTM C618, Class N.
 - 3. Silica Fume Admixture: ASTM C1240 with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33/C33M, with coarse aggregates complying with Class 5S. Provide and stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for entire project.
 - 1. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - a. Gradation: To match design reference sample .
 - b. Hard durable aggregate carefully graded from coarse to fine in proportions required to match approved samples.
 - c. Eliminate off color material from exposed aggregate.
 - 2. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by COR.
 - a. Test sand for color value in accordance with ASTM C40/C40M. Sand producing darker than specified color standard is unacceptable.
 - b. Clean washed white sand.
 - c. Special fine aggregate produced by crushing exposed coarse aggregate used for finish as specified .
- D. Unexposed Surface (Backup) Concrete Aggregates: ASTM C33/C33M or ASTM C330/C330M .
- E. Admixtures: Admixtures containing calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture are not permitted.

1. Coloring Admixture: ASTM C979/C979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable and non-fading.
 2. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 3. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 4. Retarding Admixture: ASTM C494/C494M, Type B.
 5. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 8. Plasticizing Admixture for Flowable Concrete: ASTM C1017/C1017M.
- F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A36/A36M except silicon (Si) content in the range of 0 to 0.03percent or 0.15 to 0.25 percent for materials to be galvanized. Steel with chemistry conforming to the formula $Si + 2.5P \leq 0.09$ is also acceptable.
- B. Carbon-Steel Headed Studs: ASTM A108, Grades 1018 through 1020, cold finished and bearing the minimum mechanical properties for studs as indicated under PCI MNL 117, Table 3.2.3.
 1. Make welds in accordance with AWS D1.1/D1.1M, Type A or B, with arc shields.
- C. Carbon-Steel Plate: ASTM A283/A283M.
- D. Malleable Iron Castings: ASTM A47/A47M. Grade 32510.
- E. Carbon-Steel Castings: ASTM A27/A27M, Grade U-60-30 (Grade 415-205).
- F. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M except silicon (Si) content in the range of 0 to 0.03 or 0.15 to 0.25 percent for materials to be galvanized. Steel with chemistry conforming to the formula $Si + 2.5P \leq 0.09$ is also acceptable.
- G. Carbon-Steel Structural Tubing: ASTM A500/A500M, Grade B.
- H. Wrought Carbon-Steel Bars: ASTM A675/A675M, Grade 65 (Grade 450).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A1064/A1064M or ASTM A706/A706M.
- J. Carbon-Steel Bolts and Studs: ASTM A307, Grade A, carbon-steel, hex-head bolts and studs; carbon-steel nuts ASTM A563M (A563), Grade A; and flat, unhardened steel washers complying with ASTM F844.

- K. High-Strength Bolts and Nuts: ASTM F3125/F3125M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, complying with ASTM A563M (A563) and hardened carbon-steel washers complying with ASTM F436M (F436).
- L. Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123/A123M, after fabrication, or ASTM A153/A153M, as applicable.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint with minimum 2 mils (0.002 inch) dry film containing not less than 94 percent zinc dust by weight, and complying with SSPC-Paint 20.
- M. Welding Electrodes: Provide materials that comply with requirements of AWS D1.1/D1.1M. Submit product data on welding electrodes and rods.

2.6 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless steel washers. Lubricate threaded parts of stainless steel bolts with an anti-seize thread lubricant during assembly.
- C. Stainless-Steel Headed Studs: ASTM A276 and bearing the minimum mechanical properties for studs as indicated under PCI MNL 117, Table 3.2.3.

2.7 BEARING PADS AND OTHER ACCESSORIES

- A. Provide bearing pads for units as follows:
 - 1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D2240, minimum tensile strength 15.5 MPa (2250 psi) per ASTM D412.
 - 2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D2240. Capable of supporting a compressive stress of 20.7 MPa (3000 psi) with no cracking, splitting or delaminating in the internal portions of the pad. Test one specimen for each 200 pads used in the project. Submit test results.
 - 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer according to ASTM D2240. Conforming to Division II, Section 18.10.2 of AASHTO LRFD, or MIL-C-882E.

4. Frictionless Pads: Tetrafluoroethylene (teflon), glass-fiber reinforced, bonded to stainless or mild-steel plates, of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.
- B. Reglets: Stainless steel, ASTM A240/A240M, Type 302 felt or fiber filled or cover face opening of slots.
- C. Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install units.

2.8 GROUT MATERIALS

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

2.9 CLAY PRODUCT UNITS AND ACCESSORIES

- A. Thin Brick Units: PCI Standard 13 mm (1/2 inch) thick, with an overall tolerance of plus 0 mm, minus 1.6 mm (+0 inch, -1/16 inch) for any unit dimension 203 mm (8 inch) or less and an overall tolerance of plus 0 mm, minus 2.4 mm (+0 inch, -3/32 inch) for any unit dimension greater than 203 mm (8 inch) measured according to ASTM C67.
 1. Face Size: Modular, 57 mm (2-1/4 inch) high by 190 mm (7-5/8 inch) long.
 2. Face Color, and Texture: 70% Granite Red and 30% Plum, Colonial texture as manufactured by Sioux City Brick.
 3. Special Shapes: Include corners, edge corners, and end edge corners.
 4. Cold Water Absorption at 24 Hours: Maximum 6 percent when tested per ASTM C67.
 5. Efflorescence: Tested according to ASTM C67 and rated "not effloresced."
 6. Out of Square: Plus or minus 1.6 mm (1/16 inch) measured according to ASTM C67.
 7. Warpage: Consistent plane of plus 0 mm, minus 1.6 mm (+0, -1/16 inch).

8. Variation of Shape from Specified Angle: Plus or minus 1 degree.
 9. Tensile Bond Strength: Not less than 1.0 MPa (150 psi) when tested per modified ASTM E488/E488M. Epoxy steel plate with welded rod on a single brick face for each test.
 10. Freezing the Thawing Resistance: No detectable deterioration (spalling, cracking, or chafing) when tested in accordance with ASTM C666/C666M Method B.
 11. Modulus of Rupture: Not less than 1.7 MPa (250 psi) when tested in accordance with ASTM C67.
 12. Chemical Resistance: Provide brick that has been tested according to ASTM C650 and rated "not affected."
 13. Surface Coloring: Provide brick with surface coloring to withstand 50 cycles of freezing and thawing per ASTM C67 with no observable difference in.
 14. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.
- B. Sand-Cement Mortar: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144. Mix at ratio at 1 part cement to 4 parts sand, by volume, with minimum water required for placement.
- C. Latex-Portland Cement Pointing Grout: ANSI A108/A118/A136 and as follows:
1. Dry-grout mixture, factory prepared, of Portland cement, graded aggregate, and dry, redispersible, ethylene-vinyl-acetate additive for mixing with water; uniformly colored.
 2. Commercial Portland cement grout, factory prepared, with liquid styrene-butadiene rubber or acrylic-resin latex additive; uniformly colored.
 3. Color: As selected by Architect from manufacturers standard colrs. //

2.10 CONCRETE MIXES

- A. Prepare design mixes to match COR's sample for each type of concrete required.
1. Limit use of fly ash and granulated blast-furnace slag to 20 percent replacement of Portland cement by weight; metakaolin and silica fume to 10 percent of Portland cement by weight.
- B. Provide design mixes prepared by a qualified independent testing agency or by qualified precast plant personnel at fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318/318M or PCI MNL 117 when tested in accordance with ASTM C1218/C1218M.

- D. Normal Weight Concrete Face and Backup Mixtures: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 34.5 MPa (5000 psi).
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Release strength as required by design.
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content as follows.
- G. Total air content for various sizes of coarse aggregate for normal weight concrete.

Total Air Content, Percent, by Volume		
Nominal Maximum Size of Aggregate mm (inch)	Severe Exposure	Moderate Exposure
Less than 9 (3/8)	9	7
9 (3/8)	7-1/2	6
13 (1/2)	7	5-1/2
19 (3/4)	6	5
25 (1)	6	5
38 (1-1/2)	5-1/2	4-1/2

- H. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 MOLD FABRICATION

- A. Molds: Construct and maintain molds, mortar tight, within fabrication tolerances and of sufficient strength to withstand pressures due to concrete-placement, vibration operations, and temperature changes and for prestressing and detensioning operations.
1. Form joints are not acceptable on faces exposed to view in the finished work.
 2. Edge and Corner Treatment: Uniformly chamfered .

3.2 THIN BRICK FACINGS

- A. Place form liner templates accurately to provide grid for brick facings. Provide solid backing and supports to maintain stability of liners while placing bricks and during concrete placement.

- B. Match appearance of sample panel(s).
- C. Securely place brick units face down into form liner pockets and place concrete backing mixture.
- D. After stripping units, clean faces and joints of brick facing.

3.3 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware:
Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Position anchors for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4.
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing units to supporting and adjacent construction.
- C. Provide cast-in reglets, slots, holes, and other accessories in units as indicated on contract documents.
- D. Provide cast-in openings larger than 254 mm (10 inches) in any dimension. Do not drill or cut openings or reinforcing without approval of COR.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabrication, placing, and supporting reinforcement.
 - 1. Place reinforcing steel and prestressing strand to maintain at least 19 mm (3/4 inch) minimum concrete cover. Increase cover requirements for reinforcing steel to 38 mm (1-1/2 inches) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete.
 - 2. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one (1) full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
 - 3. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A775/A775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 4. Accurately position, support, and secure reinforcement against displacement during concrete- placement and consolidation operations.

Completely conceal support devices to prevent exposure on finished surfaces.

- F. Mix concrete according to PCI MNL 117 and requirements in PART 2. After concrete batching, no additional water may be added.
 - 1. At the fabricator's option either of the following mix design/casting techniques may be used:
 - a. A single design mix throughout the entire thickness of panel.
 - b. Design mixes for facing and backup; using cement and aggregates for each type as indicated, for consecutive placement in the mold. Use cement and aggregate specified for facing mix, use cement and aggregate for backup mix complying with criteria specified as selected by the fabricator.
- G. Place concrete in a continuous operation. Comply with requirements in PCI MNL 117.
 - 1. Place backup concrete to ensure bond with face mix concrete.
 - 2. Place self-consolidating concrete without vibration in accordance with PCI TR-6.
- H. Identify pickup points of units and orientation in structure with permanent markings, complying with markings indicated on shop drawings. Imprint or permanently mark casting date on each unit on a surface that will not show in finished structure.
- I. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat accelerated heat curing using low-pressure live steam.
- J. Repair damaged units to meet acceptability requirements of PCI MNL 117 and the COR.
- K. Reinforce architectural precast concrete units to resist handling, transportation and erection stresses, and specified in-place loads, whichever governs.
- L. Comply with requirements in PCI MNL 117 and requirements in this section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- M. Place face mixture to a minimum thickness after consolidation of the greater of 25 mm (1 inch) or 1.5 times the nominal maximum aggregate size, but not less than the minimum reinforcing cover of 38 mm (1-1/2 inches).
 - 1. Use a single design mixture for those units in which more than one major face (edge) is exposed.
 - 2. Where only one (1) face of unit is exposed, at the fabricator's option, either of the following mixture design/casting techniques may be used:

- a. A single design mix throughout the entire thickness of panel.
 - b. Separate mixtures for face and backup concrete; using cement and aggregates for each type as appropriate, for consecutive placement in the mold. Use cement and aggregate specified for face mixture. Use cement and aggregate for backup mixture complying with specified criteria or as selected by the fabricator.
- N. Thoroughly consolidate placed concrete by internal or external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
1. Place self-consolidating concrete without vibration in accordance with PCI TR-6.
- O. Comply with PCI MNL 117 procedures for hot- and cold-weather concrete placement.

3.4 FABRICATION TOLERANCES

- A. Fabricate units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
1. Additional Position Tolerances: For cast-in items measured from datum line location, as indicated on shop drawings.
 - a. Location of Bearing Surface from End of Member: Plus or Minus 6 mm (1/4 inch).
 - b. Position of Sleeve: Plus or Minus 13 mm (1/2 inch).
- B. Fabricate architectural trim units such as sills, lintels, coping, cornices, quoins, medallions, bollards, benches, planters, and pavers, with tolerances meeting PCI MNL 135.
- C. Brick-Faced Architectural Precast Concrete Units.
1. Alignment of mortar joints:
 - a. Jog in Alignment: 3 mm (1/8 inch).
 - b. Alignment with Panel Centerline: Plus or Minus 3 mm (1/8 inch).
 2. Variation in Width of Exposed Mortar Joints: Plus or Minus 6 mm (1/4 inch).
 3. Tipping of Individual Bricks from the Panel Plane of Exposed Brick Surface: Plus 1.5 mm (1/16 inch); Minus 6 mm (1/4 inch) \leq depth of form liner joint.
 4. Exposed Brick Surface Parallel to Primary Control Surface of Panel: Plus 6 mm (1/4 inch); Minus 3 mm (1/8 inch).

5. Individual Brick Step in Face from Panel Plane of Exposed Brick
Surface: Plus 1.5 mm (1/16 inch); Minus 6 mm (1/4 inch) \leq depth of form
liner joint.

3.5 FINISHES

- A. Provide exposed panel faces free of joint marks, grain, and other obvious defects. Corners, including false joints to be uniform, straight and sharp. Finish exposed-face surfaces of units to match approved mockups and as follows:
 1. PCI's "Architectural Precast Concrete -Color and Texture Selection Guide," of plate numbers indicated.
 2. As-Cast Surface Finish: Provide surfaces free of excessive air voids, sand streaks, and honeycombs.
 3. Exposed Aggregate Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
 4. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 5. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections and insulation from acid attack.
- B. Finish exposed top, bottom, and back surfaces of units to match face-surface finish.
- C. Finish unexposed surfaces top, bottom, and back of units by smooth steel-trowel finish.
- D. Finish unexposed surfaces of units by float finish.

3.6 ERECTION PREPARATION

- A. Deliver anchorage devices that are embedded in or attached to the building structural frame or foundation before start of such work. Furnish locations, setting diagrams, and templates for the proper installation of each anchorage device.
- B. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install units until supporting cast-in-place concrete building structural framing has attained minimum allowable design strength

supporting steel or other structure is structurally ready to receive loads from precast.

3.7 ERECTION

- A. Erect units level, plumb and square within the specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
 - 4. Unless otherwise shown provide for uniform joint widths of 25 mm (1 inch).
- B. Connect units in position by bolting, welding, grouting, or as otherwise indicated on approved Erection Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting or grouting are completed.
 - 1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
 - 2. Welding: Comply with and AWS D1.1/D1.1M and AWS D1.4/1.4M requirements for welding, welding electrodes, appearance of welds, and methods used in connecting welding work.
 - a. Protect units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 - b. When welds are not specified, provide continuous fillet welds, using not less than the minimum fillet as specified by AWS.
 - c. Clean weld affected metal surfaces and apply a minimum 2 mils (0.002 inch) dry thickness coat of galvanized repair paint to galvanized surfaces in conformance with ASTM A780/A780M.
 - d. Visually inspect welds critical to precast connections. Visually check welds for completion and remove, reweld or repair defective welds.
 - 3. At bolted connections, provide lock washers, tack welding, or other acceptable means to prevent loosening of nuts after final adjustment.

- a. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connection apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
4. Grouting Connections: Grout connections where required or indicated on shop (erection drawings). Retain flowable grout in place until strong enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
- C. Attachments: Upon approval of COR, precast pre-stressed products may be drilled or "shot" for fasteners or small openings, provided reinforcing or pre-stressing steel is not damaged or cut.
 1. Should spalling occur, repair according to this specification section.
- D. Pointing: Wash and brush clean, leaving joints free from loose mortar, dust and other foreign material.
 1. Carefully point with a slightly concave joint.
- E. Sealing of Joints: Where shown and where required to make work watertight: clean, dry and seal joints between precast concrete elements and between precast elements and adjoining materials as specified in Section 07 92 00, JOINT SEALANTS.

3.8 ERECTION TOLERANCES

- A. Erect units level, plumb, square, true, and in alignment without exceeding the erection tolerances of PCI MNL 117, Appendix I.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor engaged qualified testing agency approved by COR is to perform tests and inspections and prepare test reports.
- B. Visually inspect field welds and test according to ASTM E165 or to ASTM E709.
- C. Report test results directly from testing agency within 5 days after testing and in writing to Contractor and COR.
- D. As directed by COR, repair, or remove and replace work that does not comply with specified requirements.
- E. Perform additional testing and inspecting, at no additional cost, to determine compliance of corrected work with specified requirements.

3.10 REPAIRS

- A. When permitted by COR, repair damaged units.

- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 6.1 m (20 feet).
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780/A780M.
- D. Remove and replace damaged units when repairs do not meet requirements.
- E. Repair damaged units to meet acceptability of PCI MNL 117.
- F. Wire brush, clean, and paint damaged prime painted components with the same type of shop primer.

3.11 CLEANING:

- A. Clean surfaces of precast concrete to be exposed to view, as necessary, prior to shipping.
- B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

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SECTION 03 63 36
HELICAL PILES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnishing helical steel piles of specified size; installation of same by experienced/qualified contractor.
- B. Coordinating installation of helical piles with other contractors and installation of complementing systems/construction.

1.2 RELATED WORK

- A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction.
- B. 31 00 00 - Earthwork

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Shop Drawings: Shop drawings and specifications for the helical piles and helical anchors intended for use on the project. The shop drawings shall include the following:
 - 1. Helical pile and helical anchor product identification number(s) and designation(s)
 - 2. Maximum allowable mechanical compression and tensile strength of the helical piles and helical anchors
 - 3. Number of helical piles and helical anchors and respective design allowable capacities from the drawings
 - 4. Planned installation depth and the number of lead and extension sections
 - 5. Preliminary helical configuration (number and diameter of helical bearing plates)
 - 6. Manufacturer's recommended capacity to installation torque ratio
 - 7. Minimum final installation torque(s)
 - 8. Product identification numbers and designations for all bracket assemblies and number and size of connection bolts or concrete reinforcing steel detail
 - 9. Corrosion protection coating on helical piles, helical anchors, and bracket assemblies

C. Contractor shall submit to the engineer calibration information certified by an independent testing agency for the torque measurement device and all load testing and monitoring equipment to be used on the project. Calibration information shall have been tested within the last year of the date submitted. Calibration information shall include, but is not limited to, the name of the testing agency, identification number or serial number of device calibrated, and the date of calibration.

1.4 QUALITY ASSURANCE

- A. Utilize equipment of proper size and in good working condition to prosecute the work to full completion in a satisfactory manner.
- B. Utilize experience personnel familiar with the equipment, methods and procedures for the design and installation of the job. The contractor must have satisfied the certification requirements related to the technical aspects of helical pile materials and installation. Proof of certification shall be provided to COR upon request.

1.5 APPLICABLE PUBLICATIONS:

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36 structural steel
 - 2. ASTM A123-02 standard specification for zinc (hot-dip galvanized) coatings on iron and steel products
 - 3. ASTM A153-05 standard specification for zinc coating (hot dip) on iron and steel hardware
 - 4. ASTM A450-07 standard specification for general requirements for carbon and low alloy steel tubes
- B. Occupational Safety and Health Administration (OSHA):
 - 1. Excavation safety guidelines
- C. ICC-evaluation services, Inc:
 - 1. AC308 acceptance criteria for helical foundation systems and devices
- D. American welding society
 - 1. ANSI AWS B2.1-00 standard for welding procedure and performance qualification

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The helical lead sections and extensions shall be manufactured by the A.B. Chance Co., Centralia, Missouri or Magnum Piering, Inc, West Chester, Ohio, or approved equal.

- B. Unless noted otherwise, it is the contractor's pile design professional's responsibility to select the appropriate size and type of helical piles, helical anchors, and brackets to support the design loads and deflection requirements shown on the drawings. These specifications and the drawings provide minimum requirements to aid the contractor in making appropriate materials selections. The size and number of helical bearing plates must be such that the helical piles and helical anchors achieve the appropriate torque and capacity in the soils at the site within the minimum and maximum length requirements. Failure to achieve proper torque and capacity shall result in contractor replacing helical piles and helical anchors as appropriate to support the required loads. All material replacements shall be acceptable to COR.
- C. All units shall conform to the material specifications as follows:
1. Shaft material:
 - a. The central shaft shall consist of a high strength structural steel tube meeting the requirements of ASTM A450.
 2. Round shafts only may be used for main support piles. Minimum diameter = 2 7/8".
 3. Helices: high strength, strength, low-alloy material formed on matching metal dies to true helical shape.
 4. Bolts: bolt holes through the external sleeve and central shaft shall have a diameter that is 1/16th inch greater than the bolt diameter. Bolts and nuts used to join helical pile and helical anchor sections at the shaft connections shall be epoxy coated, or zinc coated to match the corrosion protection used for the central shaft. All helical pile and helical anchor bolts shall be securely snug tightened.
 5. Brackets in accordance with manufacturer design selection to accommodate loading shown on drawings.
 6. Welding: all welding shall be in accordance with AWS D1.1, latest revisions.
 - a. All welders shall be AWS certified.
 7. Finish galvanized: in accordance with ASTM A153.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify and understand all site conditions and seasonal execution restraints according to the Plans and Specifications.

3.2 INSTALLATION EQUIPMENT

A. Installing units:

1. Installation units shall consist of a rotary type, torque motor with forward and reverse capabilities. These units shall be either electrically or hydraulically powered.
2. These units shall be capable of developing the minimum torque as required by the project.
3. These units shall be capable of positioning the helical pile at the proper installation angle. This angle varies between 0 (vertical) to 90 degrees depending upon application and type foundation termination specified.
4. These units shall be in good working condition and capable of being operated in a safe manner.
5. Installation tooling adapters approved by A/E shall be employed to safely connect the installation units to the helical piles and extensions.
6. These adapters shall have a torque capacity rating at least equal to the maximum torque rating of the helical piles as specified for the project.
7. These adapters shall be securely connected to the helical pile during installation so as to prevent accidental separation.
8. Torque monitoring devices measuring the torque being applied by the installing units shall be used and output recorded throughout the installation process.
9. Torque monitoring devices shall be either a part of the installing unit or an independent device in line with the installing unit. Calibration data for either unit shall be available for review by the owner or their representative.

3.3 INSTALLATION PROCEDURES

- A. The helical pile shall be positioned as shown on the Drawings. Proper angular alignment shall be established at the start of installation.
- B. The helical pile shall be installed in a smooth, continuous manner. The rate of pile rotation shall be in the range of 5 to 40 revolutions per minutes.
- C. Sufficient down pressure shall be applied to advance the pile.
- D. Plain extension material may be required to position the pile at the depth required by the Contract Drawings. Extensions shall be coupled to the helical pile using high strength bolts.

- E. Installation torque shall be monitored throughout the installation process.
- F. If underground obstructions are encountered during, the contractor option of removing the obstruction if possible or relocating the helical pile. This latter option may require the relocation of adjacent piles.
- G. Helical piles shall be installed to the minimum torque value averaged over the last 3 feet as shown on the approved drawings.
- H. The maximum installation torque shall at no time exceed the torque rating of the helical pile shaft as specified for the project.
- I. The minimum depth of installation shall be shown on the supplier's approved submittal drawings. Plan provided the top helix is located at least five (5) feet below the surface. If the installer cannot achieve this depth the COR should be contacted before proceeding further.
- J. The pile installation shall be terminated provided the minimum installation torque and minimum depth requirements have both been satisfied.
 - 1. If the minimum torque requirements have not been satisfied at the minimum depth level, the contractor will have the following options:
 - a. Install the pile deeper using additional plain extension material until the specified torque level is obtained.
 - b. Remove the existing pile and install a pile with larger and/or more helices. This revised pile shall be installed at least three (3) feet beyond the termination depth of the original pile.
 - c. Add additional piles as recommended by the COR.
 - 2. If the maximum torque rating of the pile and/or installing unit has been reached prior to satisfying the minimum depth requirements, the contractor has the following options.
 - a. Terminate the installation at the depth obtained with the approval of the COR.
 - b. Remove the existing pile and install a pile with smaller and/or fewer helices. The revised pile shall be installed at least three (3) feet beyond the termination depth of the original pile.
 - 3. Connection bracket: the helical pile shall be connected to the structure using the manufacturer's device as shown on the supplier's approved submittal drawings.
 - 4. This connection device shall be capable of safely transferring the structural loads to the helical pile.

3.4 TESTING

- A. The axial load capacity of the piles shall be verified by torque values indicated on the calculations and drawings providing an ultimate capacity of two times the required loading (safety factor=2). The ultimate capacity is shown on the drawings.

3.5 INSTALLATION TOLLERANCE

- A. Vertical piles shall be installed plumb, to the extent practicable. Diagonal brace piles shall be installed at the angle indicated on the plans, to the extent practicable. Any pile that cannot be installed as above due an encountered obstruction during installation must be approved by the inspector in the field.
- B. The pile head shall be within the following tolerances from the X,Y and elevations indicated on the plans:
 - 1. Horizontal: 0.1-feet.
 - 2. Vertical: 0.05-feet.

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Structural steel shapes, plates, and bars.
 2. Structural pipe.
 3. Bolts, nuts, and washers.

1.2 RELATED REQUIREMENTS

- A. Materials Testing And Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Steel Joist: Section 05 21 00, STEEL JOIST FRAMING.
- C. Steel Decking: Section 05 31 00, STEEL DECKING.
- D. Composite Steel Deck: Section 05 36 00, COMPOSITE METAL DECKING.
- E. Steel Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- F. Painting: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Institute of Steel Construction (AISC):
1. AISC Manual - Steel Construction Manual, 14th Ed.
 2. 303-10 - Code of Structural Steel Buildings and Bridges.
 3. 360-10: Specification for Structural Steel Buildings.
- C. The American Society of Mechanical Engineers (ASME):
1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.
- D. American Welding Society (AWS):
1. D1.1/D1.1M-15 - Structural Welding Code - Steel.
- E. ASTM International (ASTM):
1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 2. A36/A36M-14 - Carbon Structural Steel.
 3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
 4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.

6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
 7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 8. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
 9. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
 10. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 11. A992/A992M-15 - Structural Shapes.
 12. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
 13. F3125/F3125M-15 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions
- F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.
- G. Military Specifications (Mil. Spec.):
1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.
- H. Occupational Safety and Health Administration (OSHA):
1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
 2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.
- I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
1. Specification for Structural Joints Using ASTM F3125 Bolts.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 1. Show size, configuration, and fabrication and installation details.
- C. Sustainable Construction Submittals:
 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- D. Test Reports: Certify products comply with specifications.

1. Welders' qualifying tests.
- E. Certificates: Certify each product complies with specifications.
 1. Structural steel.
 2. Steel connections.
 3. Welding materials.
 4. Shop coat primer paint.
- F. Qualifications: Substantiate qualifications comply with specifications.
 1. Fabricator with project experience list.
 2. Installer with project experience list.
 3. Welders and welding procedures.
- G. Delegated Design Drawings and Calculations: Signed and sealed by responsible Architect/Engineer.
 1. Connection calculations.
- H. Record Surveys: Signed and sealed by responsible surveyor or engineer.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
 1. Regularly fabricates specified products.
 2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
- B. Installer Qualifications: AISC Quality Certification Program participant designated as AISC-Certified Erector, Category ACSE.
 1. Regularly installs specified products.
 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
- C. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.
- D. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

1.6 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS**2.1 SYSTEM PERFORMANCE**

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located.
- B. Design structural steel framing connections complying with specified performance:
 - 1. Load Capacity: Resist loads indicated on drawings. Account for connection and member loads and eccentricities.
 - a. Request additional design criteria when necessary to complete connection design.
 - 2. Configuration: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with details shown on drawings, supplementing where necessary. The details shown on drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the Contracting Officer Representative of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the Contracting Officer's Representative. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

2.2 MATERIALS

- A. W-Shapes:
 - 1. ASTM A992/A992M.
- B. Channel and Angles:
 - 1. ASTM A36/A36M.
- C. Plates and Bars:
 - 1. ASTM A36/A36M.
 - 2. ASTM A572/A572M; Grade 50.
- D. Hollow Structural Sections:
 - 1. ASTM A500/A500M.

- E. Bolts, Nuts and Washers: Galvanized for galvanized framing and plain finish for other framing.
 - 1. High-strength bolts, including nuts and washers: ASTM F3125.
 - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
 - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ASME B18.22.1.
- F. Welding Materials: AWS D1.1, type to suit application.

2.3 PRODUCTS - GENERAL

- A. Sustainable Construction Requirements:
 - 1. Steel Recycled Content: 30 percent total recycled content, minimum.
 - 2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Paints and coatings.

2.4 FABRICATION

- A. Fabricate structural steel according to Chapter M, AISC 360.
- B. Shop and Field Connections:
 - 1. Weld connections according to AWS D1.1/D1.1M. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
 - 2. High-Strength Bolts: High-strength bolts tightened to a bolt tension minimum 70 percent of their minimum tensile strength. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

2.5 FINISHES

- A. Shop Priming:
 - 1. Prime paint structural steel according to AISC 303, Section 6.
 - a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.
- B. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.
- C. Do not paint:
 - 1. Surfaces within 50 mm (2 inches) of field welded joints.

2. Surfaces indicated to be encased in concrete.
 3. Surfaces receiving sprayed on fireproofing.
 4. Beam top flanges receiving shear connector studs applied.
- D. Structural Steel Galvanizing: ASTM A123/A123M, hot dipped, after fabrication. Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.
1. Galvanize structural steel framing installed at exterior locations.
- E. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

2.6 ACCESSORIES

- A. General: Shop paint steel according to AISC 303, Section 6.
- B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.
- C. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect structural steel according to AISC 303 and AISC 360.
- B. Set structural steel accurately at locations and elevations indicated on drawings.
- C. Maintain erection tolerances of structural steel within AISC 303 requirements.
 1. Pour Stop Elevation Tolerance: 6 mm (1/4 inch), maximum, before concrete placement.
- D. Weld and bolt connections as specified for shop connections.

3.2 FIELD PAINTING

- A. After welding, clean and prime weld areas to match adjacent finish.
- B. Touch-up primer damaged by construction operations.
- C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.
- D. Finish Painting: As specified in Section 09 91 00, PAINTING.

3.3 FIELD QUALITY CONTROL

- A. Record Survey:
 1. Engage registered land surveyor or registered civil engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS to perform survey.

2. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.
3. Identify deviations from allowable tolerances specified in AISC Manual.

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**SECTION 05 21 00
STEEL JOIST FRAMING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies open web, longspan, and deep longspan steel joists.

1.2 RELATED WORK:

- A. Structural Steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Finish Painting: Section 09 91 00, PAINTING.

1.3 DESIGN REQUIREMENTS:

Design all elements with the latest published version of applicable Codes.

1.3 TOLERANCES:

Deviation from a straight line between ends of any installed joist shall not exceed 10 mm in 3 m (3/8 inch in 10 feet).

1.4 REGULATORY REQUIREMENTS:

STEEL JOIST INSTITUTE: Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders, (Latest Edition).

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete.
 - 1. Fabrication drawings including details and schedules for the fabrication and assembly of each joist.
 - 2. Erection drawings showing the size and location of each joist, bridging, cross bracing, bearing details, connections, welds, bolts and bearing plates.
- C. Certificates: STEEL JOIST INSTITUTE compliance.
- D. Design Calculations: If requested by the Resident Engineer, submit complete calculations covering the design of all members and connections. Calculations must be specifically applicable to the joists supplied.

1.6 QUALITY ASSURANCE:

Provide documentation that the joist manufacturer is a member of the Steel Joist Institute and has satisfactorily completed work of a similar scope and nature.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC):
1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Latest Edition).
 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition).
- C. American Society for Testing and Materials (ASTM):
- A307-07Carbon Steel Bolts and Studs, 400 MPa (60,000 psi) Tensile Strength
- F3125/F3125M-15Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions
- D. American Welding Society (AWS):
- D1.1-08Structural Welding Code - Steel
- E. SSPC: The Society for Protective Coatings:
- Steel Structures Painting Manual, Volumes 1 and 2
- F. Steel Joist Institute (STEEL JOIST INSTITUTE):
- Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders (Latest Edition).
- G. U.S. Army Corps of Engineers:
- CRD-C-621Specification for Non-Shrink Grout

PART 2 - PRODUCTS**2.1 OPEN WEB STEEL JOISTS:**

K-Series conforming to STEEL JOIST INSTITUTE standard specifications.

2.3 ACCESSORIES - FITTINGS:

- A. Accessories and fittings, including end supports and bridging, in accordance with standard STEEL JOIST INSTITUTE specification under which joists were designed.
- B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low carbon steel.
- C. High-strength bolts, including nuts and washers: ASTM F3125 heavy hexagon structural bolts.

PART 3 - EXECUTION**3.1 FABRICATION:**

- A. Fabrication and assembly in accordance with applicable standard STEEL JOIST INSTITUTE specification:
1. Make chord splices with full penetration welds capable of developing the ultimate strength in tension of the parent material. Make no allowance for the strength of back-up bars or other material incidental to welding.
 2. Provide shop-welded connection plates at panel points to receive supplemental framing.
 4. Extended Ends: Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable STEEL JOIST INSTITUTE specifications.
 5. Ceiling Extensions: Provide ceiling extension in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 12 mm (1/2 inch) of finished wall surface unless otherwise indicated.
 6. Bridging: Provide horizontal or diagonal type bridging for joists and joist girders, complying with STEEL JOIST INSTITUTE specifications. Provide bridging anchors for ends of bridging lines terminating at walls or beams. Provide bridging adequate to resist the loads indicated on the Contract Documents.
 7. End Anchorage: Provide end anchorages, including bearing plates, to secure joists to adjacent construction, complying with STEEL JOIST INSTITUTE specifications, unless otherwise indicated. Design all end anchorages to resist a minimum net uplift of 1.6 kPa (35 pounds per square foot) of supported area.
 8. Header Units: Provide header units to support all joists at openings in floor or roof system not framed with steel shapes.
 9. Provide supplemental steel support framing for metal deck where normal deck bearing is precluded by other framing members and minor openings.

3.2 SHOP PAINTING:

- A. Shop painting in accordance with applicable STEEL JOIST INSTITUTE standard specification.

- B. Shop paint joists and accessories with a rust-inhibiting primer paint. For joists which will be finish painted, limit paint to a primer which is compatible with specified finish paint. In high humidity areas, shop paint joists with a zinc-rich primer to receive top coats per the paint system manufacturer's recommendations.

3.3 ERECTION:

- A. Installation of joists in accordance with applicable STEEL JOIST INSTITUTE standard specification.
- B. Handle joists in a manner to avoid damaging of joists. Remove damaged joists from site, except when field repair is approved and such repairs are satisfactorily made in accordance with manufacturer's recommendations.
- C. Accurately set joists and end anchorage in accordance with the applicable STEEL JOIST INSTITUTE standard specification. Secure joists resting on masonry or concrete bearing surfaces by welding or bolting to the steel bearing plates as indicated on the Contract Documents. Secure bridging and anchoring in place prior to application of any construction loads. Distribute any temporary loads so that carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging where joist lengths are 12 m (40 feet) and longer. Where joist lengths are 12 m (40 feet) and longer, install a center row of bolted diagonal bridging to provide lateral stability before slackening of hoisting lines.

3.4 FIELD PAINTING:

- A. Clean abraded, corroded, and field welded areas and touch up with same type of paint used in shop painting.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

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**SECTION 05 31 00
STEEL DECKING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Single pan fluted metal roof deck as roof substrate.

1.2 RELATED WORK

- A. Section 05 21 00, STRUCTURAL STEEL FRAMING: Structural Steel Shapes.
- B. Section 09 06 00, SCHEDULE FOR FINISHES: Color.
- C. Section 09 91 00, PAINTING: Finish Painting.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. AISI - American Iron and Steel Institute.

- S100-16Specification for the Design of Cold-formed
Steel Structural Members.

C. American Welding Society (AWS):

- D1.1/D1.1M-20Structural Welding Code - Steel.
- 1.3/D1.3M-18 Structural Welding Code - Sheet Steel.

D. ASTM International (ASTM):

- A36/A36M-19Standard Specification for Carbon Structural
Steel.

- A653/A653M-20Standard Specification for Steel Sheet,
Zinc-Coated (Galvanized) or Zinc-Iron
Alloy-Coated (Galvannealed) by the Hot-Dip
Process.

- A1008/A1008M-20Standard Specification for Steel, Sheet,
Cold-Rolled, Carbon, Structural, High-Strength
Low-Alloy, High-Strength Low-Alloy with
Improved Formability, Solution Hardened, and
Baked Hardenable.

- C423-17Standard Test Method for Sound Absorption and
Sound Absorption Coefficients by the
Reverberation Room Method.

- E119-20Standard Test Methods for Fire Tests of
Building Construction and Materials.

E. FM Global (FM):

- 1-28-15Wind Design.
Factory Mutual Research Approval Guide.

F. Master Painters Institute (MPI):

No. 18Primer, Zinc Rich, Organic.

G. Military Specifications (Mil. Spec.):

MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing Repair.

H. Steel Deck Institute (SDI):

No. 31-07Design Manual for Composite Deck, Form Decks, and Roof Decks.

I. UL LLC (UL):

Listed Online Certifications Directory.

580Tests for Uplift Resistance of Roof Assemblies.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.

B. Submittal Drawings:

- 1. Show layout, connections to supporting members, anchorage, sump pans, accessories, deck openings and reinforcements.
- 2. Show similar information necessary for completing installation as shown and specified, including supplementary framing, ridge and valley plates, cant strips, cut openings, special jointing or other accessories.
- 3. Show welding, side lap, closure, deck reinforcing and closure reinforcing details.
- 4. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.

C. Manufacturer's Literature and Data:

- 1. Description of each product.
- 2. Show steel decking section properties and structural characteristics.

D. Qualifications: Substantiate qualifications comply with specifications.

- 1. Welders and welding procedures.

1.5 QUALITY ASSURANCE

A. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Global.

B. Welders and Welding Procedures Qualifications: AWS D1.3/D1.3M.

1.6 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS**2.1 SYSTEM PERFORMANCE**

- A. Design steel decking and accessories according to AISI S100.
 - 1. Wind Uplift Resistance and Corner Conditions:
 - a. Eave Overhang: 2.1 kPa (45 per square foot), minimum.
 - b. Other Roof Areas: 1.4 kPa (30 per square foot), minimum.
 - 2. Design side and end closures and attachment to supporting steel to safely support wet weight of concrete and construction loads.
 - 3. Cantilever Closure Deflection: 3 mm (1/8 inch), maximum.

2.2 MATERIALS

- A. Galvanized Steel Sheet: ASTM A653/A653M; G60G90 coating.
- B. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.
- C. Steel Shapes: ASTM A36/A36M.

2.3 PRODUCTS - GENERAL

- A. Sustainable Construction Requirements:
 - 1. Steel Recycled Content: 30 percent total recycled content, minimum.

2.4 METAL ROOF DECK

- A. Metal Roof Deck: UL Listed as metal roof deck panels.
 - 1. Steel decking of the type, depth, thickness, and section properties as shown.
 - 2. Deck Style:
 - a. Wide Rib (Type B) deck.
 - 3. Depth and Thickness: As indicated on drawings.
 - 4. Material: Galvanized sheet steel.

- B. Do not use steel deck for hanging supports of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

2.5 FABRICATION

- A. Fabricate steel decking in sufficient lengths to extend over 3 or more supports, except for interstitial levels.
 - 1. Cut metal deck units to proper length in shop.

- B. Fabricate accessories required to complete installation of steel decking.
 - 1. Exposed to View: Fabricate from sheet steel matching metal decking.
 - 2. Concealed from View: Fabricate from galvanized sheet steel.
- C. Sheet Metal Accessories:
 - 1. Metal Cover Plates: For end-abutting decking, to close gaps at changes in deck direction, columns, walls and openings.
 - a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
 - 2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges.
 - a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
 - 3. Metal Closure Strips: For openings between decking and other construction. Form to configurations required to provide tight-fitting closures at open ends of flutes and sides of decking.
 - a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
 - 4. Ridge and Valley Plates: Minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 1/24 (1/2 inch per foot).
 - a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
 - 5. Seat Angles for Deck: Provide where beam does not frame into column.
 - 6. Sump Pans for Roof Drains: Fabricated from single piece galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Provide sump pans of adequate size to receive roof drains and with bearing flanges minimum 75 mm (3 inches) wide. Recess pans minimum 38 mm (1-1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Drain holes will be field cut.
 - a. Sheet Steel: Minimum 1.7 mm (0.06 inch) thick.

2.6 FINISHES

- A. Shop prime painted sheet steel with two coats of primer.

2.7 ACCESSORIES

- A. Primer: Manufacturer's standard primer compatible with finish painting specified in Section 09 91 00, PAINTING.
- B. Welding Materials: AWS D1.1, type to suit application.
- C. Galvanizing Repair Paint: MPI No. 18.
- D. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.

- B. Protect existing construction and completed work from damage.
- C. Remove contaminants from structural steel surfaces where steel decking will be welded.
- D. Verify structural steel framing installation is completed, plumbed, and aligned with temporary bracing installed where required.
- E. Coordinate with structural steel erector to prevent overloading of structural members when placing steel decking for installation.

3.2 ERECTION

- A. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace deck units that become damaged after erection and before casting concrete at no cost additional to the Government.
- B. Place steel decking at right angles to supporting members with ends located over supports.
- C. Lap end joints 50 mm (2 inches), minimum.
- D. Fluted Form Deck Fastening:
 - 1. End Closure Fastening: Tack weld or self-tapping No. 8 or larger machine screws at 900 mm (3 feet) on center.
 - a. Longitudinal End Closure Fastening: Tack weld only.
 - 2. Weld side laps of adjacent decking units.
 - a. Fastener Locations: Mid-span and maximum 900 mm (3 feet) on center.
- E. Roof Deck Fastening:
 - 1. Fasten decking to steel supporting members by welding.
 - a. Welds: 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength.
 - b. Weld Spacing: as shown on Drawings.
 - 2. Fasten split or partial decking panels to structure in every valley.
 - 3. Fasten decking to each supporting member at ribs where side laps occur.
 - a. Power driven fasteners is acceptable in lieu of welding if strength equivalent to welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.
 - 4. Mechanically fasten decking side laps with self-tapping No. 8 or larger machine screws.
 - a. Fastener Locations: As shown on Drawings.
- F. Cutting and Fitting:

1. Field cut steel decking to accommodate columns and other penetrating items.
 2. Cut openings located and dimensioned on Structural Drawings.
 3. Coordinate openings for other penetrations shown on approved submittal drawings but not shown on Structural Drawings.
 - a. Cut and reinforce required opening.
 4. Make cuts neat and trim using metal saw, drill or punch-out device. Cutting with torches is prohibited.
 5. Do not make cuts in the metal deck that are not shown on the approved metal decking submittal drawings.
 - a. When additional openings are required, submit scaled drawing, locating required opening and other openings and supports in immediate area.
 - b. Do not cut the opening until drawing is approved by Contracting Officer's Representative.
 - c. Provide additional reinforcing and framing required for opening.
 - d. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected steel decking.
 6. Opening Reinforcement: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work.
- G. Touch up damaged factory finishes.
1. Apply galvanizing repair paint to damaged galvanized surfaces.
 2. Apply touch up paint to damaged shop painted surfaces.

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**SECTION 05 36 00
COMPOSITE METAL DECKING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies material and services required for installation of composite steel decking including shear connector studs and miscellaneous closures required to prepare deck for concrete placement as shown and specified.

1.2 RELATED WORK

- A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction.

1.3 DESIGN REQUIREMENTS

- A. Design steel decking in accordance with AISI S-100, except as otherwise shown or specified.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories.
1. Show welding, side lap, closure, deck reinforcing and closure reinforcing details.
 2. Show openings required for work of other trades, including openings not shown on structural drawings.
 3. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying required structural characteristics.
- D. Manufacturer's written recommendations for:
1. Shape of decking section.
 2. Cleaning of steel decking prior to concrete placement.
- E. Test Report - Establishing structural characteristics of composite concrete and steel decking system.

- F. Test Report - Stud base qualification.
- G. Welding power setting recommendation by shear stud manufacturer.
- H. Shear Stud Layouts: Submit drawings showing the quantity, pattern, spacing and configuration of shear studs for each beam and girder.
- I. Certification: For each type and gauge of metal deck supporting concrete slab or fill, submit certification of specified fire ratings. Certify that units supplied are UL listed as a "Steel Floor and Form Unit".
- J. Manufacturers Certificates for deck units attesting compliance with specified requirements.
- K. Submit manufacturer's catalog data for Welding Equipment and Welding Rods and Accessories intended use.
- L. Power Actuated Tool Operator Certificates.
- M. Welders qualifications.

1.5 QUALITY ASSURANCE

- A. Deck Units: Provide deck units and accessory products from a manufacturer engaged in the manufacture of steel decking for more than three (3) years. Submit manufacturer's certificates attesting that the decking material complies with the specified requirements.
- B. Certification of Powder-Actuated Tool Operator: Manufacturer's certificate attesting that the operators are authorized to use the low velocity powder-actuated tool.
- C. Qualifications for Welding Work: Submit qualified welder qualifications in accordance with AWS D1.1/D1.1M or under an approved qualification test.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Refer to the latest edition of referenced Standards and codes.
- B. American Iron and Steel Institute (AISI):
 - S-100-16North American Specification for the Design of Cold-Formed Steel Structural Members
- C. ASTM International (ASTM):
 - A36/A36M-19Standard Specification for Carbon Structural Steel
 - A108-18Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

A653/A653M-20Standard Specification for Steel Sheet, Zinc
Coated (Galvanized) or Zinc Iron Alloy Coated
(Galvannealed) by the Hot Dip Process

D. American Institute of Steel Construction (AISC):

1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Latest Edition)
2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)

E. American Welding Society (AWS):

- D1.1/D1.1M-20Structural Welding Code - Steel
D1.3/D1.3M-18Structural Welding Code - Sheet Steel

F. FM Global (FM):

- APP GuideApproval Guide
DS 1-28-15Design Wind Loads

G. Military Specifications (Mil. Spec.):

- MIL-P-21035BPaint, High Zinc Dust Content, Galvanizing
Repair

H. Underwriters Laboratories (UL):

- Bld Mat Dir (Annually) ..Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Decking and Flashings: ASTM A653/A653M, Structural Quality suitable for shear stud weld-through techniques.
- B. Recycled Content of Steel Products: Combined recycled content not less than 75 percent.
- C. Galvanizing: ASTM A653/A653M, G60 . Thickness not less than the amount indicated on drawings.
- D. Shear connector studs: ASTM A108, Grades 1015-1020, yield 350 Mpa (50,000 pound/square inch) minimum, tensile strength - 400 Mpa (60,000 pounds/square inch) minimum, reduction of area 50 percent minimum.
 1. Provide studs of uniform diameter, with heads concentric and on same axis to shaft.
 2. Provide studs, after welding, free from substance or defect which would interfere with its function as a shear connector.
 3. Do not paint or galvanize studs.
 4. Provide size of studs as shown on drawings.

5. Provide studs manufactured by a company normally engaged in the manufacturer of shear studs, and can furnish equipment suitable for weld-through installation of shear studs.
- E. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- F. Miscellaneous Steel Shapes: ASTM A36/A36M.
- G. Welding Electrode: E60XX minimum.
- H. Sheet Metal Accessories: ASTM A653/A653M, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
 2. Continuous sheet metal edging: at openings and concrete slab edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel to be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures to be limited to a total of 3 mm (1/8 inch) maximum.
 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
 4. Seat angles for deck: Where a beam does not frame into a column.

2.2 REQUIREMENTS

- A. Steel decking depth, gauge, and section properties to be as shown on contract documents. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.
- B. Fabricate deck units with integral embossments to provide mechanical bond with concrete slab. Deck units combined with concrete slab to be capable of supporting total design loads.
- C. Provide integral system with single point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning electrical and similar items.

1. Provide a minimum spacing pattern of 305 mm (12 inches) on centers longitudinally and 610 mm or 914 mm (24 or 36 inches) on centers transversely.
2. Provide suspension system capable of safely supporting a maximum allowable load of 45 kg (100 pounds) concentrated at one hanger attachment point.
3. System may consist of fold-down type hanger tabs or a lip hanger.

PART 3 - EXECUTION

3.1 ERECTION:

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed, and until temporary shoring, where required, has been installed.
 1. Remove oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured.
 1. Do not overload deck units once placed.
 2. Replace deck units that become damaged after erection and prior to casting concrete at no additional cost to the Government.
- D. Erect steel deck in accordance with manufacturer's printed instructions.
- E. Ship steel deck units in standard widths and fabricated to proper length.
- F. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.
- G. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastened.
 1. Bring each unit to proper bearing on supporting beams.
 2. Place deck units in straight alignment for entire length of run of flutes and with close registration of flutes of one unit with those of abutting unit.
 3. Maximum space between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates.
- H. Ceiling hanger loops, if provided, must be flattened or removed to obtain bearing of units on structural steel.
- I. Fastening Deck Units:

1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) on center with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
 2. Tack weld or use self-tapping No. 8 or larger machine screws at 914 mm (3 feet) on center for fastening end closures. Only use welds to attach longitudinal end closures.
 3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 914 mm (3 feet) on center, whichever is smaller.
- J. Weld in conformance to AWS D1.3/D1.3M and done by qualified experienced welding mechanics.
- K. Clean and touch-up area and welds scarred during erection, and repair with zinc rich galvanizing repair paint.
1. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.
- L. Provide metal concrete stops at edges of deck.
- M. Cutting and Fitting:
1. Fabricate metal deck units to proper length prior to shipping.
 2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.
 3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced.
 4. Make cuts and penetrations neat and trim using a metal saw, drill or punchout device; cutting with torches is prohibited.
 5. Do not make cuts in the metal deck that are not shown on the approved metal deck drawings.
 6. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Contracting Officer Representative (COR). Provide additional reinforcing or framing required for the opening at no additional cost to the Government.

7. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

N. Install shear connector studs through previously installed metal deck in conformance to AWS D1.1/D1.1M, Section 7.

Exception: Install studs with automatically timed welding equipment and as specified below:

1. Do not place welded wire reinforcing or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.
2. Clean steel deck sheets free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Clean and dry surface to which stud is to be welded.
3. Rest metal deck tightly upon top flange of structural member with bottom of deck rib in full contact with top of beam flange.
4. Weld studs only through a single thickness of deck. Place decking so that a butt joint is obtained. Place studs directly over beam web, where one row of studs are required.
5. Provide ferrules specially developed for the weld-through technique, and appropriate for size of studs installed. Remove ferrules after welding.
6. Submit report of successful test program for stud base qualification as required by AWS D1.1/D1.1M, Appendix K.

3.2 CLEANING

A. Clean deck in accordance with manufacturer's recommendation before concrete placement.

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
 - 1. Support for Wall and Ceiling Mounted Items
 - 2. Ladders
 - 3. Railings
 - 4. Steel Pipe Bollards

1.2 RELATED WORK

- A. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Prime and finish painting: Section 09 91 00, PAINTING.
- C. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
 - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
 - 3. Provide templates and rough-in measurements as required.
- C. Manufacturer's Certificates:
 - 1. Live load designs as specified.
- D. Design Calculations for specified live loads including dead loads.
- E. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-14Structural Steel
 - A47-99(R2014)Malleable Iron Castings
 - A48-03(R2012)Gray Iron Castings
 - A53-12Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless
 - A123-15Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products
 - A240/A240M-15Standard Specification for Chromium and
Chromium-Nickel Stainless Steel Plate, Sheet
and Strip for Pressure Vessels and for General
Applications.
 - A269-15Seamless and Welded Austenitic Stainless Steel
Tubing for General Service
 - A307-14Carbon Steel Bolts and Studs, 60,000 PSI
Tensile Strength
 - A391/A391M-07(R2015) ...Grade 80 Alloy Steel Chain
 - A786/A786M-15Rolled Steel Floor Plate
 - B221-14Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Shapes, and Tubes
 - B456-11Electrodeposited Coatings of Copper Plus Nickel
Plus Chromium and Nickel Plus Chromium
 - B632-08Aluminum-Alloy Rolled Tread Plate

- C1107-13Packaged Dry, Hydraulic-Cement Grout
(Nonshrink)
- F436-16Hardened Steel Washers
- F468-06(R2015)Nonferrous Bolts, Hex Cap Screws, Socket Head
Cap Screws and Studs for General Use
- F593-13Stainless Steel Bolts, Hex Cap Screws, and
Studs
- F1667-15Driven Fasteners: Nails, Spikes and Staples
- C. American Welding Society (AWS):
 - D1.1-15Structural Welding Code Steel
 - D1.3-18Structural Welding Code Sheet Steel
- D. National Association of Architectural Metal Manufacturers (NAAMM)
 - AMP 521-01(R2012)Pipe Railing Manual
 - AMP 500-06Metal Finishes Manual
- E. Structural Steel Painting Council (SSPC)/Society of Protective
Coatings:
 - SP 1-15No. 1, Solvent Cleaning
 - SP 2-04No. 2, Hand Tool Cleaning
 - SP 3-04No. 3, Power Tool Cleaning

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A240, Type 302 or 304.
- C. Steel Pipe (Bollard): ASTM A53.
 - 1. Galvanized for exterior locations.
 - 2. Type S, Grade A unless specified otherwise.
 - 3. NPS (inside diameter) as shown.
- D. Primer Paint: As specified in Section 09 91 00, PAINTING.
- E. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- F. Modular Channel Units:
 - 1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.

2. Form channel within turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

G. Grout: ASTM C1107, pourable type.

2.3 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:

1. Bolts with Nuts:

- a. ASME B18.2.2.
- b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
- c. ASTM F468 for nonferrous bolts.
- d. ASTM F593 for stainless steel.

2. Screws: ASME B18.6.1.

3. Washers: ASTM F436, type to suit material and anchorage.

2.4 FABRICATION GENERAL

A. Material

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power

actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:

- a. Fabricate items to design shown.
- b. Furnish members in longest lengths commercially available within the limits shown and specified.
- c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
- d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
- e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
- f. Prepare members for the installation and fitting of hardware.
- g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
- h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:

- a. Weld in accordance with AWS.
- b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
- c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
- d. Finish welded joints to match finish of adjacent surface.

3. Joining:

- a. Miter or butt members at corners.
- b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.

4. Anchors:

- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.

- b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
- a. Accurately cut, machine and fit joints, corners, copes, and miters.
 - b. Fit removable members to be easily removed.
 - c. Design and construct field connections in the most practical place for appearance and ease of installation.
 - d. Fit pieces together as required.
 - e. Fabricate connections for ease of assembly and disassembly without use of special tools.
 - f. Joints firm when assembled.
 - g. Conceal joining, fitting and welding on exposed work as far as practical.
 - h. Do not show rivets and screws prominently on the exposed face.
 - i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.
- F. Finish:
- 1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
 - 2. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:
 - 1) Finish smooth rough surfaces and remove projections.
 - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
 - c. Shop Prime Painting:
 - 1) Surfaces of Ferrous metal:
 - a) Items not specified to have other coatings.
 - b) Galvanized surfaces specified to have prime paint.
 - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.

d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.

e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

3. Stainless Steel: NAAMM AMP-504 Finish No. 4.

G. Protection:

2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

B. For Cubical Curtain Track:

1. Fabricate assembly of steel angle as shown.
2. Drill angle bent ends for anchor screws to acoustical suspension system and angle for hanger wires.
3. Provide pipe sleeve welded to angle.

C. For Exam and Procedure Room Light:

1. Fabricate as shown to suit equipment furnished.
2. Drill leveling plate for light fixture bolts.

2.6 LADDERS

A. Steel Ladders:

1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.
3. Provide holes for anchoring with expansion bolts through turned ends and brackets.
4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
5. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

2.7 RAILINGS

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
 - 1. Provide continuous welded joints, dressed smooth and flush.
 - 2. Standard flush fittings, designed to be welded, may be used.
 - 3. Exposed threads will not be approved.
 - 4. Form handrail brackets to size and design shown.
 - 5. Exterior Post Anchors.
 - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
 - b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
 - c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
 - 6. Interior Post Anchors:
 - a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
 - b. Weld or thread flanged fitting to posts at base.
 - c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
 - d. Provide sliding flange base plate on posts secured with set screws.
 - e. Weld flange base plate to removable posts set in sleeves.
- C. Handrails:
 - 1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
 - 2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
- D. Steel Pipe Railings:
 - 1. Fabricate of steel pipe with welded joints.
 - 2. Number and space of rails as shown.
 - 3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
 - 4. Opening Guard Rails:

- a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
 - b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
 - c. Fabricate rails for floor openings for anchorage in sleeves.
- E. Stainless Steel Railings:
1. Fabricate from 38 mm (1-1/2 inches) outside diameter stainless steel tubing, ASTM A269, having a wall thickness of 1.6 mm (0.065 inch).
 2. Join sections by an internal connector to form hairline joints where field assembled.
 3. Fabricate with continuous welded connections.
 4. Fabricate brackets of stainless steel to design shown.
 5. Fabricate stainless steel sleeves at least 150 mm (6 inches) deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of post.

2.8 STEEL PIPE BOLLARD

- A. Provide bollard in accordance with ASTM A53 with dimensions as shown in standard detail SD320523-04. Anchor posts in concrete and fill solidly with concrete with a minimum compressive strength of 17 MPa 2500psi.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
 1. Provide temporary bracing for such items until concrete or masonry is set.
 2. Place in accordance with setting drawings and instructions.
 3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
 1. Design and finish as specified for shop welding.
 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified.

Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

- A. Anchorage to structure.
 - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
 - 2. Secure supports to concrete inserts by bolting or continuous welding as shown.
 - 3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
 - 4. Secure steel plate or hat channels to studs as detailed.
- B. Ceiling Support for Exam and Procedure Lights:
 - 1. Anchor support to structure above as shown.
 - 2. Set leveling plate as shown level with ceiling.
 - 3. Secure operating light to leveling plate in accordance with light manufacturer's requirements.

3.3 LADDERS

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.

3.4 RAILINGS

- A. Steel Posts:
 - 1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
 - 2. Install sleeves in concrete formwork.
 - 3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS—on exterior posts.
 - 4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
 - 5. Secure sliding flanged fittings to posts at base with set screws.
 - 6. Secure fixed flanged fittings to concrete with expansion bolts.

7. Secure posts to steel with welds.

B. Handrails:

1. Anchor brackets for metal handrails as detailed.
2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
3. Expansion bolt to concrete or solid masonry.
4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.5 STEEL COMPONENTS FOR MILLWORK ITEMS

- A. Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

3.6 INSTALLATION OF STEEL PIPE BOLLARD

- A. Set bollards vertically in concrete piers. Compressive strength of concrete piers shall be 21MPa 3000psi.

3.7 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

- - - E N D - - -

**SECTION 05 51 33.23
ALTERNATING TREAD STEEL STAIRS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel alternating tread stair assemblies with railings.
 - 1. Note: Terminology used for the component covered by this specification varies among the codes or standards that address the component. This specification uses the term alternating tread stair. The International Building Code and NFPA-101, Life Safety Code use the term alternating tread device.

1.2 ADDITIONAL WORK INCLUDED IN THIS SECTION

- A. Field Measurements of alternating tread stair installation sites and verification of vertical distance between floors.

1.3 WORK SPECIFICALLY EXCLUDED IN THIS SECTION

- A. The items in this section are not to be included in the metal stair contractor's work:
 - 1. Temporary shoring or bracing.
 - 2. Demolition and removal of existing work.
 - 3. Clean up of site prior to installation.
 - 4. Concrete supports or other concrete work
 - 5. Cutting; preparation of pockets; setting of plates, inserts, adapters, or other hardware of built in items.
 - 6. Placement of wire mesh or re-bar for concrete fill.
 - 7. Temporary lights or electricity.
 - 8. Temporary safety rails.
 - 9. Protection after erection.
 - 10. Wood trim or moldings, for treads or stringers.
 - 11. Rubber treads or carpets.
 - 12. Slip resistant concrete treatments.
 - 13. Field painting other than touch up of damaged surfaces.
 - 14. Final surface cleaning, passivation, or application of surface protectant after installation.

1.4 RELATED DOCUMENTS

- A. Project drawings and specifications and general provisions of Contract; including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.5 SUMMARY

- A. Provide all material, labor, equipment and services and perform all operations required for the work of this section in accordance with the Drawings and Specifications, including fabrication and installation of alternating tread steel stairs.

1.6 REFERENCES

- A. American Institute of Steel Construction (AISC)
 - 1. Manual of Steel Construction (AISC-360)
 - 2. Code of Standard Practice (AISC-303)
- B. American Iron and Steel Institute
 - 1. Type 304 Stainless Steel (UNS S30400)
 - 2. Type 1010 Stainless Steel (UNS G10100)
- C. American Society for Testing and Materials (ASTM)
 - 1. ASTM A108 Standard Specification for Steel Bars, Carbon, Cold-Finished
 - 2. ASTM A123 - Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
 - 3. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications
 - 4. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - 5. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
 - 6. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 7. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
 - 8. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
 - 9. ASTM A568/568M - Specification for Steel Sheet, Carbon, Structural, and High Strength, Low Alloy, Hot Rolled and Cold Rolled General Requirements
 - 10. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - 11. ASTM A786/A786M Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plate

12. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability and Ultra High Strength
13. ASTM F844 Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
14. Note: Editions specified in the applicable building code apply. If the editions is not specified in the applicable building code, then the latest edition of the References shall apply.

D. National Association of Architectural Metal Manufacturers (NAAMM)

1. NAAMM STANDARD AMP 510-92 Metal Stairs Manual 5th Edition

1.7 PERFORMANCE REQUIREMENTS

- A. Alternating Tread Stair Treads: shall be capable of withstanding a single concentrated 1000 pound load without permanent deformation; or 100 pounds per square foot or 300 pounds on an area of 4 square inches without exceeding the allowable working stress of the material.
- B. Alternating Tread Stair Guard/Handrail: shall be capable of withstanding a single concentrated load of 200 pounds or a uniform load of 50 pounds per linear foot applied in any direction at any point on the rail without exceeding the allowable working stress of the material.
- C. Alternating Tread Stair Stringers: shall be capable of withstanding a single concentrated load of 1000 pounds at any point on the stair without permanent deformation; or a uniform live loading of 100 pounds per square foot applied in a downward direction to all tread surfaces or a 300 pound load on an area of 4 square inches without exceeding the allowable working stress of the material.

1.8 CONSTRUCTION REQUIREMENTS

- A. Landings, Treads, and Mounting Base: shall be stamped and formed from single piece material. Stock shapes, hand forming, or welded remnants shall not be permitted. All stamped parts shall have integrally formed rigidizing bends and shall be spot welded to stringers of like material.
- B. Welds: shall be a minimum of 6 welds per tread, and 12 welds each on the landing and mounting base. Each weld shall be quality controlled and be capable of withstanding a minimum of 2800 lbs. in shear.
- C. Landing and Tread Surfaces: shall be punched through with upset non-skid openings.

- D. Riser Spacing: shall be equally spaced to within 3/16" for adjacent risers and to within 3/8" for any two non-adjacent risers on a stair.
- E. Guards and Handrails: shall be contoured for body guidance and underarm support and shall be attached to the outside stringers and landings by bolting.
- F. Landing Reinforcement: shall be with 1/4" steel angle notched and punched and factory welded to the landing at the points of a guard or handrail attachment.
- G. Rubber Bumper: shall be affixed to the central portion of the landing. A rubber bumper strip shall be attached or will be provided for field attaching to the central stringer.

1.9 DIMENSIONS

- A. Alternating Tread Stair Angle: 68 degrees from horizontal as specified in the drawings.
- B. Vertical Drop: the change in elevation, as shown on the drawings, between the upper finished floor surface where the top landing will be attached and the lower finished floor surface where the base of the alternating tread stair will be secured.

1.10 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
 - 1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
- C. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.
- D. Fabrication qualifications.
 - 1. Installer qualifications.
 - 2. Calculations.
- E. Welding qualifications.

1.11 QUALITY ASSURANCE

- A. Fabricator: A firm with a minimum of three (3) years' experience in type of work required by this section. Submit fabricator qualifications.
- B. Installer: A firm with a minimum of three (3) years' experience in type of work required by this section. Submit installer qualifications.
- C. Calculations: Provide professionally prepared calculations and certification of performance of this work, signed and sealed by a

Professional Engineer registered in the state where the work is located. Perform structural design of the stair including supports for the metal stair frame. Indicate how Design Criteria as specified have been incorporated into the design.

Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M and AWS D1.3/D1.3M.

1.12 DELIVERY STORAGE AND HANDLING

- A. Reference: AISC Code of Standard Practice, sections 6 & 7.
- B. Deliver materials to the job-site in good condition and properly protected against damage to finished surfaces.
- C. Store material in a location and manner to avoid damage. Do not stack components. Lay out components on firm foundation material such that bending cannot occur.
- D. Store metal components in a clean dry location, away from uncured concrete, cement, or masonry products, acids, oxidizers, rainwater, or any other chemical or substance that might damage the material or finish.
- E. Plan work and storage locations to keep on-site handling to a minimum.
- F. Exercise particular care to avoid damage to material finishes or unprotected surfaces when handling.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. Basis of Design: Lapeyre Stair - alternating tread steel stairs.

2.2 MATERIALS

- A. Carbon Steel:
 - 1. Treads: 13 Gauge; Minimum 36 ksi yield stress; AISI 1010/15 HRPO or ASTM A1011 structural steel (SS) type grade 36 (or higher).
 - 2. Landing & Foot Stampings: 11 Gauge; Minimum 36 ksi yield stress; AISI 1010/15 or ASTM A1011 structural steel (SS) type grade 36 (or higher).
 - 3. Top Landing Support Clips: Formed L2 x 2 x ¼" x 4" lg. with 5/8" Φ round holes and 5/8" x 1" slot holes, ASTM A1011 structural steel (SS) Type, grade 36 (or higher).
 - 4. Stringers: 2" x 1 3/4" x 11 Gauge U section; minimum 36 ksi yield stress; AISI 1010/15 or ASTM A1011 structural steel (SS) Type, grade 36 (or higher) for 68 degree stairs 12 vertical feet or less.

5. Handrails: 1 1/2" OD x 0.095"; Minimum 42 ksi yield stress; AISI 1010/15 CS or ASTM A1011 cold drawn, fully annealed tube per ASTM A513 grade 1026 or higher As-welded tubing or ASTM A500 Grade B.

B. Fasteners

1. Bolts: handrail to stringer; Hex Head A307 or SAE J429 Grade 5, 1/2" Φ x 13 TPI Landing to structure; Carriage Head A307 or Hex Head SAE J429 Grade 5, 1/2" Φ x 13 TPI; dimensions per ANSI/ASME B18.2.1
2. Nuts: ASTM A563 Grade A, B, C, D or O; dimensions per ANSI/ASME B18.2.2.
3. Washers ASTM F436 or F844, dimensions per ANSI/ASME B18.22.1.

C. Miscellaneous Material:

1. Rubber Spine: Hollow neoprene.
2. Rubber Foot Divider: Solid Santoprene.

2.3 FINISHES

A. Carbon Steel:

1. Gray Primer: Epoxy Powder Coat or
2. Safety Yellow Paint: Polyester TGIC* Powder Coat or
3. Iron Gray: TGIC*.
4. Typical RAL selections: Polyester Powder Coat.
5. Hot-Dip Galvanized: per ASTM A123.

*Triglycidyl Isocyanate

2.4 FABRICATION

- A. Fabricate alternating tread steel stairs to conform to performance and construction requirements, in accordance with approved shop drawings or dimensional prints. Fabricate and shop-assemble to greatest extent possible.
 1. Carbon Steel: gas metal arc welded (GMAW/MIG) with E70 electrodes (or other approved welding wire) with treads spot welded to stringers and bolt-on handrails (with bolts included).

PART 3 - EXECUTION

3.1 PREPARATIONS

- A. Coordination: Coordinate start and installation of steel alternating tread stair with all other related and adjacent work. Installation shall not start until the construction has progressed to the point that weather conditions and remaining construction operations will not damage alternating tread stair installation.
- B. Verification: Verify that dimensions and angle are correct and that substrate is in proper condition for alternating tread stair

installation. Do not proceed with installation until all necessary corrections have been made.

3.2 INSTALLATION

- A. If bumper has not been installed at the factory, install the bumper in accordance with the manufacturer's instructions (peel and stick).
- B. Prepare mounting holes.
- C. Position alternating tread stair with top tread at same elevation as upper finished floor or roof surface.
- D. Secure alternating tread stair with not less than 2 bolts or studs at top and with not less than 2 at bottom of stair.
- E. Touch up with matching paint any chipped or abraded damage to factory finish or
- F. Touch up any damage to galvanized surfaces using galvanized repair paint in accordance with ASTM A780

3.3 CLEAN UP

- A. Leave work area clean and free of debris.

- - - E N D - - -

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies wood blocking, sheathing, and nailers.

1.2 RELATED WORK:

A. Sustainable design requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

2. For composite wood products, submit documentation indicating that product contains no added urea formaldehyde.

B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

C. Manufacturer's Literature and Data:

1. Submit data for lumber and panels.

2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.

D. Manufacturer's certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

- A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

1.6 GRADING AND MARKINGS:

- A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):
 - NDS-15National Design Specification for Wood Construction
 - WCD1-01Details for Conventional Wood Frame Construction
- C. American Institute of Timber Construction (AITC):
 - A190.1-07Structural Glued Laminated Timber
- D. American Society of Mechanical Engineers (ASME):
 - B18.2.1-12(R2013)Square and Hex Bolts and Screws
 - B18.2.2-10Square and Hex Nuts
 - B18.6.1-81(R2008)Wood Screws
- E. American Plywood Association (APA):
 - E30-11Engineered Wood Construction Guide
- F. ASTM International (ASTM):
 - A653/A653M-13Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

- C954-11Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness
- C1002-14Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs
- D198-14Test Methods of Static Tests of Lumber in Structural Sizes
- F844-07a(R2013)Washers, Steel, Plan (Flat) Unhardened for General Use
- G. American Wood Protection Association (AWPA):
AWPA Book of Standards
- H. Commercial Item Description (CID):
A-A-55615Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)
- I. Forest Stewardship Council (FSC):
FSC-STD-01-001 (Ver. 4-0) FSC Principles and Criteria for Forest Stewardship
- J. Military Specification (Mil. Spec.):
MIL-L-19140ELumber and Plywood, Fire-Retardant Treated
- K. Environmental Protection Agency (EPA):
40 CFR 59(2014)National Volatile Organic Compound Emission Standards for Consumer and Commercial Products
- M. U.S. Department of Commerce Product Standard (PS)
PS 1-95Construction and Industrial Plywood
PS 20-10American Softwood Lumber Standard
- N. ICC Evaluation Service (ICC ES):
AC09Quality Control of Wood Shakes and Shingles
AC174Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)

PART 2 - PRODUCTS

2.1 LUMBER:

- A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
 - 1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for

qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.

2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.B. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.

C. Sizes:

1. Conforming to PS 20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

D. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
 - a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.

E. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

F. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.2 PLYWOOD:

- A. Comply with PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
 - 1. APA rated Exposure 1 or Exterior; panel grade CD or better.
 - 2. Wall sheathing:
 - a. Minimum 12 mm (15/32 inch) thick unless specified otherwise.

2.3 ROUGH HARDWARE AND ADHESIVES:

- A. Anchor Bolts:
 - 1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
 - 2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).
- B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
 - 1. ASTM F844.
 - 2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
 - 1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
 - 2. Wood to Steel: ASTM C954, or ASTM C1002.
- E. Adhesives:
 - 1. Adhesives to have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).

PART 3 - EXECUTION**3.1 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS:**

- A. Conform to applicable requirements of the following:
 - 1. APA for installation of plywood.
- B. Fasteners:
 - 2. Bolts:
 - a. Fit bolt heads and nuts bearing on wood with washers.
 - b. Countersink bolt heads flush with the surface of nailers.

- c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
 - d. Provide toggle bolts to hollow masonry or sheet metal.
 - e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
- a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
 - b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
- a. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
- C. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- D. Blocking Nailers, and Furring:
- 1. Install furring, blocking, nailers, and grounds where shown.
 - 2. Provide longest lengths practicable.
 - 3. Provide fire retardant treated wood blocking.
 - 4. Layers of Blocking or Plates:
 - a. Stagger end joints between upper and lower pieces.
 - b. Screw at ends and not over 610 mm (24 inches) between ends.
 - c. Stagger screws from side to side of wood member over 127 mm (5 inches) in width.
- E. Sheathing:
- 1. Provide plywood sheathing.
 - 2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and screwed over bearings as specified.
 - 3. Set screws not less than 9 mm (3/8 inch) from edges.
 - 4. Install 50 mm by 101 mm (2 inch by 4 inch) blocking spiked between studs to support edge or end joints of panels.

- - - E N D - - -

**SECTION 06 20 00
FINISH CARPENTRY**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Interior millwork.

B. Items specified:

- 1. Custom Plastic Laminate and Decorative Protection Panel Millwork (Including Cabinetry).
- 2. Window Sills.
- 3. Wall Caps and Counter or Work Tops.
- 4. Shelves and Rods.
- 5. Plastic Resin Decorative Panels.

1.2 RELATED REQUIREMENTS

A. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.

B. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International:

- A36/A36M-19Carbon Structural Steel.
- A53/A53M-20Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- A240/A240M-20Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- B26/B26M-18e1Aluminum-Alloy Sand Castings.
- B221-14Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E84-20Surface Burning Characteristics of Building Materials.

C. American National Standard Institute (ANSI):

- ANSI Z97.1For Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

D. American Hardboard Association (AHA):

- A135.4-12Basic Hardboard.

E. Architectural Woodwork Institute (AWI):

- AWI-14Architectural Woodwork Standards, 2nd ed.
- F. Builders Hardware Manufacturers Association (BHMA):
- A156.9-15Cabinet Hardware.
- A156.11-14Cabinet Locks.
- A156.16-18Auxiliary Hardware.
- G. Federal Specifications (Fed. Spec.):
- A-A-1922AShield Expansion (Calking Anchors, Single Lead).
- A-A-1936AAdhesive, Contact, Neoprene Rubber.
- FF-N-836ENut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding.
- FF-S-111D(1)Screw, Wood (Notice 1 inactive for new design).
- MM-L-736C(1)Lumber, Hardwood.
- H. Hardwood Plywood and Veneer Association (HPVA):
- HP1-16Hardwood and Decorative Plywood.
- I. Military Specification (Mil. Spec):
- MIL-L-19140ELumber and Plywood, Fire-Retardant Treated.
- J. National Particleboard Association (NPA):
- A208.1-09Wood Particleboard.
- K. National Electrical Manufacturers Association (NEMA):
- LD 3-05High-Pressure Decorative Laminates.
- L. U.S. Department of Commerce, Product Standard (PS):
- PS1-07Construction and Industrial Plywood.
- PS20-10American Softwood Lumber Standard.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.
 2. Half full-size scale for sections and details 1: 50 (1/4 inch) for elevations and plans.
- C. Manufacturer's Literature and Data:
1. Description of each product.
 - a. Finish hardware.
- D. Samples:
1. Plastic Laminate Finished Plywood and Particleboard: 150 mm by 300 mm (6 by 12 inches) long, each type and color.
 - a. Submit quantity required to show full color and texture range.

2. Acrylic Solid Surface: 100 mm by 100 mm (4 inches by 4 inches), each type and color.
3. Plastic Resin Decorative Panel: 100 mm by 100 mm (4 inches by 4 inches), each type and color.
4. Plastic Resin Decorative Panel Hardware, each type and finish.
5. Decorative Protection Panel: 100 mm by 100 mm (4 inches by 4 inches), each type and color.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 1. Regularly fabricates specified products.
 2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
- B. Installer Qualifications:
 1. Regularly installs specified products.
 2. Installed specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
- D. Store products indoors in dry, weathertight, conditioned facility.
- E. Protect products from damage during handling and construction operations.

1.7 FIELD CONDITIONS

- A. Environment:
 1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
 2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions continuously, beginning 48 hours before installation until Government occupancy.
 3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.
 4. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

B. Field Measurements: Verify field conditions affecting fabrication and installation. Show field measurements on Submittal Drawings.

1. Coordinate field measurement and fabrication schedule to avoid delay.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grading and Marking: Factory mark with grade stamp lumber and plywood of inspection agency approved by the Board of Review, American Lumber Standard Committee.

B. Lumber:

1. Sizes:

- a. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes within manufacturing tolerances allowed by the standard under which product is produced.

2. Moisture Content:

- a. 32 mm (1-1/4 inches) or less nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
- b. Other materials: According to standards under which the products are produced.

3. Fire Retardant Treatment: Mil. Spec. MIL-L-19140E.

- a. Treatment and performance inspection by an independent and qualified testing agency that establishes performance ratings.
- b. Each piece of treated material bear identification of the testing agency and indicate performance according to such rating of flame spread and smoke developed.
- c. Treat wood for maximum flame spread of 25 and smoke developed of 25.

C. Plywood:

1. Softwood Plywood: DOC PS1.

- a. Plywood, 13 mm (1/2 inch) and thicker; minimum five ply construction, except 32 mm (1-1/4 inch) thick plywood minimum seven ply.
- b. Plastic Laminate Plywood Cores:
 - 1) Exterior Type, and species group.
 - 2) Veneer Grade: A-C.

- c. Shelving Plywood:
 - 1) Interior Type, any species group.
 - 2) Veneer Grade: A-B or B-C.
- d. Acrylic Solid Surface Plywood Cores:
 - 1) Exterior Type, and species group.
 - 2) Veneer Grade: A-C.
- D. Particleboard: NPA A208.1, Type 1, Grade 1-M-3 and Type 2, Grade 2-M-2.
 - 1. Plastic Laminate Particleboard Cores:
 - a. Type 1, Grade 1-M-3, unless otherwise specified.
- E. Plastic Laminate: NEMA LD-3.
 - 1. Exposed Laminate Surfaces including Sides of Cabinets : Grade HGL.
 - 2. Enclosed Cabinet Interiors including Drawers and Shelving: NEMA, CLS as a minimum, with the following:
 - a. Resin impregnated decorative paper thermally fused to particle board.
 - 3. Exposed Shelving: NEMA, CLS as a minimum, with the following:
 - a. Plastic laminate clad particle board.
- F. Acrylic Solid Surface: NEMA-LD-3.
- G. Stainless Steel: ASTM A240, Type 302 or 304.
- H. Cast Aluminum: ASTM B26.
- I. Extruded Aluminum: ASTM B221.
- J. Steel: ANSI 156.16.
- K. Chrome-Plated Steel: ANSI 156.16.
- L. Plastic Resin Decorative Panel: ANSI Z97.1.
- M. Decorative Protection Panel: NEMA-LD-3; ASTM E84.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run.

2.3 FABRICATION

- A. General:
 - 1. AWI Custom Grade for interior millwork.
 - 2. Plywood, minimum 13 mm (1/2 inch), unless otherwise shown on Drawings or specified.
 - 3. Edges of members in contact with concrete or masonry having a square corner caulking rebate.
- B. Custom Plastic Laminate Work (PL-2):
 - a. Factory glued to either a plywood or a particle board core, thickness as shown on Drawings or specified.

- b. Cover outside corners and exposed edges with aluminum trim (TRIM-3 and TRIM-4) as shown on drawings and specified. Cover cabinet edges, door and drawer front edges, and exposed shelf edges with matching plastic molded edge strips as shown on drawings or specified. Use plastic molded edge strips on 19 mm (3/4 inch) thick or thinner core material.
 - c. Use backing sheet on concealed large panel surface when decorative face does not occur.
- C. Shelves and Rods:
1. Plastic laminate cover, 19 mm (3/4 inch) thick plywood or particle board core with matching plastic molded edge and end strips. Size as shown on Drawings.
 2. Rod or Closet Bar: L03131.
 3. Combination Garment and Shelf Support, Intermediate Support for Closet Bar: B04051 for rods over 1800 mm (6 feet) long.
- D. Acrylic Solid Surface Window Sills (S-1):
1. Window Sills: 13 mm (1/2 inch) and 19 mm (3/4 inch) solid surface applied with waterproof adhesive to 2 layers 19 mm (3/4 inch) exterior-grade plywood; eased square edge.
 2. Divider Wall Top Cap: 13 mm (1/2 inch) solid surface; eased square edge.
- E. Acrylic Solid Surface Countertops, Divider Wall Cap, and Display Wall Elements (S-2):
1. Thickness: 13 mm (1/2 inch) solid surface applied with waterproof adhesive to 19 mm (3/4 inch) exterior-grade plywood.
 2. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid surface manufacturer requirements. Form joints between components to create inconspicuous seams, using manufacturer's standard joint adhesive. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
 3. Thermoform corners and edges to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
 4. Ensure no blistering, whitening and cracking of components during forming.

5. Form backsplashes from solid surfacing material with radius cove where counter and backsplashes meet as indicated on Drawings. Refer to Technical Bulletin K28235 Thermoformed Backsplash.
 6. Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid surface material under each joint.
 7. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
 8. Finish: Ensure surfaces have uniform finish.
 9. Fabrication Tolerances:
 - a. Variation in Component Size: ± 3 mm ($\pm 1/8$ ").
 - b. Location of Openings: ± 3 mm ($\pm 1/8$ ") from indicated location.
- F. Plastic Resin Decorative Panel (ACR-1 and ACR-2):
1. Engineered co-polyester resin.
 2. Sheet Size: Maximum 4-foot by 10-foot.
 3. Thickness: 1/2 inch (12.7 mm).
 4. Fabricate Plastic Fabrications to designs, sizes and thicknesses indicated and to comply with indicated standards.
 5. Comply with manufacturer's written recommendations for fabrication.
 6. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.
 - a. Sawing: Select equipment and blades suitable for type of cut required.
 - b. Drilling: Drills specifically designed for use with plastic products.
 - c. Milling: Climb cut where possible.
 - d. Routing.
 - e. Tapping.
 7. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.
 8. Mounting Hardware: As recommended by manufacturer for frameless suspended partition where drawn and specified.
 9. Fasteners: Use screws designed specifically for plastics. Self-threading screws are acceptable for permanent installations.
 10. Bonding Cements: May be achieved with solvents or adhesives, suitable for use with product and application.

11. Cleaner: Type recommended by manufacturer.
 12. Opaque backer at ACR-1 in soffit above Information Desk.
 13. Custom Digital Image (ACR-2):
 - a. Custom image to be embedded in resin panel for protection; NOT printed on panel surface.
 - b. Electronic file of custom image to be provided by Owner to be printed on panels by manufacturer.
- G. Custom Decorative Protection Panel Work (DPP-1 and DPP-2)
1. Impact-resistant panels.
 2. Treated fiberglass core; Class A fire-rated.
 3. Laminate Grade: H1, 0.0677 inches to 0.0827 inches thick.
 4. Finish: Matte.
 5. Fabrication:
 - a. AWI-14 and NEMA LD 3-05.
 - b. Factory glued to either a plywood or a particle board core, thickness as shown on Drawings or specified.
 - c. Conform to manufacturer's standard practices, procedures, conditions including preconditioning, material recommendations, machining, equipment and workmanship.
 - d. Router base should be clean and free of burrs and debris. Table saws should be clean, flat, and free of burrs.
 - e. Cover outside corners and exposed edges with aluminum trim (TRIM-3 and TRIM-4) as shown on drawings and specified.

2.4 ACCESSORIES

- A. Casework Hardware:
1. Rough Hardware:
 - a. Provide rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process.
 - b. Fasteners:
 - 1) Bolts with Nuts: FF-N-836.
 - 2) Expansion Bolts: A-A-1922A.
 - 3) Screws: Fed. Spec. FF-S-111.
 2. Finish Hardware:
 - a. Cabinet Hardware: ANSI A156.9.
 - 1) Door/Drawer Pulls: B02011. Door in seismic zones: B03182.

- 2) Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm (3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.
 - 3) Adjustable Shelf Standards: B4061 with shelf rest B04083.
 - 4) Concealed Hinges: B1601, minimum 110 degree opening.
 - b. Cabinet Locks: ANSI A156.11.
 - 1) Drawers and Hinged Door: E07262.
 - c. Auxiliary Hardware: ANSI A156.16.
 - 1) Shelf Bracket: B04041, japanned or enameled finish.
 - 2) Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
 - 3) Closet Bar: L03131 chrome finish of required length.
 - d. Counter Brackets:
 - 1) Steel angles drilled for fasteners on 100 mm (4 inches) centers.
 - e. Edge and Corner Trim and Edge Strips:
 - 1) Cabinets: Vinyl plastic to match plastic laminate color.
 - 2) Extruded aluminum channels (TRIM-3 and TRIM-4):
 - a) Profiles: Division Bar, Corner Guard, End Cap, Inside Corner, and Outside Corner as required or shown on drawings.
 - f. Countertop Grommets: Circular, 3-inch OD, plastic grommet for cable passage with flexible top; color: black.
 - g. Primers: Manufacturer's standard primer for steel providing baked enamel finish.
- B. Adhesive:
1. Plastic Laminate: Fed. Spec. A-A-1936.
 2. Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Remove existing construction as shown on drawings to permit new installation.
 1. Dispose of removed materials.
- D. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION

A. Installation:

1. Seal cut edges of fire retardant treated wood materials with a certified acceptable sealer.
2. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
3. Plumb and level items unless shown otherwise.
4. Apply adhesive uniformly for full contact between finish and substrate.

B. Acrylic Solid Surface Window Sills:

1. Install plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.
2. No overhang on length or depth.

C. Acrylic Solid Surface Wall Caps and Countertops:

1. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.
2. Form field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.
3. Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's written recommendations using adhesive in color to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.
4. Install countertops with no more than 3 mm (1/8") sag over a 3 m (10') span, bow or other variation from a straight line.
5. Adhere undermount/submount/bevel mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.
6. Adhere topmount sinks/bowls to countertops using manufacturer recommended adhesives and color-matched silicone sealant.
7. Seal between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.
8. Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard color-matched silicone

sealant. Adhere applied sidesplashes to countertops using a standard color-matched silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard color-matched joint adhesive.

D. Plastic Resin Decorative Panels:

1. General: Comply with manufacturer's written instructions for the installation of Plastic Fabrications.
2. Manufacturer's shop to fabricate items to the greatest degree possible.
3. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for installations indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.
4. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
5. Form field joints using manufacturer's recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

E. Shelves:

1. Install metal bracket, ANSI A156.16, B04051, not over 1200 mm (4 feet) on centers where shelf length exceeds 1800 mm (6 feet) in length with metal rods, clothes hanger bars ANSI A156.16, L03131, of required length, full length of shelf.

F. Decorative Protection Panels:

1. Install decorative protection panels in accordance with manufacturer's installation instructions and approved submittals.
2. Provide templates and rough-in measurements.
3. Accessory Materials: Install in accordance with manufacturer's written installation instructions.

3.3 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed surfaces. Remove contaminants and stains.
- C. Touch up damaged factory finishes.
 1. Repair painted surfaces with touch up primer.

3.4 PROTECTION

- A. Protect finish carpentry from traffic and construction operations.
- B. Cover finish carpentry with reinforced kraft paper, and plywood or hardboard.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

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**SECTION 07 01 50.19
PREPARATION FOR RE-ROOFING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Partial roof removal for new roof system installation.
- B. Existing Roofing System: TPO . System components include:
 - 1. Roofing membrane.
 - 2. Cover board.
 - 3. Roof insulation.
 - 4. Vapor retarder.

1.2 RELATED WORK

- A. Section 05 31 00, STEEL DECKING: Installation of Additional Roof Deck.
- B. Section 06 10 00, ROUGH CARPENTRY: Replacement Parapet Sheathing.
- C. Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING: New Roofing System.
- D. Section 07 60 00, FLASHING AND SHEET METAL: Sheet Metal Counterflashing.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
 - FX-1 (R2016)Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
- C. American Society for Nondestructive Testing (ASNT):
 - SNT-TC-1A (2019)Personnel Qualification and Certification for Nondestructive Testing.
- D. ASTM International (ASTM):
 - C208-12(2017)e2Cellulosic Fiber Insulating Board.
 - C578-19Rigid, Cellular Polystyrene Thermal Insulation.
 - C728-17aPerlite Thermal Insulation Board.
 - C1177/C1177M-17Glass Mat Gypsum Substrate for Use as Sheathing.
 - C1278/C1278M-17Standard Specification Fiber-Reinforced Gypsum Panel.
- E. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
 - DOC PS 1-19Structural Plywood.

DOC PS 2-18Performance Standard for Wood-Based
Structural-Use Panels.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Contractor.
 - d. Installer.
 - e. Other installers responsible for adjacent and intersecting work, including mechanical and electrical equipment installers and metal roof deck installer.
 - 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Removal and installation schedule.
 - b. Removal and installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Removal and installation.
 - f. Temporary roofing including daily terminations.
 - g. Transitions and connections to other work.
 - h. Other items affecting successful completion.
 - 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Description of temporary roof system and components.
 - 3. List of patching materials.
 - 4. Recover board fastening requirements.
 - 5. Temporary roofing installation instructions and removal instructions. Preparation instructions to receive new roofing.

- D. Photographs: Document existing conditions potentially affected by roofing operations before work begins.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Same installer as Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING .

1.7 FIELD CONDITIONS

A. Building Occupancy: Perform work to minimize disruption to normal building operations.

1. Verify occupants are evacuated from affected building areas when working on structurally impaired roof decking above occupied areas.
2. Provide notice minimum 72 hours before beginning activities affecting normal building operations.
3. Examine available information before beginning work of this section.

B. Weather Limitations: Proceed with reroofing preparation only during dry weather conditions as specified for new roofing installation in Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.

1. Remove only as much roofing in one day as can be made watertight in same day.

C. Hazardous materials are not expected in existing roofing system.

1. Do not disturb suspected hazardous materials. When discovered, notify Contracting Officer's Representative.
2. Hazardous materials discovered during execution of the work will be removed by Government as work of a separate contract.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Existing Warranties: No existing roofing warranty in effect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Patching Materials: Match existing roofing system materials.

B. Plywood Sheathing: See Section 06 10 00, ROUGH CARPENTRY.

C. Metal Flashing: See Section 07 60 00, FLASHING AND SHEET METAL.

D. Temporary Protection Materials:

1. Expanded Polystyrene (EPS) Insulation: ASTM C578-19.
2. Plywood: NIST DOC PS 1-19, Grade CD Exposure 1-18.
3. Oriented Strand Board (OSB): NIST DOC PS 2-18, Exposure 1.

E. Temporary Roofing System Materials: Contractor's option.

- F. Recover Board: One of the following:
1. Insulation: See Section 07 22 00, ROOF AND DECK INSULATION.
 2. Fiber Board: ASTM C208-12(2017)e2, Type II, fiber board; 13 mm (1/2 inch) thick.
 3. Glass Mat Gypsum Board: ASTM C1177/C1177M-17, water-resistant; 6 mm (1/4 inch) or 13 mm (1/2 inch).
 4. Fiber Reinforced Gypsum Board: ASTM C1278/C1278M-17, water-resistant; 6 mm (1/4 inch) or 13 mm (1/2 inch) thick.
- G. Fasteners: Type and size required by roof membrane manufacturer to resist wind uplift.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing roofing system indicated to remain.
1. Cover roof membrane with temporary protection materials without impeding drainage.
 2. Limit traffic and material storage to protected areas.
 3. Maintain temporary protection until replacement roofing is completed.
- C. Protect existing construction and completed work from damage.
- D. Coordinate use of rooftop fresh air intakes with Contracting Officer's Representative to minimize effect on indoor air quality.
- E. Ensure temporary protection materials are available for immediate use in case of unexpected rain.
- F. Ensure roof drainage remains functional.
1. Keep drainage systems clear of debris.
 2. Prevent water from entering building and existing roofing system.
- G. Coordinate rooftop utilities remaining active during roofing work with Contracting Officer's Representative.

3.2 RE-ROOFING PREPARATION - GENERAL

- A. Notify Contracting Officer's Representative of planned operations, daily.
1. Identify location and extent of roofing removal.
 2. Request authorization to proceed.

3.3 PARTIAL ROOFING SYSTEM REMOVAL

- A. Remove existing roofing completely, exposing structural roof deck at locations and to extent indicated on drawings.
1. Remove roof insulation and substrate board.

2. Remove or cut-off roofing system fasteners.

3.4 DECK PREPARATION

- A. Inspect structural roof deck after roofing system removal.
- B. Steel Roof Decks:
 1. New additional steel roof deck to be installed over the top of the existing steel roof deck prior to installing new roofing.

3.5 TEMPORARY ROOFING

- A. Install temporary roofing to maintain building watertight.
- B. Remove temporary roofing before installing new roofing.

3.6 BASE FLASHING REMOVAL

- A. Expose base flashings to permit removal.
 1. Two-Piece Counterflashings: Remove cap flashing and store for reuse.
 2. Single Piece Counterflashings: Carefully bend counterflashing.
- B. Remove existing base flashings.
 1. Clean substrates to receive new flashings.
- C. Replace counterflashings damaged during removal.
 1. Counterflashings: See Section 07 60 00 FLASHING AND SHEET METAL.

3.7 DISPOSAL

- A. Collect waste materials in containers.
- B. Remove waste materials from project site, regularly, to prevent accumulation.
- C. Legally dispose of waste materials.

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**SECTION 07 13 52
MODIFIED BITUMINOUS SHEET WATERPROOFING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Modified bituminous sheet material used for exterior below grade waterproofing and split slab waterproofing.

1.2 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. Federal Specifications (Fed. Spec.):

- UU-B-790A Notice 2 v04-1992 ...Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent, and Fire Resistant).

C. ASTM International (ASTM):

- C578-19Rigid, Cellular Polystyrene Thermal Insulation.
- D41/D41M-11(2016)Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.
- D4586/D4586M-07(2018) ..Asphalt Roof Cement, Asbestos-Free.
- D6380/D6380M-03(2018) ..Asphalt Roll Roofing (Organic Felt).

D. American Hardboard Association (AHA):

- A135.4-(r2020)Basic Hardboard.

1.3 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:

- a. Contracting Officer's Representative.
- b. Contractor.
- c. Installer.
- d. Manufacturer's field representative.
- e. Other installers responsible for adjacent and intersecting work, including substrate and flashing installers.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.

- a. Installation schedule.
- b. Installation sequence.
- c. Preparatory work.
- d. Protection before, during, and after installation.
- e. Installation.

- f. Terminations.
 - g. Transitions and connections to other work.
 - h. Inspecting.
 - i. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings: Show size, configuration, and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
 - 3. Sample warranty.
- D. Samples:
 - 1. Waterproofing and Flashing Sheet: 200 mm (8 inch) square, each type and color.
 - 2. Insulation: 200 mm (8 inch) square.
- E. Certificates: Certify products comply with specifications.

1.5 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.7 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
 - 2. Weather Limitations: Install waterproofing only during dry current and forecasted weather conditions.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant waterproofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the waterproofing system materials or workmanship of the installer.
 - 1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Waterproofing System: Modified bituminous sheet material for exterior below grade and split slab waterproofing.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.
- B. Sustainable Construction Requirements:
 - 1. Insulation Recycled Content: Rigid Foam: 9 percent total recycled content, minimum.

2.3 BITUMINOUS SHEET

- A. Cold applied waterproofing membrane composed primarily of modified bituminous material prefabricated in sheet form designed for below grade exterior and split slab waterproofing. Sheet reinforced with fibers at manufacturer's option.
- B. Thickness: Not less than 1.5 mm (60 mils) plus or minus 0.13 mm (5 mils), and bonded to 0.1 mm (4 mil) thick plastic sheet.
- C. Provide release sheet to prevent bonding of bituminous sheet to itself.

2.4 PROTECTION MATERIAL

- A. Polystyrene Insulation: ASTM C578, Type I or VIII, 13 mm (1/2 inch) minimum thickness.
- B. Waterproofed Building Paper: Fed. Spec. UU-B-790A Notice 2, Type I, Grade C.
- C. Roll Roofing: ASTM D6380/D6380M, Class S (smooth), Type III with minimum net mass per unit area of roofing, 2495 g/sq. m (51 lbs./100 sq. ft.).

2.5 ACCESSORIES

- A. Patching Compound: Factory-prepared, non-shrinking, fast-setting, cementitious adhesive compound containing no ferrous metal or oxide.
- B. Primer: ASTM D41/D41M.
- C. Roof Cement: ASTM D4586/D4586M.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
 - 1. Concrete surfaces cured minimum time recommended by waterproofing manufacturer.
 - 2. Substrate to be dry as recommended by waterproofing manufacturer.
- B. Protect existing construction and completed work from damage.
- C. Correct substrate deficiencies.
 - 1. Fill voids, joints, and cracks with patching compound.
- D. Clean substrates. Remove contaminants capable of preventing full adhesion.
- E. Priming:
 - 1. Prime concrete surfaces.
 - 2. Application method, amount of primer and condition or primer before installation of bituminous sheet as recommended by primer manufacturer.
 - 3. Reprime when required according to manufacturer's instructions.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 WATERPROOFING INSTALLATION

- A. Bituminous Sheet Installation:
 - 1. Remove release sheet before application.
 - 2. Lay bituminous sheet from low point to high point so laps shed water.
 - 3. Treat expansion, construction and control joints and evident working cracks as expansion joints. Apply bituminous sheet in double thickness over joint by first applying a strip of bituminous sheet minimum 200 mm (8 inches) wide, centered over joint.
 - 4. Lap seams minimum 50 mm (2 inches).
 - 5. Lay succeeding sheet with laps, and roll or press into place.
 - 6. Repair misaligned or inadequately lapped seams according to manufacturer's instructions.
 - 7. Seal seams and terminations according to sheet manufacturer's instructions.

B. Corner Treatment:

1. At inside and outside corners, apply double cover using an initial strip minimum 280 mm (11 inches) wide, centered along axis of corner.
2. Cover each strip completely by the regular application of bituminous sheet.
3. Provide a fillet or cant on inside corners.
4. Form cants using patching compound.
5. Do not use wood, fiber, and insulating materials for cants.

C. Projection Treatment:

1. Apply a double layer of bituminous sheet around pipes and similar projections at least 150 mm (6 inches) wide.
2. At drains, apply a bead of roof cement over a double layer of bituminous sheet under clamping rings.

D. Patching:

1. Repair tears, punctures, air blisters, and inadequately lapped seams, according to manufacturer's instructions before protection course is applied.

E. Permanent Protection:

1. Vertical Surfaces:
 - a. Install polystyrene insulation, or roll roofing protection material.
 - b. Extend protection full height from footing to top of backfill.
 - c. If graded backfill is used, use roll roofing.

3.4 FIELD QUALITY CONTROL

- A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Inspection:
 1. Do not cover waterproofed surfaces by other materials or backfill until work is approved by Contracting Officer's Representative.

3.5 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed waterproofing surfaces. Remove contaminants and stains.

3.6 PROTECTION

- A. Protect waterproofing from construction operations.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.

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**SECTION 07 21 13
THERMAL INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermal insulation.
 - a. Batt or blanket insulation at exterior furred walls.
 - 2. Acoustical insulation.
 - a. Batt and blanket insulation at interior framed partitions and ceilings.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Adhesives VOC Limits.
- B. Section 03 30 00, CAST-IN-PLACE CONCRETE: Insulation System Cast in Foundation.
- C. Section 07 21 19, FOAMED-IN-PLACE INSULATION: Spray Applied Insulation at Pre-Cast Wall Panels.
- D. Section 07 84 00, FIRESTOPPING: Safing Insulation.
- E. Section 09 54 23, LINEAR METAL CEILINGS: Insulation for Sound Absorptive Pad.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - C552-17e1Cellular Glass Thermal Insulation.
 - C553-13(2019)Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - C954-18Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch to 0.112 inch (2.84 mm) in thickness.
 - C1002-18Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - D312/D312M-16aAsphalt Used in Roofing.
 - E84-20Surface Burning Characteristics of Building Materials.
 - F1667-18aDriven Fasteners: Nails, Spikes, and Staples.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show insulation type, thickness, and R-value for each location.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
- D. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
 - 2. Low Pollutant-Emitting Materials: Show volatile organic compound types and quantities.

1.5 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS**2.1 INSULATION - GENERAL**

- A. Insulation Thickness:
 - 1. Provide thickness indicated when R-value is not shown on drawings.
- B. Insulation Types:
 - 1. Provide one insulation type for each application.
- C. Sustainable Construction Requirements:
 - 1. Insulation Recycled Content:
 - a. Polyisocyanurate/polyurethane rigid foam: 9 percent recovered material.
 - b. Polyisocyanurate/polyurethane foam-in-place: 5 percent recovered material.
 - c. Glass fiber reinforced: 6 percent recovered material.

- d. Phenolic rigid foam: 5 percent recovered material.
- e. Rock wool material: 75 percent recovered material.
- 2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Non-Flooring Adhesives and Sealants.

2.2 THERMAL INSULATION

- A. Exterior Framing or Furring Insulation:
 - 1. Mineral Fiber: ASTM C665, Type II, Class C, Category I where concealed by thermal barrier.
 - 2. Mineral Fiber: ASTM C665, Type III, Class A at other locations.

2.3 ACOUSTICAL INSULATION

- A. Semi Rigid, Batts and Blankets:
 - 1. Widths and lengths to fit tight against framing.
 - 2. Mineral Fiber Batt or Blankets: ASTM C665 FSK faced or unfaced.
 - 3. Maximum Surface Burning Characteristics: ASTM E84.
 - a. Flame Spread Rating: 25.
 - b. Smoke Developed Rating: 450.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install batt and blanket insulation with joints tight. Fill framing voids completely. Seal penetrations, terminations, facing joints, facing cuts, tears, and unlapped joints with tape.
- C. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.
- D. Exterior Framing or Furring Insulation:
 - 1. General:
 - a. Open voids are not acceptable.

- b. Pack behind outlets, around pipes, ducts, and services encased in walls.
 - c. Hold insulation in place with pressure sensitive tape.
 - d. Lap facing flanges together over framing for continuous surface. Seal penetrations through insulation and facings.
2. Metal Studs: Fasten insulation between metal studs, framing, and furring with pressure sensitive tape continuous along flanged edges.
- a. Metal Framing:
 - 1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
 - 2) Tape insulation tightly together without gaps. Cover metal framing members with insulation.

3.3 ACOUSTICAL INSULATION

A. General:

- 1. Install insulation without voids.
- 2. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.
- 3. Pack behind outlets, around pipes, ducts, and services encased in walls.
- 4. Hold insulation in place with pressure sensitive tape.
- 5. Lap facer flanges together over framing for continuous surface. Seal all penetrations through the insulation and facers.
- 6. Do not compress insulation below required thickness except where embedded items prevent required thickness.

B. Semi Rigid, Batts and Blankets:

- 1. When insulation is not full thickness of cavity, adhere insulation to one side of cavity, maintaining continuity of insulation and covering penetrations or embedments.
 - a. Metal Framing:
 - 1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
 - 2) At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing.
 - 3) Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.

3.4 CLEANING

- A. Remove excess adhesive before adhesive sets.

3.5 PROTECTION

- A. Protect insulation from construction operations.
- B. Repair damage.

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**SECTION 07 21 19
FOAMED-IN-PLACE INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermal insulation. Closed-cell spray polyurethane foam.

1.2 RELATED WORK

A. Section 07 21 13, THERMAL INSULATION for foam-plastic board insulation.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

C1029Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.

E84Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Surface preparation and application instructions.

C. Manufacturer's Certification:

1. Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

C. Protect insulation from UV exposure.

D. Protect materials from freezing.

1.7 PROJECT CONDITIONS

A. Ambient and Substrate Temperatures: As recommended by manufacturer.

- B. Moisture: Do not apply polyurethane foam insulation when moisture in form of rain, snow, ice, fog, frost, or dew is expected during application.
- C. Relative Humidity: Do not apply polyurethane foam insulation when relative humidity over 85 percent is expected during application.
- D. Wind: Do not apply polyurethane foam insulation with wind speed above 12 mph (19 kmh).
- E. Do not apply polyurethane foam insulation under ambient conditions outside manufacturer's limits.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of [1.5 lb/cu. ft. (24 kg/cu. m)] and minimum aged R-value at 1-inch (25.4-mm) thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F (43 K x sq. m/W at 24 deg C).
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: [25] [75] or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
- D. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Cavity Walls: Install into cavities to thickness indicated on Drawings.
- F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 CLEANING

- A. Remove excess adhesive before adhesive sets.

3.4 PROTECTION

- A. Protect insulation from construction operations.
- B. Repair damage.

- - E N D - -

**SECTION 07 22 00
ROOF AND DECK INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
- B. Roof and deck insulation, and vapor retarder, on new metal deck substrates ready to receive roofing membrane.
- C. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Non-Flooring Adhesives and Sealants VOC Limits.
- B. Section 06 10 00, ROUGH CARPENTRY: Wood Blocking and Edge Strips.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Society of Civil Engineers
ASCE 7-16Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- C. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):
Standard 90.1-13Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. ASTM International (ASTM):
C726-17Mineral Fiber Roof Insulation Board.
C728-17aPerlite Thermal Insulation Board.
C1289-19Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
D41/D41M-11 (2016)Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
D312/D312M-16aAsphalt Used in Roofing.
D2178/D2178M-15aAsphalt Glass Felt Used in Roofing and Waterproofing.
D2822/D2822M-05(2011)e1 Asphalt Roof Cement, Asbestos Containing.
D4586/D4586M-07(2018) ..Asphalt Roof Cement, Asbestos-Free.
E84-20Surface Burning Characteristics of Building Materials.
F1667-18aDriven Fasteners: Nails, Spikes, and Staples.
- E. National Roofing Contractors Association (NRCA):

Manual-15The NRCA Roofing Manual: Membrane Roof Systems-
2019.

F. UL LLC (UL):

Listed Online Certifications Directory.

G. U.S. Department of Agriculture (USDA):

USDA BioPreferred Program Catalog.

H. U.S. Department of Commerce National Institute of Standards and
Technology (NIST):

DOC PS 1-19Structural Plywood.

DOC PS 2-18Performance Standard for Wood-Based
Structural-Use Panels.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA,
AND SAMPLES.

B. Submittal Drawings:

- 1. Show size, configuration, and installation details.
 - a. Nailers, cants, and terminations.
 - b. Layout of insulation showing slopes, tapers, penetrations, and edge conditions.

C. Manufacturer's Literature and Data:

- 1. Description of each product.

D. Samples:

- 1. Roof insulation, each type.
- 2. Fasteners, each type.

E. Sustainable Construction Submittals:

- 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- 2. Biobased Content:
 - a. Show type and quantity for each product.
- 3. Low Pollutant-Emitting Materials:
 - a. Show volatile organic compound types and quantities.
 - b. Certify each product contains no added urea formaldehyde.

F. Qualifications: Substantiate qualifications meet specifications.

- 1. Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Same installer as Division 07 roofing section installer.

1.6 DELIVERY

- A. Comply with recommendations of NRCA Manual.
- B. Deliver products in manufacturer's original sealed packaging.
- C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.
- D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Comply with recommendations of NRCA Manual.
- B. Store products indoors in dry, weathertight facility.
- C. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant vapor retarder and insulation against material and manufacturing defects as part of Division 07 roofing system warranty.

PART 2 - PRODUCTS**2.1 SYSTEM PERFORMANCE**

- A. Insulation Thermal Performance:
 - 1. Overall Average R-Value: RSI-57 (R-33), minimum.
 - 2. Any Location R-Value: RSI-17 (R-10), minimum.
- B. Wind Uplift Resistance: Provide roof insulation complying with requirements specified in Division 07 roofing section.
- C. Insulation on Metal Decking: UL labeled indicating compliance with one of the following:
 - 1. UL Listed.
 - 2. Insulation Surface Burning Characteristics: When tested according to ASTM E84.
 - a. Flame Spread Rating: 75 maximum.
 - b. Smoke Developed Rating: 150 maximum.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.
- B. Sustainable Construction Requirements:

1. Insulation Recycled Content:
 - a. Mineral Fiber: 75 percent total recycled content, minimum.
 - b. Fiberglass: 20 percent total recycled content, minimum.
 - c. Cellulose: 75 percent post-consumer recycled content, minimum.
 - d. Perlite Composite Board: 23 percent post-consumer recycled content, minimum.
 - e. Rigid Foam: 9 percent total recycled content, minimum.
 - f. Glass Fiber Reinforced Rigid Foam: 6 percent total recycled content, minimum.
2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Non-flooring adhesives and sealants.
 - b. Composite wood and agrifiber.
3. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.

2.3 ADHESIVES

- A. Primer: ASTM D41/D41M.
- B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- C. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to adhere roof insulation to another insulation layer.
- D. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to adhere roof insulation to another insulation layer.
- E. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.
- F. Roof Cement: Asbestos free, ASTM D2822/D2822M, Type I or Type II; or, ASTM D4586/D4586M, Type I or Type II.

2.4 ROOF AND DECK INSULATION

- A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.

C. Tapered Roof Insulation System:

1. Fabricate of polyisocyanurate. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
4. Minimum slope 1/48 (1/4 inch per 12 inches).

2.5 INSULATION ACCESSORIES

A. Glass (Felt): ASTM D2178/D2178M, Type VI, heavy duty ply sheet.

B. Vapor Retarder:

1. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt impregnated.
2. Self-Adhering Sheet Vapor Retarder: ASTM D1970/D1970M, minimum 1.0 mm (40 mils) thick membrane of HDPE film fully coated with asphalt adhesive, or 0.76 to 1.0 mm (30 to 40 mils) thick membrane of butyl rubber based adhesive backed by a layer of high density cross-laminated polyethylene; maximum permeance rating of 6 ng/Pa/s/sq. m (0.1 perms).

2.6 ACCESSORIES

A. Fasteners: Corrosion-resistant carbon steel fasteners and galvalume-coated steel or plastic round plates for fastening substrate board and insulation to roof deck.

B. Nails: ASTM F1667; type to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with requirements of Division 07 roofing section.

3.2 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.3 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Comply with requirements of UL for insulated steel roof deck.

C. Attach substrate board and other products to meet requirements of Division 07 roofing section.

3.4 VAPOR RETARDER INSTALLATION

A. Vapor Retarder Installation, General:

1. Install continuous vapor retarder on roof decks where indicated.
2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
3. Seal penetrations through vapor retarder with roof cement to prevent moisture entry from below.

3.5 INSULATION INSTALLATION

A. Insulation Installation, General:

1. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate before installation of insulation.
2. Use same insulation as existing for roof repair and alterations unless specified otherwise.

B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.
2. Insulation on Metal Decks: Provide insulation in minimum thickness recommended by insulation manufacturer to span deck flutes. Support edges of insulation on metal deck ribs.
3. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascias and similar items.
4. Where tapered insulation is used, maintain insulation thickness at high points and roof edges shown on drawings.
 - a. Low Point Thickness: Minimum 38 mm (1-1/2 inches).
5. Use minimum two layers of insulation when required thickness is 68 mm (2.7 inch) or greater.

C. Lay insulating units with close joints, in regular courses and with end joints staggered.

1. Stagger joints between layers minimum 150 mm (6 inches).

D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.

E. Seal cut edges at penetrations and at edges against blocking with bitumen or roof cement.

F. Cut to fit tightly against blocking or penetrations.

G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.

H. Installation Method:

1. Mechanically Fastened and Adhered Insulation:
 - a. Fasten first layer of insulation according to "Mechanically Fastened Insulation" requirements.
 - b. Fasten each subsequent layer of insulation according to "Adhered Insulation" requirements.
2. Mechanically Fastened Insulation (first layer):
 - a. Fasten insulation according to requirements in Division 07 roofing section.
 - b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section and ASCE-7.
3. Adhered Insulation (subsequent layers):
 - a. Prime substrate as required.
 - b. Set each layer of insulation firmly in solid mopping of hot asphalt.
 - c. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.
 - d. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.

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SECTION 07 42 13.23
METAL COMPOSITE MATERIAL 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 metal composite material wall panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
 8. Review procedures for repair of panels damaged after installation.
 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal Composite Material Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical metal composite material panel assembly as shown on Drawings, including supports, attachments, and accessories.

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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.

- b. Deterioration of metals and other materials beyond normal weathering.
- 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

- A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
1. Basis of Design Product: Petersen Aluminum Corp., PAC-CLAD, PAC-3000 CS.
- B. Aluminum-Faced Composite Wall Panels : Formed with 0.020-inch- (0.50-mm-) thick, coil-coated aluminum sheet facings.
1. Panel Thickness: 0.157 inch (4 mm).
 2. Core: Standard.
 3. Exterior Finish: Three-coat fluoropolymer.
 - a. Color: Musket Gray.
- C. Attachment Assembly Components: Formed from extruded aluminum.
- D. Attachment Assembly: Manufacturer's standard clip system.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal

composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
 - 1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal composite material panels.
 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal composite material panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
- F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
- G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed

edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

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**SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Thermoplastic Polyolefin (TPO) sheet roofing adhered to insulated roof deck.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Non-Flooring Adhesives and Sealants VOC Limits.
- B. Section 07 01 50.19, PREPARATION FOR REROOFING: Preparation of Existing Membrane Roofs and Repair Areas.
- C. Section 07 22 00, ROOF AND DECK INSULATION: Roof Insulation.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
 - FX-1-16Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
 - 7-16Minimum Design Loads for Buildings and Other Structures.
- D. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
 - 90.1-13Energy Standard for Buildings Except Low-Rise Residential Buildings.
- E. ASTM International (ASTM):
 - C67-20Sampling and Testing Brick and Structural Clay Tile.
 - C140/C140M-20aSampling and Testing Concrete Masonry Units and Related Units.
 - C1371-15Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
 - C1549-16Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - D1876-08(2015)e1Peel Resistance of Adhesives (T-Peel Test).

D4263-83(2018)Indicating Moisture in Concrete by the Plastic Sheet Method.

D4434/D4434M-15Poly(Vinyl Chloride) Sheet Roofing.

D6878/D6878M-13Thermoplastic Polyolefin Based Sheet Roofing.

E408-13Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

E1918-16Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

E1980-11(2019)Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

F. Cool Roof Rating Council (CRRC):

1-20Product Rating Program.

G. National Roofing Contractors Association (NRCA):

Manual-19The NRCA Roofing Manual: Membrane Roofing Systems.

H. U.S. Department of Agriculture (USDA):

BioPreferred® Program Catalog.

I. UL LLC (UL):

580-06Tests for Uplift Resistance of Roof Assemblies.

1897-20Uplift Tests for Roof Covering Systems.

J. U.S. Department of Commerce National Institute of Standards and Technology (NIST):

DOC PS 1-19Structural Plywood.

DOC PS 2-18Performance Standard for Wood-Based Structural-Use Panels.

K. U.S. Environmental Protection Agency (EPA):

Energy StarENERGY STAR Program Requirements for Roof Products Version 3.0.

1.4 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:

a. Contracting Officer's Representative.

b. Architect/Engineer.

c. Inspection and Testing Agency.

d. Contractor.

e. Installer.

f. Manufacturer's field representative.

- g. Other installers responsible for adjacent and intersecting work, including roof deck, flashings, roof penetrations, roof accessories, utility penetrations, rooftop curbs and equipment.
- 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Inspecting and testing.
 - i. Other items affecting successful completion.
 - j. Pullout test of fasteners.
 - k. Material storage, including roof deck load limitations.
- 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Roof membrane layout.
 - 2. Roofing membrane seaming and joint details.
 - 3. Roof membrane penetration details.
 - 4. Base flashing and termination details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Minimum fastener pullout resistance.
 - 3. Installation instructions.
 - 4. Warranty.
- D. Samples:
 - 1. Roofing Membrane: 150 mm (6 inch) square.
 - 2. Base Flashing: 150 mm (6 inch) square.
 - 3. Fasteners: Each type.
 - 4. Roofing Membrane Seam: 300 mm (12 inches) square.
- E. Sustainable Construction Submittals:
 - 1. Solar Reflectance Index (SRI) for roofing membrane.

2. Low Pollutant-Emitting Materials:
 - a. Show volatile organic compound types and quantities.
3. Energy Star label for roofing membrane.
- F. Certificates: Certify products comply with specifications.
 1. Fire and windstorm classification.
 2. Energy performance requirements.
- G. Qualifications: Substantiate qualifications comply with specifications.
 1. Installer, including supervisors with project experience list.
 2. Manufacturer's field representative with project experience list.
- H. Field quality control reports.
- I. Temporary protection plan. Include list of proposed temporary materials.
- J. Operation and Maintenance Data:
 1. Maintenance instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Approved by roofing system manufacturer as installer for roofing system with specified warranty.
 2. Regularly installs specified products.
 3. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
 4. Employs full-time supervisors experienced installing specified system and able to communicate with Contracting Officer's Representative and installer's personnel.
- B. Manufacturer's Field Representative:
 1. Manufacturer's full-time technical employee or independent roofing inspector.
 2. Individual certified by Roof Consultants Institute as Registered Roof Observer.

1.7 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

- A. Comply with NRCA Manual storage and handling requirements.
- B. Store products indoors in dry, weathertight facility.
- C. Store adhesives according to manufacturer's instructions.
- D. Protect products from damage during handling and construction operations.
- E. Products stored on the roof deck must not cause permanent deck deflection.

1.9 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
 - 2. Weather Limitations: Install roofing only during dry current and forecasted weather conditions.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant roofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the roofing system materials or workmanship of the installer.
 - 1. Warranty Period: 10 years.

PART 2 - PRODUCTS**2.1 SYSTEM DESCRIPTION**

- A. Roofing System: Thermoplastic Polyolefin (TPO) sheet roofing adhered to insulated roof deck.

2.2 SYSTEM PERFORMANCE

- A. Design roofing system complying with specified performance:
 - 1. Load Resistance: ASCE/SEI 7; Design criteria: as indicated on Drawings.
 - 2. Energy Performance:
 - a. EPA Energy Star Listed for low-slope roof products.
 - b. ASTM E1980; Minimum 78 Solar Reflectance Index (SRI).

2.3 PRODUCTS - GENERAL

- A. Provide roof system components from one manufacturer.
- B. Sustainable Construction Requirements:
 - 1. Solar Reflectance Index: 78 minimum.

2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:

a. Non-flooring adhesives and sealants.

2.4 TPO ROOFING MEMBRANE

1. TPO Sheet: ASTM D6878/D6878M, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with no backing.

2.5 MEMBRANE ACCESSORY MATERIALS

- A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- B. Factory Formed Flashings: Inside and outside corners, pipe boots, and other special flashing shapes to minimize field fabrication.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Metal Termination Bars: Manufacturer's standard, stainless-steel or aluminum, 25 mm wide by 3 mm thick (1-inch wide by 1/8 inch thick) factory drilled for fasteners.
- E. Battens: Manufacturer's standard, galvanized or galvanized steel sheet, 25 mm wide by 1.3 mm thick (1-inch wide by 0.05 inch thick), factory punched for fasteners.
- F. Fasteners: Manufacturer's standard coated steel with metal or plastic plates, to suit application.
- G. Primers, Sealers, T-Joint Covers, Lap Sealants, and Termination Reglets: As specified by roof membrane manufacturer.
- H. Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.

2.6 ACCESSORIES

- A. Temporary Protection Materials:
 - 1. Expanded Polystyrene (EPS) Insulation: ASTM C578.
 - 2. Plywood: NIST DOC PS 1, Grade CD Exposure 1.
 - 3. Oriented Strand Board (OSB): NIST DOC PS 2, Exposure 1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine and verify substrate suitability with roofing Installer and roofing inspector present.
 - 1. Verify roof penetrations are complete and secured against movement
 - 2. Verify roof deck is adequately secured to resist wind uplift.

3. Verify roof deck is clean, dry, and in-plane ready to receive roofing system.

B. Correct unsatisfactory conditions before beginning roofing work.

3.2 PREPARATION

A. Complete roof deck construction before beginning roofing work:

1. Curbs, blocking, edge strips, nailers, cants, and other components to which insulation, roofing, and base flashing is attached in place ready to receive insulation and roofing.

2. Coordinate roofing membrane installation with flashing work and roof insulation work so insulation and flashing are installed concurrently to permit continuous roofing operations.

3. Complete installation of flashing, insulation, and roofing in same day except for the area where temporary protection is required when work is stopped for inclement weather or end of work day.

B. Dry out surfaces including roof deck flutes, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates, only.

C. Broom clean roof decks. Remove dust, dirt and debris.

D. Remove projections capable of damaging roofing materials.

E. Existing Membrane Roofs and Repair Areas:

1. Comply with requirements in Section 07 01 50.19 PREPARATION FOR REROOFING.

3.3 TEMPORARY PROTECTION

A. Install temporary protection consisting of a temporary seal and water cut-offs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.

B. Install temporary cap flashing over top of base flashings where permanent flashings are not in place to protect against water intrusion into roofing system. Securely anchor in place to prevent blow off and damage by construction activities.

C. Temporarily seal exposed insulation surfaces within roofing membrane.

1. Apply temporary seal and water cut off by extending roofing membrane beyond insulation and securely embedding edge of the roofing membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant. Weight roofing membrane edge with sandbags, to prevent displacement; space sandbags maximum 2400 mm (8 feet) on center.

2. Direct water away from work. Provide drainage, preventing water accumulation.
3. Check daily to ensure temporary seal remains watertight. Reseal open areas and weight down.
- D. Before the work resumes, cut off and discard portions of roof membrane in contact with temporary seal.
 1. Cut minimum 150 mm (6 inches) back from sealed edges and surfaces.
- E. Remove sandbags and store for reuse.

3.4 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Comply with NRCA Manual installation requirements.
- C. Comply with FM Approvals 4474, UL 580, or UL 1897 for uplift resistance.
- D. Do not allow membrane and flashing to contact surfaces contaminated with asphalt, coal tar, oil, grease, or other substances incompatible with TPO.

3.5 ROOFING INSTALLATION

- A. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- B. Begin installation at the low point of the roof and work towards the high point. Lap membrane shingled in water flow direction.
- C. Position the membrane free of buckles and wrinkles.
- D. Roll membrane out; inspect for defects as membrane is unrolled. Remove defective areas:
 1. Lap edges and ends of sheets 50 mm (2 inches) or more as recommended by the manufacturer.
 2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434/D4434M.
 3. Check seams to ensure continuous adhesion and correct defects.
 4. Finish seam edges with beveled bead of lap sealant.
 5. Finish seams same day as membrane is installed.
 6. Anchor membrane perimeter to roof deck or parapet wall as indicated on drawings.

7. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
 8. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (4 inches) beyond cut.
- E. Membrane Perimeter Anchorage:
1. Install batten at perimeter of each roof area, curb flashing, expansion joints and similar penetrations on top of roof membrane as indicated on drawings.
 2. Mechanically Fastening:
 - a. Space fasteners maximum 300 mm (12 inches) on center, starting 25 mm (1 inch) from ends.
 - b. When battens are cut, round edges and corners before installing.
 - c. After mechanically fastening strip cover and seal strip with a 150 mm (6 inch) wide roof membrane strip; heat weld to roof membrane and seal edges.
 - d. At gravel stops and fascia-cants turn roofing membrane down over front edge of the blocking, cant, or nailer. Secure roofing membrane to vertical portion of nailer; or, if required by the membrane manufacturer, with fasteners spaced maximum 150 mm (6 inches) on centers.
 - e. At parapet walls intersecting building walls and curbs, secure roofing membrane to structural deck with fasteners 150 mm (6 inches) on centers or as shown in NRCA manual.
- F. Adhered System:
1. Apply bonding adhesive in quantities required by roof membrane manufacturer.
 2. Fold sheet back on itself, clean and coat the bottom side of the membrane and the top of substrate with adhesive. Do not coat the lap joint area.
 3. After adhesive has set according to adhesive manufacturer's instruction, roll roofing membrane into adhesive minimizing voids and wrinkles.
 4. Repeat for other half of sheet.
- 3.6 FLASHING INSTALLATION**
- A. Install flashings same day as roofing membrane is installed. When flashing cannot be completely installed in one day, complete installation until flashing is watertight and provide temporary covers or seals.

B. Flashing Roof Drains:

1. Install roof drain flashing as recommended by roofing membrane manufacturer.
 - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
 - b. Do not allow the roof cement to come in contact with TPO roofing membrane.
 - c. Adhere roofing membrane to metal flashing with bonding adhesive.
2. Turn down the metal drain flashing and roofing membrane into drain body. Install clamping ring and strainer.

C. Installing Base Flashing and Pipe Flashing:

1. Install flashing sheet to pipes, wall or curbs to minimum 200 mm (8 inches) above roof surfaces and extending roofing manufacturer's standard lap dimension onto roofing membranes.
 - a. Adhere flashing with bonding adhesive.
 - b. Form inside and outside corners of flashing sheet according to NRCA manual. Form pipe flashing according to NRCA manual.
 - c. Lap ends roofing manufacturer's standard dimension.
 - d. Heat weld flashing membranes together and flashing membranes to roofing membranes. Finish exposed edges with lap sealant.
 - e. Install flashing membranes according to NRCA manual.
2. Anchor top of flashing to walls and curbs with fasteners spaced maximum 150 mm (6 inches) on center. Use surface mounted fastening strip with sealant on ducts. Use pipe clamps on pipes or other round penetrations.
3. Apply sealant to top edge of flashing.

D. Repairs to Membrane and Flashings:

1. Remove sections of roofing membrane or flashing that are creased, wrinkled, or fishmouthed.
2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Heat weld to roofing membrane or flashing sheet. Finish edge of lap with lap sealant.

3.7 FIELD QUALITY CONTROL**A. Manufacturer Services:**

1. Inspect initial installation, installation in progress, and completed work.

2. Issue supplemental installation instructions necessitated by field conditions.
3. Prepare and submit inspection reports.
4. Certify completed installation complies with manufacturer's instructions and warranty requirements.

3.8 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed roofing surfaces. Remove contaminants and stains.

3.9 PROTECTION

- A. Protect roofing system from traffic and construction operations.
 1. Protect roofing system when used for subsequent work platform, materials storage, or staging.
 2. Distribute scaffolding loads to exert maximum 50 percent roofing system materials compressive strength.
- B. Loose lay temporary insulation board overlaid with plywood or OSB.
 1. Weight boards to secure against wind uplift.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

- - - E N D - - -

**SECTION 07 60 00
FLASHING AND SHEET METAL**

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae and drainage specialties are specified in this section.

1.2 RELATED WORK

- A. Section 07 54 23 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING: Membrane base flashings and stripping.
- B. Section 07 92 00, JOINT SEALANTS: Joint Sealants.
- C. Section 09 06 00, SCHEDULE FOR FINISHES: Color of factory coated exterior architectural metal and anodized aluminum items.
- D. Section 09 91 00, PAINTING: Paint materials and application.
- E. Division 22, PLUMBING: Integral flashing components of manufactured roof specialties and accessories or equipment.
- F. Section 22 14 00, FACILITY STORM DRAINAGE: Flashing of Roof Drains.
- G. Division 23 HVAC: Integral flashing components of manufactured roof specialties and accessories or equipment.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. Aluminum Association (AA):
 - AA-C22A41Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick
 - AA-C22A42Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick
 - AA-C22A44Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish
- C. American National Standards Institute/Single-Ply Roofing Institute/Factory Mutual (ANSI/SPRI/FM):
 - 4435/ES-1-11Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems
- D. American Architectural Manufacturers Association (AAMA):

AAMA 620-02Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum

AAMA 621-02Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. ASTM International (ASTM):

A240/A240M-20Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A653/A653M-20Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-08 (2014)Solder Metal

B209-14Aluminum and Aluminum-Alloy Sheet and Plate

D173/D173M-03 (2018)Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-16Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187/D1187M-97 (2018) ..Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-20Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D4586/D4586M-07 (2018) ..Asphalt Roof Cement, Asbestos Free

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

G. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06Metal Finishes Manual

H. Federal Specification (Fed. Spec):

A-A-1925AShield, Expansion; (Nail Anchors)

UU-B-790ABuilding Paper, Vegetable Fiber

I. International Code Commission (ICC): International Building Code, Current Edition

1.4 PERFORMANCE REQUIREMENTS

- A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:
 - 1. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 pound force/square foot):
 - 2.87-kPa (60 pound force/square foot) perimeter uplift force, 4.31-kPa (90 pound force/square foot) corner uplift force, and 1.44-kPa (30 pound force/square foot) outward force.
- B. Wind Design Standard: Fabricate and install copings and roof-edge flashings tested per ANSI/SPRI/FM ES-1 to resist design pressure indicated on Drawings.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: For all specified items in this section and other related sections, including:
 - 1. Flashings
 - 2. Copings
 - 3. Gravel Stop-Fascia
 - 4. Gutter and Conductors
- C. Manufacturer's Literature and Data: For all specified items.
 - 1. Fascia-cant
- D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

- A. Stainless Steel: ASTM A240, Type 302B, dead soft temper.
- B. Aluminum Sheet: ASTM B209, alloy 3003-H14
- C. Galvanized Sheet: ASTM, A653.

2.2 FLASHING ACCESSORIES

- A. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m² (6 pounds/100 square feet).
- B. Bituminous Paint: ASTM D1187, Type I.
- C. Fasteners:
 - 1. Use stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
 - 2. Nails:
 - a. Minimum diameter for aluminum nails 3 mm (0.105 inch).
 - b. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.

- c. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
- 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
- 4. Expansion Shields: Fed Spec A-A-1925A.
- D. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- E. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
 - 1. Stainless steel: 0.25 mm (0.010 inch) thick.
 - 2. Galvanized steel: 0.5 mm (0.021 inch) thick.
- C. Exposed Locations:
 - 1. Stainless steel: 0.4 mm (0.015 inch).
- D. Thickness of aluminum or galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

- A. Jointing:
 - 1. Joints shall conform to following requirements:
 - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
 - b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
 - c. Lap joints shall finish not less than 100 mm (4 inches) wide.
 - 2. Flat and lap joints shall be made in direction of flow.
- B. Expansion and Contraction Joints:
 - 1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
 - 2. Space joints as shown or as specified.
 - 3. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet)
 - 4. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
 - 5. Fabricate joint covers of same thickness material as sheet metal served.
- C. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.

2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

2.5 FINISHES

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:
 1. Stainless Steel: Finish No. 2B or 2D.
 2. Aluminum:
 - a. Fluorocarbon Finish: AAMA 620, high performance organic coating.
 3. Steel and Galvanized Steel:
 - a. Manufacturer's finish:
 - 1) Fluorocarbon Finish: AAMA 621, high performance organic coating.

2.6 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. Stainless steel, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
 1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
 2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
 3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
 4. Manufactured assemblies may be used.
 5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
 6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
- C. One-piece Counterflashing:
 1. Back edge turned up and fabricate to lock into reglet in concrete.
 2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).
- D. Two-Piece Counterflashing:

1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
 2. Counterflashing upper edge designed to snap lock into receiver.
- E. Surface Mounted Counterflashing; one or two piece:
1. Use at existing or new surfaces where flashing cannot be inserted in vertical surface.
 2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
 3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

2.7 GRAVEL STOPS

- A. General:
1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
 2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
 3. Fabricate roof flange not less than 100 mm (4 inches) wide.
 4. Fabricate top edge to extend above roof not less than 25 mm (one inch).
 5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
 - a. Fabricate of one-piece material of suitable width for fascia height as shown.
 - b. Fabricate bottom edge of formed fascia to receive edge strip.
 - c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).
- B. Formed Flat Sheet Metal Gravel Stops and Fascia:
1. Fabricate as shown of 1.25 mm (0.050 inch) thick aluminum.
 2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.

3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.

2.8 HANGING GUTTERS

- A. Fabricate gutters of not less than the following:
 1. 1.3mm (0.051inch) thick aluminum.
- B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.
- C. Building side of gutter shall be not less than 25 mm (1 inch) higher than exterior side.
- D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately 19 mm (3/4 inch) unless shown otherwise.
- E. Gutter Spacers:
 1. Fabricate of same material and thickness as gutter.
 2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
 3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
 4. Rivet and solder to gutter except rivet and seal to aluminum.
- F. Outlet Tubes:
 1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
 2. Lock and solder longitudinal seam except use sealant in lieu of solder with aluminum.
 3. Seal aluminum tube to gutter and rivet to gutter.
- G. Gutter Brackets:
 1. Fabricate of same metal as gutter. Use the following:
 - a. 5 by 25 mm (3/16 by 1 inch) aluminum.
 2. Fabricate to gutter profile.

3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

2.9 CONDUCTORS (DOWNSPOUTS)

- A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long [with 19 mm (3/4 inch) wide flat locked seams].
 1. Fabricate open face channel shape with hemmed longitudinal edges.
- B. Fabricate elbows by mitering, riveting, and sealing aluminum. Lap upper section to the inside of the lower piece.
- C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual for rectangular and round shapes.
- D. Conductor Heads:
 1. Fabricate of same material as conductor.
 2. Fabricate conductor heads 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.
 3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
 4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
 5. Extend wall edge not less than 25 mm (one inch) above front edge.
 6. Seal joints for water tight assembly.
 7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

2.10 REGLETS

- A. Fabricate reglets of one of the following materials:
 1. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
 2. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
- B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.
- C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

- D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- E. Fabricate mitered corners, fittings, and special shapes as may be required by details.
- F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.11 SCUPPERS

- A. Fabricate scuppers with minimum of 100 mm (4 inch) wide flange.
- B. Provide flange at top on through wall scupper to extend to top of base flashing.
- C. Fabricate exterior wall side to project not less than 13 mm (1/2 inch) beyond face of wall with drip at bottom outlet edge.
- D. Fabricate exterior wall flange for through wall scupper not less than 25 mm (one inch) wide on top and sides with edges hemmed.
- E. Fabricate scupper 200 mm (8 inch) wide and 125 mm (5 inch) high for through wall scupper.
- F. Seal joints watertight.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
 - 2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
 - 3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
 - 4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
 - 5. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.

6. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
7. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
8. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
9. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
10. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
11. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
12. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with waterproof building paper, or a coat of bituminous paint.
13. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
 - a. Paint dissimilar metal with a coat of bituminous paint.
14. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
15. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint.

3.2 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 200 mm (8 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch).

5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
 6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.
- B. One Piece Counterflashing:
1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
 2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
 3. Where flashing is surface mounted on flat surfaces.
 - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
 - 1) Locate fasteners in masonry mortar joints.
 - 2) Use screws to sheet metal or wood.
 - b. Fill joint at top with sealant.
- C. When counter flashing is a component of other flashing install as shown.

3.3 REGLETS

- A. Install reglets in a manner to provide a watertight installation.
- B. Locate reglets not less than 200 mm (8 inch) nor more than 400 mm (16 inch) above roofing.
- C. Butt and align end joints on each section of reglet and securely hold in position until concrete or mortar are hardened:
 1. Coordinate reglets for anchorage into concrete with formwork construction.

3.4 GRAVEL STOPS

- A. General:
 1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
 2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
 3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.

4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
 5. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI/FM ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.
- B. Sheet metal gravel stops and fascia:
1. Install with end joints of splice plates sheets lapped three inches.
 2. Hook the lower edge of fascia into a continuous edge strip.
- C. Scuppers:
1. Set scupper at roof water line and fasten to wood blocking.
 2. Coordinate to lap over conductor head and to discharge water into conductor head.

3.5 COPINGS

- A. General:
1. On walls topped with a wood plank, install a continuous edge strip on the front edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
 2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing.
 3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.
- B. Aluminum Coping:
1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
 2. Install joint covers, centered at each joint, and securely lock in place.

3.6 HANGING GUTTERS

- A. Hang gutters with high points equidistant from downspouts. Slope at 1:200 (1/16 inch per foot).
- B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal lapped joints.
- C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to fascia or wood nailer by at least two screws or nails.
1. For aluminum gutters use aluminum brackets
 2. Use brass or stainless steel screws.

D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.

E. Gutter Expansion Joint:

1. Locate expansion joints midway between outlet tubes.
2. Provide at least a 25 mm (one inch) expansion joint space between end baffles of gutters.
3. Install a cover plate over the space at expansion joint.
4. Fasten cover plates to gutter section on one side of expansion joint only.
5. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.

3.7 CONDUCTORS (DOWNSPOUTS)

- A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.
- B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.
- C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

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SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.
- B. Section 07 92 00, JOINT SEALANTS: Sealants and application.
- C. Section 23 31 00, HVAC DUCTS AND CASINGS: Fire and smoke damper assemblies in ductwork.
- D. Section 23 37 00, AIR OUTLETS AND INLETS: Fire and smoke damper assemblies in ductwork.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
 - 1. Volatile organic compounds per volume as specified in
PART 2 - PRODUCTS.
- C. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- D. List of FM, UL, or WH classification number of systems installed.
- E. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.
- F. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

1.5 QUALITY ASSURANCE

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

- E84-20Surface Burning Characteristics of Building Materials
- E699-16Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components
- E814-13a(2017)Fire Tests of Penetration Firestop Systems
- E2174-20aStandard Practice for On-Site Inspection of Installed Firestop Systems
- E2393-20Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

C. FM Global (FM):

- Annual Issue Approval Guide Building Materials
- 4991-13Approval of Firestop Contractors

D. Underwriters Laboratories, Inc. (UL):

- Annual Issue Building Materials Directory

E. Annual Issue Fire Resistance Directory

- 723-Edition 11(2018) ...Standard for Test for Surface Burning Characteristics of Building Materials
- 1479-04(2015)Fire Tests of Penetration Firestops

F. Intertek Testing Services - Warnock Hersey (ITS-WH):

- Annual Issue Certification Listings

G. Environmental Protection Agency (EPA):

- 40 CFR 59(2014)National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

- A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the

passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.

- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 inches) nominal pipe or 0.01 square meter (16 square inches) in overall cross sectional area.
- C. Firestop sealants used for firestopping or smoke sealing to have the following properties:
 - 1. Contain no flammable or toxic solvents.
 - 2. Release no dangerous or flammable out gassing during the drying or curing of products.
 - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
 - 4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
 - 5. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
 - a. Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
- D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:
 - 1. Classified for use with the particular type of penetrating material used.
 - 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
- E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.

- F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.
- H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 101 mm (4 inches) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.2 FIRE STOPPING IN RATED PARTITIONS

- A. Provide sealant in rated partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Provide mineral fiber filler and bond breaker behind sealant.
- C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.
- B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.
- C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 INSTALLATION

- A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.

3.4 CLEAN-UP

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Clean up spills of liquid type materials.
- C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 firestopping immediately and install new materials to provide firestopping complying with specified requirements.

3.5 INSPECTIONS AND ACCEPTANCE OF WORK

- A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).
- B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

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**SECTION 07 92 00
JOINT SEALANTS**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- C. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Glazed Aluminum Curtain Wall: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
- F. Sound Rated Gypsum Partitions/Sound Sealants: Section 09 29 00, GYPSUM BOARD.

1.3 QUALITY ASSURANCE:

- A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.
- B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by

- reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:
1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.
 2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
 3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
1. Locate test joints where indicated in construction documents or, if not indicated, as directed by COR.
 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
 3. Notify COR seven (7) days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
- F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections and to demonstrate aesthetic effects and qualities of materials and execution:

1. Joints in mockups of assemblies that are indicated to receive elastomeric joint sealants.

1.4 CERTIFICATION:

- A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
 1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Installer qualifications.
- D. Contractor certification.
- E. Manufacturer's installation instructions for each product used.
- F. Cured samples of exposed sealants for each color.
- G. Manufacturer's Literature and Data:
 1. Primers
 2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- H. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

- A. Environmental Limitations:
 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:

- 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Backing Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY:

- A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. ASTM International (ASTM):
 - C509-06Elastomeric Cellular Preformed Gasket and Sealing Material
 - C612-14Mineral Fiber Block and Board Thermal Insulation
 - C717-14aStandard Terminology of Building Seals and Sealants
 - C734-06 (R2012)Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering
 - C794-10Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
 - C919-12.Use of Sealants in Acoustical Applications.
 - C920-14aElastomeric Joint Sealants.

- C1021-08 (R2014)Laboratories Engaged in Testing of Building Sealants
- C1193-13Standard Guide for Use of Joint Sealants.
- C1248-08 (R2012)Test Method for Staining of Porous Substrate by Joint Sealants
- C1330-02 (R2013)Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
- C1521-13Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
- D217-10Test Methods for Cone Penetration of Lubricating Grease
- D1056-14Specification for Flexible Cellular Materials—Sponge or Expanded Rubber
- E84-09Surface Burning Characteristics of Building Materials
- C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide
- D. Environmental Protection Agency (EPA):
40 CFR 59 (2014)National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SEALANTS:

- A. Exterior Sealants:
1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
 2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
 3. Provide location(s) of exterior sealant as follows:
 - a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
 - b. Metal to metal.
 - c. Masonry to masonry or stone.
 - d. Stone to stone.
 - e. Cast stone to cast stone.
 - f. Masonry expansion and control joints.
 - g. Wood to masonry.

- h. Masonry joints where shelf angles occur.
 - i. Voids where items penetrate exterior walls.
 - j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.
- B. Floor Joint Sealant:
- 1. ASTM C920, Type S or M, Grade P, Class 25, Use T.
 - 2. Provide location(s) of floor joint sealant as follows:
 - a. Seats of metal thresholds exterior doors.
 - b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.
- C. Interior Sealants:
- 1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
 - a. Architectural Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
 - 2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
 - 3. Provide location(s) of interior sealant as follows:
 - a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.
 - b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
 - c. Interior surfaces of exterior wall penetrations.
 - d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
 - e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.
 - f. Exposed isolation joints at top of full height walls.
 - g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.
 - h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.

- i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

D. Acoustical Sealant:

1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
2. Provide location(s) of acoustical sealant as follows:
 - a. Exposed acoustical joint at sound rated partitions.
 - b. Concealed acoustic joints at sound rated partitions.
 - c. Joints where item pass-through sound rated partitions.

2.2 COLOR:

- A. Sealants used with exposed masonry are to match color of mortar joints.
- B. Sealants used with unpainted concrete are to match color of adjacent concrete.
- C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type 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 C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. 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

where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 WEEPS:

- A. Weep/Vent Products: Provide the following unless otherwise indicated or approved.
 - 1. Round Plastic Tubing: Medium-density polyethylene, 10 mm (3/8-inch) OD by thickness of stone or masonry veneer.

2.5 FILLER:

- A. Mineral fiberboard: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POROUS SURFACES:

- A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION**3.1 INSPECTION:**

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous 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 surfaces include but are not limited to the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 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.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

- A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.

- D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY:

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

- A. General:
 - 1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
 - 2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
 - 3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
 - 4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
 - 5. Avoid dropping or smearing compound on adjacent surfaces.
 - 6. Fill joints solidly with compound and finish compound smooth.
 - 7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
 - 8. Finish paving or floor joints flush unless joint is otherwise detailed.
 - 9. Apply compounds with nozzle size to fit joint width.
 - 10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
 - 11. Replace sealant which is damaged during construction process.

- B. Weeps: Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, at all flashing, and as indicated on construction documents.
1. Use round plastic tubing to form weep holes.
 2. Space weep holes formed from plastic tubing not more than 406 mm (16 inches) o.c.
 3. Trim tubing material used in weep holes flush with exterior wall face after sealant has set.
- C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.
- D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
 2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
 3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
 4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
 5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL:

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.

- b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
 - 1. 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 type of product and joint substrate.
 - 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - 3. Whether sealants filled joint cavities and are free from voids.
 - 4. Whether sealant dimensions and configurations comply with specified requirements.
- D. 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.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-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.

3.7 CLEANING:

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.
- B. Leave adjacent surfaces in a clean and unstained condition.

- - - E N D - - -

**SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hollow metal doors hung in hollow metal frames at interior and exterior locations.
 - 2. Hollow metal door frames for wood doors and borrowed lights at interior locations.
 - 3. Glazed openings in hollow metal doors.

1.2 RELATED WORK

- A. Section 05 50 00, METAL FABRICATIONS: Frames fabricated of structural steel.
- B. Section 08 34 53, SECURITY DOORS AND FRAMES: Forced Entry and Ballistic Resistant doors.
- C. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum frames entrance work.
- D. Section 08 71 00, DOOR HARDWARE: Door Hardware:
- E. Section 08 80 00, GLAZING: Glazing.
- F. Card Readers and Biometric Devices: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.
- G. Intrusion Alarm: Section 28 16 00, INTRUSION DETECTION SYSTEM.
- H. Security Monitors: Section 28 23 00, VIDEO SURVEILLANCE.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standard Institute (ANSI):
 - A250.8-2014Standard Steel Doors and Frames
- C. ASTM International (ASTM):
 - A240/A240M-15bChromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - A653/A653M-15Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip
 - A1008/A1008M-15Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low

Alloy with Improved Formability, Solution
Hardened, and Bake Hardenable

B209-14Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14Aluminum and Aluminum-Alloy Sheet and Plate
(Metric)

B221-14Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Profiles, and Tubes

B221M-13Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Profiles, and Tubes (Metric)

D3656/D3656M-13Insect Screening and Louver Cloth Woven from
Vinyl Coated Glass Yarns

E90-09Laboratory Measurement of Airborne Sound
Transmission Loss of Building Partitions and
Elements

D. Federal Specifications (Fed. Spec.):

L-S-125BScreening, Insect, Nonmetallic

E. Master Painters Institute (MPI):

No. 18Primer, Zinc Rich, Organic

F. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06Metal Finishes Manual

G. National Fire Protection Association (NFPA):

80-16Fire Doors and Other Opening Protectives

H. UL LLC (UL):

10C-09Positive Pressure Fire Tests of Door Assemblies

1784-15Air Leakage Tests of Door Assemblies and Other
Opening Protectives

I. Department of Veterans Affairs

VA Physical Security and Resiliency Design Manual October 1, 2020

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA,
AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.

2. Include schedule showing each door and frame requirements fire label
and smoke control label for openings.

3. Installation instructions.

- D. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- E. Test reports: Certify products comply with specifications.
 - 1. Sound rated door.
- F. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Manufacturer with project experience list .
- G. Blast Design Calculations.
 - 1. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying door assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1, W2 and GP1, GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the structural blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant doors to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Regularly manufactures specified products.
 - 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.

1.6 DELIVERY

- A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.
- B. Deliver products in manufacturer's original sealed packaging.
- C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

- D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Design hollow metal doors and frames complying with specified performance:
 - 1. Fire Doors and Frames: UL 10C; NFPA 80 labeled.
 - a. Fire Ratings: See drawings.
 - 2. Smoke Control Doors and Frames: UL 1784; NFPA 80 labeled, maximum 0.15424 cubic meter/second/square meter (3.0 cubic feet/minute/square foot) at 24.9 Pa (0.10 inches water gauge) pressure differential.
 - 3. Sound Rated Doors and Frames: Minimum 35 sound transmission class (STC) when tested according to ASTM E90.
 - 4. Thermal Transmittance: 0.38 U-value maximum at exterior doors.
 - 5. Thermal Resistance: 2.63 R-value minimum at exterior doors.
 - 6. Blast Resistant Doors: Door, Frame and Anchorage:
 - a. Standoff Distance: 25 feet (Life Safety Protected)
 - b. Design Threat W1 at the standoff distance not to exceed pressure and impulse associated with GP1 threat for Life Safety Protected buildings
 - c. Frame Rotation not to exceed L/20 (Life Safety Protected) while experiencing design level pressure and impulse.
 - d. Glazing: Glazing shall meet the blast requirements shown in Specification 08 80 00.
 - e. Minimum gauge of metal used on blast resistant doors shall be 14 gauge.

2.2 MATERIALS

- A. Sheet Steel: ASTM A1008/A1008M, cold-rolled.
- B. Galvanized Sheet Steel: ASTM A653.
- C. Insect Screening: ASTM D3656/D3656M, 18 by 18 aluminum wire mesh.

D. Aluminum Sheet: ASTM B209M (ASTM B209).

E. Aluminum Extrusions: ASTM B221M (ASTM B221).

2.3 PRODUCTS - GENERAL

A. Provide hollow metal doors and frames from one manufacturer.

B. Sustainable Construction Requirements:

1. Steel Recycled Content: 30 percent total recycled content, minimum.
2. Stainless Steel Recycled Content: 70 percent total recycled content, minimum.

2.4 HOLLOW METAL DOORS

A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick. See drawings for sizes and designs.

1. Interior Doors: Level 1 and Physical Performance Level C, standard duty; Model 2, seamless.
2. Interior Doors: Level 2 and Physical Performance Level B, heavy duty; Model 2, seamless.
3. Exterior Doors: Level 3 and Physical Performance Level A, extra-heavy duty; Model 2, seamless .

B. Door Faces:

1. Interior Doors: Sheet steel .
2. Exterior Doors: Galvanized sheet steel minimum Z180 or ZF180 (G60 or A60) coating .

C. Door Cores:

1. Interior Doors: Kraft paper honeycomb or vertical steel stiffeners.
2. Exterior Doors: polyurethane.
3. Fire Doors: Manufacturer's standard complying with specified fire rating performance.

2.5 HOLLOW METAL FRAMES

A. Hollow Metal Frames: ANSI A250.8; face welded . See drawings for sizes and designs.

1. Interior Frames:

- a. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.
- b. Level 2 and Level 3 Hollow Metal Doors: 1.3 mm (0.053 inch) thick.
- c. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.

2. Interior Borrowed Light Frames: 1.3 mm (0.051 inch) thick.

3. Interior Automatic Operator Door Frames: 1.7 mm (0.067 inch) thick.

4. Exterior Frames:

- a. Level 3Hollow Metal Doors: 1.3 mm (0.053 inch) thick.

b. Level 4 Hollow Metal Doors: 1.7 mm (0.067 inch) thick.

B. Frame Materials:

1. Interior Frames: Sheet steel
2. Exterior Frames: Galvanized sheet steel minimum Z180 or ZF180 (G60 or A60) coating.

2.6 FABRICATION

A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:

1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Fire and Smoke Control Doors:

1. Close top and vertical edges flush.
- Fire and Smoke Control Door Clearances: NFPA 80.

D. Custom Metal Hollow Doors:

1. Provide custom hollow metal doors where nonstandard steel doors are shown on drawings.
 - a. Provide door sizes, design, materials, construction, gauges, and finish as specified for standard steel doors.

E. Sound Rated Doors:

1. Seals: Integral spring type automatic door bottom seal.
2. Fabricate vision panel cutouts and frames to receive double glazing as shown on drawings.

F. Vision panels:

1. Weld 3 mm (1/8 inch) thick steel channel reinforcements around cut-outs in doors to accommodate vision lights.
2. Fabricate glazing stops on room side of doors, of 3 mm (1/8 inch) thick steel sheets mitered and welded at corners, and continuously welded both sides into doors.
3. Fabricate glazing bead for corridor side of doors of 9 mm (3/8 inch) by 19 mm (3/4 inch) steel bar, miter and weld at the corners, and fasten to doors with 6 mm (1/4 inch) countersunk screws near corners and centers of both sides of opening.
 - a. Back-up screw holes with 3 mm (1/8 inch) thick reinforcements or weld nuts to back of frames to receive screws.
4. Size rabbet for safety glass and glazing cushions specified.

G. Transom Panel Fabrication:

1. Fabricate panels as specified for doors.
2. Fabricate bottom edge with rabbet stop where no transom bar occurs.

H. Hollow Metal Frame Fabrication:

1. Fasten mortar guards to back of hardware reinforcements.
2. Concealed Closers in Head Frame: Provide 1 mm (0.042 inch) thick steel removable stop sections for access to concealed face plates and control valves, except when cover plates are furnished with closer.
3. Terminated Stops: ANSI A250.8.
4. Borrowed Light Frames:
 - a. Provide integral stop on exterior, corridor, or secure side of door.
 - b. Design rabbet width and depth to receive glazing material or panel shown on drawings.
5. Frame Anchors:
 - a. Floor anchors:
 - 1) Provide extension type floor anchors to compensate for depth of floor fills.
 - 2) Provide 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive floor fasteners.
 - 3) Provide 50 mm by 50 mm by 9 mm (2 inch by 2 inch by 3/8 inch) clip angle for lead lined frames, drilled for floor fasteners.
 - 4) Provide mullion 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two floor fasteners and frame anchor screws.
 - 5) Provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for floor fasteners and frame anchor screws for sill sections.
 - a) Space floor bolts 50 mm (2 inches) on center.
 - b. Jamb anchors:
 - 1) Place anchors on jambs:
 - a) Near top and bottom of each frame.
 - b) At intermediate points at maximum 600 mm (24 inches) spacing.
 - 2) Form jamb anchors from steel minimum 1 mm (0.042 inch) thick.

- 3) Anchors set in masonry: Provide adjustable anchors designed for friction fit against frame and extended into masonry minimum 250 mm (10 inches). Provide one of following types:
 - a) Wire Loop Type: 5 mm (3/16 inch) diameter wire.
 - b) T-Shape type.
 - c) Strap and stirrup type: Corrugated or perforated sheet steel.
- 4) Anchors for stud partitions: Provide tabs for securing anchor to sides of studs. Provide one of the following:
 - a) Welded type.
 - b) Lock-in snap-in type.
- 5) Anchors for frames set in prepared openings:
 - a) Steel pipe spacers 6 mm (1/4 inch) inside diameter, welded to plate reinforcing at jamb stops, or hat shaped formed strap spacers 50 mm (2 inches) wide, welded to jamb near stop.
 - b) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass through frame and spacers.
 - c) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.
- 6) Anchors for observation windows and other continuous frames set in stud partitions.
 - a) Weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
 - b) Space maximum 600 mm (24 inches) on centers.
- 7) Modify frame anchors to fit special frame and wall construction.
- 8) Provide special anchors where shown on drawings and where required to suit application.

I. Sound Rated Door Frames:

1. Seals: Integral continuous gaskets on frames.

2.7 FINISHES

- A. Steel and Galvanized Steel : ANSI A250.8; shop primed.
- B. Finish exposed surfaces after fabrication.
- C. ACCESSORIES
- D. Primers: ANSI A250.8.
- E. Barrier Coating: ASTM D1187/D1187M.
- F. Welding Materials: AWS D1.1/D1.1M, type to suit application.

- G. Clips Connecting Members and Sleeves: Match door faces.
- H. Fasteners: Galvanized steel .
 - 1. Metal Framing: Steel drill screws.
 - 2. Masonry and Concrete: Expansion bolts
- I. Anchors: Galvanized steel .
- J. Galvanizing Repair Paint: MPI No. 18.
- K. Insulation: Unfaced mineral wool.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
 - 2. Install fire doors and frames according to NFPA 80.
 - 3. Install smoke control doors and frames according to NFPA 105.

3.3 FRAME INSTALLATION

- A. Apply barrier coating to concealed surfaces of frames built into masonry.
- B. Plumb, align, and brace frames until permanent anchors are set.
 - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 - 2. Use wood spreaders at bottom of frame when shipping spreader is removed.
 - 3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.
 - 4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.
- C. Floor Anchors:
 - 1. Anchor frame jambs to floor with two expansion bolts.
 - a. Frames: Use 6 mm (1/4 inch) diameter bolts.

2. Power actuated drive pins are acceptable to secure frame anchors to concrete floors.

D. Jamb Anchors:

1. Masonry Walls:

- a. Embed anchors in mortar.
- b. Fill space between frame and masonry with grout or mortar as walls are built.

2. Metal Framed Walls: Secure anchors to sides of studs with two fasteners through anchor tabs.

3. Prepared Masonry and Concrete Openings:

- a. Direct Securement: 6 mm (1/4 inch) diameter expansion bolts through spacers.
- b. Subframe or Rough Buck Securement:
 - 1) 6 mm (1/4 inch) diameter expansion bolts on 600 mm (24 inch) centers.
 - 2) Power activated drive pins on 600 mm (24 inches) centers.

E. Frames for Sound Rated Doors: Fill frames with insulation.

F. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.
2. Repair painted surfaces with touch up primer.

3.4 DOOR INSTALLATION

- A. Install doors plumb and level.
- B. Adjust doors for smooth operation.
- C. Touch up damaged factory finishes.
 1. Repair galvanized surfaces with galvanized repair paint.
 2. Repair painted surfaces with touch up primer.

3.5 CLEANING

- A. Clean exposed door and frame surfaces. Remove contaminants and stains.

3.6 PROTECTION

- A. Protect doors and frames from traffic and construction operations.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.

- - - E N D - - -

SECTION 08 14 00
INTERIOR WOOD DOORS

PART 1 - GENERAL**1.1 SUMMARY**

A. Section Includes:

1. Interior flush wood doors with impact-resistant finish.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Paints and Coatings and Composite Wood and Agrifiber VOC Limits.
- B. Section 08 71 00, DOOR HARDWARE: Door Hardware including hardware location (height).
- C. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Installation of Doors.
- D. Section 08 71 00, DOOR HARDWARE: Installation of Door Hardware.
- E. Section 09 06 00, SCHEDULE FOR FINISHES: Door Finish.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Window and Door Manufacturers Association (ANSI/WDMA):
 1. I.S. 1A-13 - Architectural Wood Flush Doors.
- C. ASTM International (ASTM):
 1. D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
 2. D4226 - Standard Test Methods for Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products.
 3. E90-09(2016) - Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions and Elements.
- D. National Fire Protection Association (NFPA):
 1. 80-16 - Fire Doors and Other Opening Protectives.
 2. 252-12 - Fire Tests of Door Assemblies.
- E. UL LLC (UL):
 1. 10C-09 - Positive Pressure Fire Tests of Door Assemblies.
- F. Window and Door Manufacturers Association (WDMA):
 1. TM 7-14 - Cycle-Slam Test.
 2. TM 8-14 - Hinge Loading Test.
 3. TM 10-14 - Screw Holding Capacity.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
 - 2. Include details of glazing .
 - 3. Indicate project specific requirements not included in Manufacturer's Literature and Data submittal.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Fire rated doors showing conformance with NFPA 80.
- D. Samples:
 - 1. Impact-resistant finish sample 200 mm by 275 mm (8 inches by 11 inches) showing specified color and finish.
- E. Sustainable Construction Submittals:
 - 1. Low Pollutant-Emitting Materials:
 - Show volatile organic compound types and quantities.
- F. Test Reports: Indicate products comply with specifications.
 - 1. Screw Holding Capacity Test.
 - 2. Cycle-Slam Test.
 - 3. Hinge-Loading Test.
- G. Operation and Maintenance Data:
 - 1. Care instructions for each exposed finish product.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Regularly and presently manufactures specified products.
 - 2. Manufactures specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
 - 1. Minimum 0.15 mm (6 mil) polyethylene bags or cardboard packaging to remain unbroken during delivery and storage.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, and manufacture date.
 - 1. Identify door opening corresponding to Door Schedule.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging. Retain packaging for door protection after installation.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
 - 1. Store doors according to ANSI/WDMA I.S. 1A.

- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

Comply with door manufacturer's instructions for relative humidity.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant interior factory finished flush wood doors against material and manufacturing defects.
 1. Warranty Period: Lifetime of original installation.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer.
- C. Sustainable Construction Requirements:
 1. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 2. Paints and coatings.
 3. Composite wood and agrifiber.

2.2 FLUSH WOOD DOORS

A. General:

1. ANSI/WDMA I.S. 1A, Extra Heavy Duty.
2. Adhesive: Type II.
3. Core: Solid. Interior stiles and rails bonded. Tops and bottoms factory sealed with an approved sealer to prevent moisture intrusion. Structural composite lumber, except when mineral core is required for fire rating.
4. Thickness: 44 mm (1-3/4 inches) unless otherwise shown or specified.

B. Faces:

1. ANSI/WDMA I.S. 1A.

2. Impact-resistant material.
3. Face material base color must be integral throughout to eliminate discoloration caused by scratching.
4. Face Veneer Wear Index - Abrasion Resistance Testing - ASTM D4060-90: 28,000 cycles to prove out resistant to scuffing and scratching.
5. Face Veneer Impact Resistance - ASTM D-4226: 86 in/lb. (99.08kg/cm³) to confirm impact resistance of face finish.
6. Door Edges: Same material as door face.
Stops For Flush Doors: Wrapped metal lite kit.

C. Fire-Rated Wood Doors:

1. Fire Resistance Rating:
 - a. B Label: 1-1/2 hours.
 - b. C Label: 3/4 hour.
2. Provide 20-minute smoke-rated doors in smoke-rated barriers.
3. Labels:
 - a. Comply with NFPA 252, UL 10C, and labeled by qualified testing and inspection agency showing fire resistance rating.
 - 1) Metal labels with raised or incised markings.
4. Performance Criteria for Stiles of Doors Utilizing Standard Mortise Leaf Hinges:
 - a. Hinge Loading: WDMA TM 8. Average of 10 test samples for Extra Heavy Duty doors.
 - b. Direct Screw Withdrawal: WDMA TM 10 for Extra Heavy Duty doors. Average of 10 test samples using a steel, fully threaded #12 wood screw.
 - c. Cycle-Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested according to WDMA TM 7.
5. Hardware Reinforcement:
 - a. Provide fire and smoke rated doors with hardware reinforcement blocking.
 - b. Size of lock blocks as required to secure hardware specified.
 - c. Top, Bottom and Intermediate Rail Blocks: Minimum 125 mm (5 inches) by full core width.
 - d. Reinforcement blocking in compliance with labeling requirements.
Mineral material similar to core is not acceptable.
6. Other Core Components: Manufacturer's standard as allowed by labeling requirements.
7. Glazed Vision Panel Frame: Steel approved for use in labeled doors.

8. Astragal: Steel type for pairs of doors.

D. Smoke Barrier Doors:

1. Glazed Vision Panel Frame: Steel approved for use in labeled doors.
2. Astragal: Steel type for pairs of doors, including double egress doors.

E. Sound Rated Doors:

1. Fabricated as specified for flush wood doors with additional construction requirements to comply with specified sound transmission class (STC).
2. STC Rating of door assembly in place when tested according to ASTM E90 by independent acoustical testing laboratory minimum 35 .
 - a. Accessories:
 - 1) Frame Gaskets and Automatic Door Bottom Seal: As specified in Section 08 71 00, DOOR HARDWARE.

2.3 FABRICATION

A. Factory machine interior wood doors to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.

1. Factory fit fire rated doors according to NFPA 80.

B. Rout doors for hardware using templates and location heights specified in Section 08 71 00, DOOR HARDWARE.

C. Factory fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness undercut where shown .

D. Clearances between Doors and Frames and Floors:

1. Fire Rated Doors: Comply with NFPA 80.
 - a. Doors with Automatic Bottom Seal: Maximum clearance 10 mm (3/8 inch) at threshold.
 - b. Other Door Bottoms: Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
2. Door Jambs, Heads, and Meeting Stiles: Maximum 3 mm (1/8 inch).

E. Provide cutouts for glazed openings.

F. Identify each door on top edge.

1. Mark with stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, date of manufacture and quality.
2. Mark door or provide separate certification including name of inspection organization.
3. Identify door manufacturing standard, including glue type.

4. Identify veneer and quality certification.
5. Identification of preservative treatment for stile and rail doors.

2.4 FINISHES

A. Factory Finish:

1. Factory finish, impact-resistant, flush doors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

1. Verify door frames are properly anchored.
2. Verify door frames are plumb, square, in plane, and within tolerances for door installation.

B. Protect existing construction and completed work from damage.

C. Install astragal on active leaf of pair of smoke doors and one leaf of double egress smoke doors.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. Install fire rated doors according to NFPA 80.
2. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 PROTECTION

A. After installation, place shipping container over door and tape in place.

1. Do not apply tape to door faces and edges.

B. Provide protective covering over exposed hardware in addition to covering door.

C. Maintain covering in good condition until removal is directed by Contracting Officer's Representative.

- - E N D - -

**SECTION 08 31 13
ACCESS DOORS AND FRAMES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Access doors and panels installed in walls and ceilings.

1.2 RELATED WORK

- A. Section 08 71 00, DOOR HARDWARE: Lock Cylinders.
- B. Section 09 91 00, PAINTING: Field Painting.
- C. Section 09 06 00, SCHEDULE FOR FINISHES: Finish Color.
- D. Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS: Access Doors for Control or Drain Valves.
- E. Section 21 12 16, DRY-PIPE SPRINKLER SYSTEMS: Access Doors for Control or Drain Valves.
- F. Section 22 40 00, PLUMBING FIXTURES: Access Doors for Plumbing Valves.
- G. Section 23 31 00, HVAC DUCTS AND CASINGS: Locations of Access Doors for Ductwork Cleanouts.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Welding Society (AWS):
 - D1.3/D1.3M-2018Structural Welding Code - Sheet Steel
(6th Edition.
- C. ASTM International (ASTM):
 - A653/A653M-20Steel Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by the
Hot-Sip Process.
 - A1008/A1008M-18Steel, Sheet, Cold-Rolled, Carbon, Structural,
High-Strength Low-Alloy, High-Strength
Low-Alloy with Improved Formability, Solution
Hardened, and Bake Hardenable.
 - A666-15Annealed or Cold-Worked Austenitic Stainless
Steel sheet, Strip, Plate, and Flat Bar.
 - E119-20Fire Test of Building Construction and
Materials.
- D. National Fire Protection Association (NFPA):
 - 80-2019 EditionFire Doors and Other Opening Protectives.
 - 252-2017 EditionFire Tests of Door Assemblies.
- E. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500-06Metal Finishes Manual.

F. UL LLC (UL):

- ListedOnline Certifications Directory.
- 10B-08 (Edition 10)Standard for Fire Tests of Door Assemblies.
- 263-11 (Edition 14)Fire Tests of Building Construction and
Materials.

PART 2 - SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
- D. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

2.2 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

2.3 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.

2.4 FIELD CONDITIONS

- A. Field Measurements: Verify field conditions affecting access door fabrication and installation. Show field measurements on Submittal Drawings.
 - 1. Coordinate field measurement and fabrication schedule to avoid delay.

2.5 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

2.6 MATERIALS

- A. Steel Sheet: ASTM A1008/A1008M.
- B. Galvanized Steel: ASTM A653/A653M.

2.7 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer.
- C. Sustainable Construction Requirements:
 - 1. Steel Access Doors Recycled Content: 30 percent total recycled content, minimum.

2.8 ACCESS DOORS, FLUSH PANEL, NON-RATED

- A. Door Panel:
 - 1. 1.5 mm (0.06 inch) thick steel sheet.
 - 2. Reinforce to maintain flat surface.
- B. Frame:
 - 1. 1.5 mm (0.06 inch) thick steel sheet, depth and configuration to suit material and construction type where installed.
 - 2. Exposed Joints in Flange: Weld and grind smooth.
 - 3. Provide expanded galvanized metal lath perimeter wings when installed in plaster, except veneer plaster.
- C. Hinge:
 - 1. Concealed spring hinge, 175 degrees of opening.
 - 2. Removable hinge pin to allow removal of door panel from frame.
- D. Lock:
 - 1. Flush, screwdriver-operated cam lock.

2.9 FABRICATION - GENERAL

- A. Size: Minimum 600 mm (24 inches) square door unless otherwise shown.
- B. Component Fabrication: Straight, square, flat and in same plane where required.
 - 1. Exposed Edges: Slightly rounded, without burrs, snags and sharp edges.
 - 2. Exposed Welds: Continuous, ground smooth.
 - 3. Welding: AWS D1.3/D1.3M.
- C. Locks and Non-Continuous Hinges: Provide in numbers required to maintain alignment of door panel with frame.
- D. Anchoring: Make provisions in frame for anchoring to adjacent construction. Provide anchors in size, number and location on four sides to secure access door to substrate.

2.10 FINISHES

- A. Steel Paint Finish: Factory primed for field painting.

2.11 ACCESSORIES

- A. Fasteners: Type and size recommended by access door manufacturer, to suit application.
 - 1. Other Access Doors: Galvanized fasteners.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
 - 1. Verify access door locations and sizes provide required maintenance access to installed building services components.
- B. Protect existing construction and completed work from damage.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions and concealed above gypsum board and plaster ceilings.
- C. Install flush access panels in partitions and in gypsum board and plaster ceilings.

3.3 ACCESS DOOR AND FRAME INSTALLATION

- A. Wall Installations: Install access doors in openings with sides vertical.
- B. Ceiling Installations: Install access doors parallel to ceiling suspension grid or room partitions.
- C. Frames without Flanges: Install frame flush with surrounding finish surfaces.
- D. Secure frames to adjacent construction with fasteners.
- E. Install type, size and quantity of anchoring device suitable for material surrounding opening to maintain alignment, and resist displacement, during normal use of access door.
- F. Field Painting Primed Access Doors: Comply with the requirements of Section 09 91 00, PAINTING.

3.4 ADJUSTMENT

- A. Adjust hardware so door panel opens freely.
- B. Adjust door when closed so door panel is centered in frame.

- - E N D - -

**SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum-framed entrances and storefronts.

1.2 RELATED REQUIREMENTS

- A. Door Finish and Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Glass and Glazing: Section 08 80 00, GLAZING.
- C. Hardware: Section 08 71 00, DOOR HARDWARE.
- D. Automatic Door Actuators: Section 08 71 13, AUTOMATIC DOOR OPERATORS.
- E. Aluminum Finish and Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Welding Society (AWS):
 - D1.2/D1.2M-14Structural Welding Code - Aluminum
- C. ASTM International (ASTM):
 - A240/A240M-20Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - B209-14Aluminum and Aluminum-Alloy Sheet and Plate.
 - B209M-14Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
 - B221-14Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - B221M-13Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
 - D1187/D1187M-97(2018) ..Asphalt-Base Emulsions for Use as Protective Coatings for Metal
 - E283/E283M-19Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - E330/E330M-14Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - E331-00(2016)Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

E1886-19Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposes to Cyclic Pressure Differentials

E1996-17Performance of Exterior Windows, Curtain Walls, Doors, and impact Protective Systems Impacted by Windborne Debris in Hurricanes

F468-16Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

F593-17Stainless Steel Bolts, Hex Cap Screws, and Studs

D. National Association of Architectural Metal Manufacturers (NAAMM): AMP 500-06Metal Finishes Manual

E. National Fenestration Rating Council (NFRC): 500-14 (E1A0)Determining Fenestration Product Condensation Resistance Values

F. Department of Veterans Affairs (VA): 1. VA Physical Security and Resiliency Design Manual October 1, 2020

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:

- a. Contracting Officer's Representative.
- b. Architect/Engineer.
- c. Contractor.
- d. Installer.
- e. Manufacturer's field representative.
- f. Other installers responsible for adjacent and intersecting work.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.

- a. Installation schedule.
- b. Installation sequence.
- c. Preparatory work.
- d. Protection before, during, and after installation.
- e. Installation.
- f. Terminations.
- g. Transitions and connections to other work.
- h. Other items affecting successful completion.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings: Minimum 1 (half size) scale.
 1. Show size, configuration, and fabrication and installation details.
 2. Show anchorage and reinforcement.
 3. Show interface and relationship to adjacent work, including thermal, air, and water barrier continuity.
- C. Manufacturer's Literature and Data:
 1. Description of each product.
 2. Doors, each type.
 3. Entrance and Storefront construction.
 4. Installation instructions.
 5. Warranty.
- D. Samples:
 1. Door Corner Section: Minimum 450 mm x 450 mm (18 x 18 inches) for each specified door type, showing head rail and hinge stile, door closer reinforcement, and internal reinforcement.
 2. Aluminum Anodized Finish: wo sample extrusions minimum 150 mm (6 inches) long for each specified color in sets of three showing maximum color range.
- E. Sustainable Construction Submittals:
 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- F. Test reports: Certify products comply with specifications.
- G. Certificates: Certify products comply with specifications.
 1. Certify anodized finish thickness.
- H. Qualifications: Substantiate qualifications comply with specifications.
 1. Manufacturer.
 2. Installer.
 3. Welders and welding procedures.
- I. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.
 1. Show location and magnitude of loads applied to building structural frame.
 2. Identify deviations from details shown on drawings.

3. Blast Design Calculations

- a. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying storefront assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1,W2 and GP1,GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the structural engineer blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant entrances and storefronts to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

J. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.

B. Installer Qualifications: Manufacturer authorized representative.

1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations for minimum five years.

C. Welders and Welding Procedures Qualifications: AWS D1.2/D1.2M.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
- D. Store products indoors in dry, weathertight facility.

- E. Protect products from damage during handling and construction operations.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.
 - 1. Minor deviations to details shown on drawings to accommodate manufacturer's standard products may be accepted by Contracting Officer's Representative when deviations do not affect design concept and specified performance.
- B. Design aluminum framed entrances and storefronts complying with specified performance:
 - 1. Wind Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings when tested according to ASTM E330/E330M.
 - a. Maximum Deflection: 1/175 of span, maximum with minimum 1.65 safety factor.
 - 2. Thermal Movement: Accommodate ambient temperature range of 67 degrees C (120 degrees Fahrenheit).
 - 3. Physical Security Mission Critical Facilities:
 - a. Provide glazed aluminum curtain walls designed to meet or exceed the design and construction standards as provided in the Physical Security Design Manual for VA Facilities: Mission Critical Facilities.
 - 1) Blast Resistance: Design level vehicle threat (W2) located at the standoff distance, but not greater than GP2.
 - 2) The standoff distances vary. See site plan for standoff distances.
 - 4. Condensation Resistance: NFRC 500.
 - a. Fixed Framing: 45 CRF, minimum.
 - 5. Water Resistance: ASTM E331; No uncontrolled penetration at 380 Pa (8 pounds/square foot), minimum, pressure differential.
 - 6. Fixed Framing Air Infiltration Resistance: ASTM E283; 0.30 liter/second/square meter (0.06 cubic foot/minute/square foot),

maximum at 300 Pa (6.24 pounds/square foot), minimum, pressure differential.

7. Entrance Doors Air Infiltration Resistance: ASTM E283; maximum allowable at 75 Pa (1.57 pounds/square foot), minimum, pressure differential.
 - a. Single Doors: 2.5 liter/second/square meter (0.5 cubic foot/minute/square foot).
 - b. Paired Doors: 6 liter/second/square meter (1.2 cubic foot/minute/square foot).

2.2 MATERIALS

- A. Aluminum:
 1. Sheet Metal: ASTM B209M (ASTM B209), minimum 1.6 mm (0.063 inch) thick.
 2. Extrusions: ASTM B221M (ASTM B221).
 - a. Framing: Minimum 3 mm (0.125 inch) wall thickness.
 - b. Glazing Beads, Moldings, and Trim: Minimum 1.25 mm (0.050 inch) thick.
 3. Alloy 6063 temper T5 for doors, door frames, fixed glass sidelights, storefronts and transoms.
 4. Alloy 6061 temper T6 for guide tracks for sliding doors and other extruded structural members.
 - a. Color Anodized Aluminum: Provide aluminum alloy required to produce specified color.
- B. Stainless Steel: ASTM A240/A240M; Type 302 or Type 304.
- C. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.

2.3 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide aluminum entrances, storefront, and curtain wall systems from same manufacturer.
- C. Sustainable Construction Requirements:
 1. Aluminum Recycled Content: 50 percent total recycled content, minimum.

2.4 FRAMES

- A. Framing Members: Extruded aluminum, thermally broken.
- B. Stops: Provide integral fixed stops and glass rebates and snap-on removable stops.
- C. Provide concealed screws, bolts and other fasteners.

D. Secure cover boxes to frames in back of lock strike cutouts.

2.5 STILE AND RAIL DOORS

A. Stiles and Rails: Extruded aluminum, thermally broken.

1. Thickness: 45 mm (1-3/4 inch).
2. Stiles and Head Rails: 90 mm (3-1/2 inches) wide.
3. Bottom Rails: 250 mm (10 inches) wide.

B. Single-Acting Doors:

1. Bevel: 3 mm (1/8 inch) at lock, hinge, and meeting stile edges.
2. Clearances: 2 mm (1/16 inch) at hinge stiles, 3 mm (1/8 inch) at lock stiles and top rails, and 5 mm (3/16 inch) at floors and thresholds.

C. Glass Rebates: Integral with stiles and rails.

D. Glazing Beads: Extruded aluminum, 1.3 mm (0.050 inch) thick. Integral with stiles and rails or applied type, snap-fit secured.

E. Stile and Rail Joints: Welded or interlocking dovetail joints between stiles and rails.

1. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel tie rod extending into stiles and having self-locking nut and washer at both ends.
2. Reinforce stiles and rails to prevent door distortion when tie rods are tightened.
3. Provide compensating spring-type washer under each nut for stress relief.
4. Construct joints to remain rigid and tight when door is operated.

F. Weather-stripping: Removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder.

1. Make slots for applying weather-stripping integral with doors and door frame stops.
2. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames so doors swing freely and close positively.

2.6 COLUMN COVERS AND TRIM

A. Column Covers and Trim: Sheet aluminum fabrications shown from sheet aluminum of longest available lengths.

B. Provide concealed fasteners.

C. Provide aluminum stiffeners and supporting members shown on drawings and as required to maintain component integrity and shape.

2.7 FABRICATION

- A. Form metal parts and fit and assemble joints, except joints designed to accommodate movement. Seal joints to resist air infiltration and water penetration.
- B. Welding:
 - 1. Make welds without distorting and discoloring exposed surfaces.
 - 2. Clean and dress welds. Remove welding flux and weld spatter.
- C. Prepare and reinforce doors and frames for hardware and accessories.
 - 1. Coordinate preparation with specified hardware. See Section 08 71 00, DOOR HARDWARE.
 - 2. Fabricate reinforcement from stainless steel plates.
 - a. Hinge and pivot reinforcing: Minimum 4.5 mm (0.179 inch) thick.
 - b. Lock Face, Flush Bolts, Concealed Holders, Concealed and Surface Mounted Closers Reinforcing: Minimum 2.6 mm (0.104 inch) thick.
 - c. Other Surface Mounted Hardware Reinforcing: Minimum 1.5 mm (0.059 inch) thick.
 - 3. Where concealed hardware is specified, provide space, cutouts, and reinforcement for installation and secure fastening.
- D. Factory assembled doors.

2.8 FINISHES

- A. Aluminum Anodized Finish: NAAMM AMP 500.
 - 1. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.

2.9 ACCESSORIES

- A. Dielectric Tape: Plastic, non-absorptive, with pressure sensitive adhesive; 0.18 to 0.25 mm (7 to 10 mils) thick.
- B. Barrier Coating: ASTM D1187/D1187M.
- C. Welding Materials: AWS D1.2/D1.2M, type to suit application.
- D. Fasteners:
 - 1. Aluminum: ASTM F468, Alloy 2024.
 - 2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.
- E. Anchors: Aluminum or stainless steel; type to suit application.
- F. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
 - 1. Coordinate floor closer installation recessed into concrete slabs.
 - 2. Coordinate anchor installation built into masonry and concrete.

- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
- D. Apply dielectric tape or barrier coating to aluminum surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install aluminum framed entrances and storefronts plumb and true, in alignment and to lines shown on drawings.
- C. Anchor frames to adjoining construction at heads, jambs and sills.
- D. Provide concealed aluminum clips to connect adjoining frame sections.
- E. Install door hardware and hang doors. See Section 08 71 00, DOOR HARDWARE.
- F. Install door operators. See Section 08 71 13, AUTOMATIC DOOR OPERATORS.
- G. Adjust doors and hardware uniform clearances and proper operation.
- H. Touch up damaged factory finishes.
 - 1. Repair galvanized surfaces with galvanized repair paint.
- I. Tolerances:
 - 1. Variation from Plumb, Level, Warp, and Bow: Maximum 3 mm in 3 meters (1/8 inch in 10 feet).
 - 2. Variation from Plane: Maximum 3 mm in 3.65 meters (1/8 inch in 12 feet); 6 mm (1/4 inch) over total length.
 - 3. Variation from Alignment: Maximum 1.5 mm (1/16 inch) in-line offset and maximum 3 mm (1/8 inch) corner offset.
 - 4. Variation from Square: Maximum 3 mm (1/8 inch) diagonal measurement differential.

3.3 PROTECTION, CLEANING AND REPAIRING

- A. Clean exposed aluminum and glass surfaces. Remove contaminants and stains.
- B. Protect aluminum-framed entrances and storefronts from construction operations.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

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**SECTION 08 41 26.24
INTERIOR PRIVACY GLASS WALLS AND ENTRANCES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior, switchable privacy glass, glazing accessories and supplementary items necessary to complete the work required for their installation.

1.2 RELATED REQUIREMENTS

- A. Overhead Steel Supports: Section 05 50 00, METAL FABRICATIONS.
- B. Glazing Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.
- D. Window Film: Section 08 87 33, ARCHITECTURAL WINDOW FILM.
- E. Electrical connection to switchable privacy glass: Division 26, ELECTRICAL.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - ASTM C 1036.....Standard Specification for Flat Glass
 - ASTM C 1048.....Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass
 - ASTM C 1172.....Standard Specification for Laminated Architectural Flat Glass
- C. Consumer Product Safety Commission (CPSC):
 - CPSC 16 CFR-1201.....Safety Standard for Architectural Glazing Materials
- D. Glass Association of North America (GANA):
 - GANA Glazing Manual
 - GANA Laminated Glazing Reference Manual
 - GANA Glass Information Bulletins

1.4 DEFINITIONS

- A. Connection Nipple: Fitting attached to the edge of the glass that wires pass through to provide strain relief for wires
- B. Lay Flat Wiring Bar: Alternate to Connection Nipple; Used to run wires parallel with the edge of the glass
- C. Greenfield: A metallic flexible conduit used to shield the wires coming from the glass

- D. Busbar: Copper foil tape which supplies power to switchable liquid crystal film
- E. Frosted State: The default state of switchable privacy glass; no power running to the glass
- F. Transparent State: The powered state of the glass, with its highest level of clarity.
- G. Off-Axis: When the line of sight to the glass is at an angle; not straight on.

1.5 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site.

1.6 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Submit manufacturer's product data, including performance characteristics and installation instructions.
- C. Shop Drawings: Submit manufacturer's or fabricator's shop drawings, including plans, elevations, sections, and details, indicating glass dimensions, tolerances, types, thicknesses, and coatings.
- D. Samples: Submit 8" x 11" functioning manufacturer's samples of each type, thickness, and coating.
- E. Submit manufacturer's standard warranty for switchable privacy glass units.
- F. Door Hardware Schedule:
 - 1. Door Hardware Schedule: Detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate final door hardware schedule with door components, assemblies, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
- G. Maintenance Data: For interior all-glass entrance systems to include in maintenance manuals. Furnish a complete set of specialized tools and maintenance instructions as required for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum of 5 years' experience manufacturing switchable glass.
- B. Installer Qualifications: Minimum of 5 years' experience in installing and handling laminated glass meeting ASTM C 1172 and CPSC 16CFR-1201.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup for interior all-glass door including accessories.
 - 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. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
- D. Store products indoors in dry, weathertight facility.
- E. Protect products from damage during handling and construction operations.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty on Switchable Privacy Glass: Manufacturer's standard form in which Switchable Privacy Glass manufacturer agrees to replace Switchable Privacy Glass units that fail within specified warranty period.
 - 1. Warranty Period on the function of the Switchable Privacy Glass Unit: 5 years from date of receipt by purchaser
 - a. Defects in material or workmanship causing material obstruction of vision as a result of electrical failure of the switchable film.
 - b. Defects in material or workmanship causing the switchable film to no longer switch from frosted to translucent.
 - 2. Warranty Period on the lamination of Switchable Privacy Glass: 5 years from date of shipment
 - a. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to

maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard of ASTM.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Obtain all components of interior all-glass entrance systems, including accessories, from single manufacturer.

2.2 PRIVACY GLASS:

- A. Basis of Design: LC Privacy Glass by Innovative Glass Corp., 120 Commercial Street, Plainview, New York 11803. Phone: 516-777-1100. Fax: 516.777.1106. Web Site: www.innovativeglasscorp.com Other manufacturers may be allowed provided that all performance requirements and design intent are met; Architect approval required.
- B. Fabricators:
 - 1. Sealed Insulating Glass Units, Laminated Glass Units, Heat-Strengthened Glass, Tempered Glass, and Spandrel Glass:
 - 2. Acceptable Fabricators: All must be certified by glass manufacturer.
- C. Laminated Switchable Privacy Glass Materials (SPG1):
 - 1. Switchable Privacy film: Approx. .012 inch (0.30 mm) thick film.
 - 2. Interlayers: .060 inch total interlayer thickness typical.
 - 3. Glass Components:
 - a. Annealed clear OR low iron glass: Clear, transparent, flat, annealed, float glass, conforming to ASTM C1036, Type I, Class 1, Quality q3.
 - b. Fully tempered glass:
 - 1) Provide heat tempered, annealed glass components where required to adequately resist loading conditions, size of units, and anticipated thermal stresses in accordance with ASTM C1048, Kind FT.
 - 2) Fully tempered glass shall meet requirements of ANSI Z97.1 and CPSC 16 CFR to qualify as safety glass.
 - c. Standard Switchable Glass thickness make-ups: 9/16" (11mm) = 1/4" Glass / LC Interlayer / 1/4" Glass.
 - d. Edge treatment of glass to be:

1) Polished Verticals - Use this for butt glazed panels where vertical edges will be exposed. All glass doors will also use this option.

2) Edge Seal - Use this when panels are captured on all sides.

e. Bus bars used to terminate switchable film will be made of copper foil conductive tape and will be positioned on the top of the panel unless otherwise specified.

D. Electrical Requirements:

1. Operating Voltage: 110 - 120 VAC / 50 - 60 Hz.
2. Operating Current: .012 Amps (12mA per square foot).
3. Power consumption: Less than 1 watt per sq ft of privacy glass.
4. One LCPS-1 Surge Protection Power Module required per independently controlled zone. Each office shall be considered an independently controlled zone.
5. Bus bars will be visible for 5/8" in from the edge of the glass and installer should account for adequate frame coverage to hide them during installation.
6. Panels shall be fabricated with 2-Conductor 18Ga Wires; 15-20ft long through Connection Nipple or Lay Flat Wiring Bar.
7. Wires should be captured in 3/8" Trade Size Greenfield Conduit or "other" suitable conduit for job conditions and routed back to approved junction box that is in accordance with local electrical codes.
8. Power from the building, the LCPS-1 Power Module and Wires from the glass shall be spliced together at Junction Box.
9. All wiring to be completed in accordance with manufacturer's wiring instructions.
10. Electrical controllers used must be capable of controlling 120VAC On/Off.
11. Glass may be integrated into building automation system for automated and remote control. System must have prior approval of glass manufacturer.

E. Performance:

1. Visible haze is expected when Switchable Privacy Glass is in the transparent state. Noticeable haze will be 7-10% depending on substrates used in the glass make-up. Haze will be more noticeable when glass is viewed off-axis (at an angle) and less noticeable when viewed straight on.

2. Operating Temperature Range (installed environment): Range = 14°F to +122°F.
3. Specular Light Transmittance:
 - a. T (On) - 75%
 - b. T (Off) - .01%
4. Parallel Light Transmittance:
 - a. (On) - 70%
 - b. T (Off) - 5%
5. Total Light Transmittance:
 - a. T (On) - 75%
 - b. T (Off) - 51%
6. Switchable Glass must be UL Listed.
7. Switching Speed ON/OFF: <15ms/50ms.

2.3 INTERIOR, MANUAL-SWINGING, ALL-GLASS ENTRANCE SYSTEMS

- A. Basis of Design: LC Privacy Glass by Innovative Glass Corp., 120 Commercial Street, Plainview, New York 11803. Phone: 516-777-1100. Fax: 516.777.1106. Web Site: www.innovativeglasscorp.com Other manufacturers may be allowed provided that all performance requirements and design intent are met; Architect approval required.
- B. Fitting Configuration:
 1. System Rails: Provide CRL 1 1/2" deep U-channel top rails and 1" deep U-channel bottom rails for glazing system, or approved equal.
 - a. Acceptable glazing silicones for field glazing into frames.
 - 1) Only DOW995, or equal, shall be used in any enclosed glazing pocket.
 - 2) DOW1199 Silicone, or equal, should be used to fill butt joints.
 2. Door Patch Fittings: Provide door patch kit for doors with fixed transom and two sidelites including transom patches, door patches, top and bottom pivots, and gaskets. Provide CRL PHA5BS kit or approved equal.
 3. Door Lock and Strike: Basis of Design is CRL Lever Lock Glass Housing Grade 1 LH50BS (Entrance) and Lever Lock Glass Keeper Grade 1 LHK1BS or approved equal for interior tempered glass doors. Cylinder and wall stop provided under 08000 Door Hardware.
- C. Accessory Fittings:
 1. U-channel end caps.
- D. Stainless Steel Cladding: ASTM A240/A240M or ASTM A666, Type 304.
 1. Finish: ASTM A480/A480M No. 4 directional satin finish.

2.4 FABRICATION

- A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
 - 1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.
- B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

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 - GENERAL

- A. Install all-glass entrance systems and associated components in accordance with manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.
- C. Maintain uniform clearances between adjacent components.
- D. Lubricate hardware and other moving parts in accordance with manufacturer's written instructions.
- E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.

3.3 FIELD QUALITY CONTROL

- A. Coated glass, when viewed from minimum of 10 feet, exhibiting slightly different hue or color not apparent in hand samples, will not be cause of rejection of glass units, as determined by Architect.
- B. Verify glass is free of chips, cracks, and other inclusions that could inhibit structural or aesthetic integrity PRIOR TO INSTALLATION.
- C. All glass panels to be electrically tested before and after installation.
- D. Glass shall be demonstrated to Owner after installation.

3.4 ADJUSTING AND CLEANING

- A. Clean glass promptly after installation in accordance with manufacturer's instructions.
- B. Remove labels from glass surface.

- C. Do not use harsh cleaning materials or methods that would damage glass.
 - 1. Refer to the following GANA Glass Information Bulletins:
 - a. GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.
 - b. GANA TD-02-0402 - Heat-Treated Glass Surfaces Are Different.
- D. Do not use scrapers or other metal tools to clean glass.

3.5 PROTECTION

- A. Protect installed glass from damage during construction.
- B. Protect installed glass from contact with contaminating substances resulting from construction operations.
- C. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

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**SECTION 08 42 29.53
SLIDING AUTOMATIC ENTRANCES BLAST RESISTANT**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes the following types of automatic entrances:
 - 1. Exterior and interior, single slide and bi-parting, sliding automatic entrances.
 - 2. Sliding automatic entrances shall be blast resistant.

1.2 RELATED WORK

- A. Section 07 92 00, JOINT SEALANTS: Caulking to the extent not specified in this section.
- B. Section 08 71 00, DOOR HARDWARE: Hardware to the extent not specified in this Section.
- C. Division 26, ELECTRICAL: Electrical connections provided separately including conduit and wiring for power to sliding automatic entrances.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.
- C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.
- D. Certifications: Automatic sliding door systems shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
 - 1. ANSI/BHMA A156.10.
 - 2. UL325 Listed.
- E. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.
- F. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated; Architect approval required.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
- C. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
Engineering Calculations: Submit engineering calculations and supporting product data as required to confirm compliance with 1.05 Performance Requirements. Calculations shall be prepared in accordance with common, accepted engineering practice and shall conform to appropriate design rules of the referenced standards and building ordinances. All documents are to bear the seal of a licensed engineer. Calculations shall include:
 - 1. Material specifications and properties.
 - 2. The derivation of member properties.
 - 3. Analyses of stress and deflections for all structural elements, connections and anchorages.
 - 4. Dimensioned drawings of extrusion shapes where required to support calculations
 - 5. Safety Factors.
- D. Color Samples for selection of factory-applied color finishes.
- E. Closeout Submittals:
 - 1. Owner's Manual.
 - 2. Warranties.

1.5 PROJECT CONDITIONS

- A. Field Measurements: General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.
- C. Other trades: General Contractor shall advise of any inadequate conditions or equipment.

1.6 COORDINATION

- A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies.

1.7 WARRANTY

- A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".
- B. Automatic Entrances shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.
- C. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- D. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. Underwriters Laboratories (UL):
UL 325Standard for Door, Drapery, Gate, Louver, and
Window Operators and Systems
- C. General Services Administration (GSA):
Building Classifications Level C
Test Protocol GSA-TS01-2003
- D. Unified Facilities Criteria (UFC):
UFC 4-010-01DoD Antiterrorism Standards for New and
Existing Buildings
- E. American National Standards Institute (ANSI) / Builders' Hardware
Manufacturers Association (BHMA):

- ANSI/BHMA A156.10Standard for Power Operated Pedestrian Doors
- F. American Society for Testing and Materials (ASTM):
 - B209Aluminum and Aluminum-Alloy Sheet and Plate
 - B221Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - E330Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- G. American Association of Automatic Door Manufacturers (AAADM)
- H. Consumer Product Safety Commission (CPSC):
 - 16 CFR 1201Architectural Glazing Standards and Related Material
- I. National Fire Protection Association (NFPA):
 - NFPA 70National Electric Code
- J. National Association of Architectural Metal Manufacturers (NAAMM):
 - Metal Finishes Manual for Architectural and Metal Products
- K. American Architectural Manufacturers Association (AAMA):
 - AAMA 606.1 Integral Color Anodic Finishes for Architectural Aluminum
 - AAMA 611Voluntary Specification for Anodized Architectural Aluminum
 - AAMA 701Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals

1.9 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- B. Safety Device: Device that prevents a door from opening or closing, as appropriate.

1.10 PERFORMANCE REQUIREMENTS

- A. General: Provide automatic entrance door assemblies capable of withstanding structural loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Thermal Movements: Provide automatic entrances that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure

of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).
- D. Closing-Force Requirements: Not more than 30 lbf (133 N) required to prevent door from closing.
- E. Sliding automatic entrances specified with automatic locking shall be designed to function as follows:
1. Entrances shall be normally closed and locked by automatic locking system with exterior motion activation system disabled. Interior motion activation system to remain enabled; free egress.
 2. Upon signal from exterior secure activation device, sliding automatic entrances will unlock and open enabling motion activation system. Entrance will be held open as long as an object or pedestrian remains in the activation or safety zones.
 3. Once all activation and safety zones have cleared the entrance will close and re-lock, returning to normal state.
- F. Structural properties of components:
1. Deflection limitations
 - a. The deflection of any framing member in a direction normal to the plane of the wall when subjected to the specified design loads shall not exceed 1/175 of its clear span or 3/4 inch (19 mm) whichever is less.
 - b. For cantilevers, the span shall be taken as two times the distance between anchor centerline and end of cantilever.
 - c. The deflection shall not exceed 50% of the nominal joint width at sealant joints occurring between framing members and relatively stiff building elements, or less if required by sealant manufacturer.
 - d. Upon reversal of load direction at magnitudes up to and including 1.5 times design pressures, slippage at fastened and/or clamped connections shall not exceed 1/8 inch (3 mm).
 - e. Glass deflection at full design load shall not exceed 1/100 of its span, or 3/4 inch (19 mm) whichever is less.

- f. Metal panel deflection shall not exceed 1/90 of its span or 3/4 inch (19 mm) whichever is less. The span shall be taken as the lesser of the distances between the horizontal or vertical support members.
- 2. Structural design criteria and testing requirements.
 - a. The work shall be designed to withstand the design loads and pressures specified herein. Compliance shall be demonstrated by calculations performed in accordance with accepted engineering practice.
 - b. The work shall be designed to conform to ASTM E 330. Inward and outward acting test pressures shall be equal to 1.5 times the inward and outward acting design pressures to demonstrate a safety factor of 1.5 design pressures. Satisfactory performance at these loads shall mean no glass breakage, no permanent damage to fasteners or anchors, hardware, parts or actuating mechanisms; no malfunction of windows; no permanent deformation of main framing members in excess of 0.2% of their clear span.
- G. The glazed framing system and its anchorage shall be designed to withstand normal recognized testing criteria to accept seismic movement without structural failure or glass breakage.

PART 2 - PRODUCTS

2.1 AUTOMATIC ENTRANCES

- A. Basis-of-Design: Stanley Access Technologies; Dura-Shield™ Blast High Security Series sliding automatic entrances. Other manufacturers shall meet or exceed the design requirements of this specification; Architect approval required.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Headers: 6063-T6.
 - 2. Framing, stiles and rails: 6105-T5
 - 3. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 4. Sheet and Plate: ASTM B 209.
- B. Sealants and Joint Fillers: Performed under Division 7 Section "Joint Sealants".

2.3 AUTOMATIC DOOR ASSEMBLIES

- A. General: Provide manufacturer's standard automatic entrance door assemblies including doors, sidelights, framing, headers, carrier

assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrances:

1. Single Slide Entrance (opening J01F):
 - a. Configuration: One sliding leaf and one full sidelight.
 - b. Traffic Pattern: Two-way.
 - c. Emergency Breakaway Capability: None.
 - d. Mounting: Between jambs.
2. Bi-Parting Entrance (opening J01M):
 - a. Configuration: Two sliding leaves and two full sidelights.
 - b. Traffic Pattern: Two-way.
 - c. Emergency Breakaway Capability: None.
 - d. Mounting: Between jambs.

2.4 COMPONENTS

- A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
 1. Nominal Size: 2 1/2 inch by 6 inch (63.5 mm by 152.4 mm).
- B. Stile and Rail Doors and Sidelights: Manufacturer's standard 2 3/8 inch (60.3 mm) thick glazed doors with extruded-aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails or mechanically fasten corners with reinforcing brackets that are welded.
 1. Glazing Stops and Gaskets: Extruded-security aluminum stops and gaskets.
 2. Stile Design: Narrow stile; 2 3/4 inch (70 mm) nominal width.
 3. Top Rail Design: 2 3/4 inch (70 mm) nominal height
 4. Bottom Rail Design: 8 1/2 inch (216 mm) nominal height.
 5. Muntin Bars: Horizontal tubular rail member for each door; 1 5/8 inch (41 mm) nominal height.
- C. Glazing: Provide insulated laminated glazing units for sliding automatic entrances as follows:
 1. Safety glass complying with CPSC 16 CFR 1201 for Category II materials.
 2. Total thickness of 1 1/4 inch (32 mm) with makeup as follows:
 - a. 1/4 inch (6 mm) clear tempered glass.
 - b. 3/4 inch (19 mm) hermetically sealed, dehydrated air space.

- c. Laminate glazing units, 1/8 inch (3 mm) inner and outer panes, clear, heat strengthened with 0.060 inch (1.5 mm) clear PVB interlayer.
- 3. Wet Glazing: Wet glaze in accordance with manufacturer's instructions with Dow 995 structural silicone sealant, or approved equivalent.
- D. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
 - 1. Mounting: Surface applied to structural framing system.
 - Capacity: Capable of supporting doors up to 400 lb (182 kg) per leaf over spans up to 14 feet (4.3 m) without intermediate supports.
- E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch (3 mm); consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from carrier assembly by load wheels and anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing load wheels and two anti-rise rollers for each active leaf. Minimum load wheel diameter shall be 2 1/2 inch (64 mm); minimum anti-rise roller diameter shall be 2 inch (51 mm).
- F. Thresholds: Manufacturer's standard thresholds as indicated below:
 - 1. Standard double bevel continuous extrusion with integrated track under sidelights.
 - 2. All thresholds to conform to details and requirements for code compliance.
- G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
- H. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

2.5 DOOR OPERATORS

- A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.

- B. Electromechanical Operators: Two (2) self-contained overhead units, 1/4 horsepower minimum, permanent-magnet DC motors with gear reduction drives, microprocessor controller; and encoder.
 - 1. Operation: Power opening and power closing.
 - 2. Features:
 - a. Adjustable opening and closing speeds.
 - b. Adjustable back-check and latching.
 - c. Adjustable braking.
 - d. Adjustable hold-open time between 0 and 30 seconds.
 - e. Obstruction recycle.
 - f. On/Off switch to control electric power to operator.
 - g. Energy conservation switch that reduces door-opening width.
 - h. Closed loop speed control with active braking and acceleration.
 - i. Adjustable obstruction recycle time delay.
 - j. Self adjusting stop position.
 - k. Self adjusting closing compression force.
 - l. Onboard sensor power supply.
 - m. Onboard sensor monitoring.
 - n. Optional Switch to open/Switch to close operation.
 - 3. Mounting: Concealed.
 - 4. Drive System: Synchronous belt type.
- C. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 5 amps.

2.6 ELECTRICAL CONTROLS

- A. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed. Systems utilizing external magnets and magnetic switches are not acceptable. A single controller shall be capable of controlling up to two (2) operators per entrance system.
- B. Performance Data: The microprocessor shall collect and store performance data as follows:
 - 1. Counter: A non-resettable counter to track operating cycles.
 - 2. Event Reporting: Unit shall include event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.

3. LED Display: Display presenting the current operating state of the controller.
- C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
1. Automatic Reset Upon Power Up.
 2. Main Fuse Protection.
 3. Electronic Surge Protection.
 4. Internal Power Supply Protection.
 5. Auto-Resetting sensor supply protection.
 6. Motor Protection, over-current protection.
- D. Soft Start/Stop: A "soft-start" "soft-stop" motor driving circuit shall be provided for smooth normal opening and recycling.
- E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location, and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.
- F. Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be a software driven handheld interface. The following parameters may be adjusted via the configuration tool.
1. Operating speeds and forces as required to meet ANSI/BHMA A156.10.
 2. Adjustable and variable features as specified.
 3. Reduced opening position.
 4. Fail Safe/Secure control.
 5. Firmware update.
 6. Trouble Shooting
 - a. I/O Status.
 - b. Electrical component monitoring including parameter summary.
 7. Software for local configuration tool shall be available as a free download from the sliding automatic entrance manufacturer's internet

site. Software shall be compatible with the following operating system platforms: Palm®, Android®, and Windows Mobile®.

2.7 ACTIVATION AND SAFETAY DEVICES

- A. Motion Sensors: Motion sensors shall be mounted on each side of door header to detect pedestrians in the activating zone, and to provide a signal to open doors in accordance with ANSI/BHMA A156.10. Units shall be programmable for bi-directional or uni-directional operation and shall incorporate K-band microwave frequency to detect all motion in both directions.
- B. Presence Sensors: Presence sensors shall be provided to sense people or objects in the threshold safety zone in accordance with ANSI/BHMA A156.10. Units shall be self-contained, fully adjustable, and shall function accordingly with motion sensors provided. The sensor shall be enabled simultaneously with the door-opening signal and shall emit an elliptical shaped infrared presence zone, centered on the doorway threshold line. Presence sensors shall be capable of selectively retuning to adjust for objects which may enter the safety zone; tuning out, or disregarding, the presence of small nuisance objects and not tuning out large objects regardless of the time the object is present in the safety zone. The door shall close only after all sensors detect a clear surveillance field.
- C. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies. Beams shall be monitored by electrical controls for faults and shall fail safe.

2.8 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.
- B. Automatic Locking System: Provide automatic locking hardware on sliding automatic entrances as follows:
 - 1. System shall include a fail-safe electric solenoid locking device with a self contained solid state electronic control factory mounted inside the header.
 - 2. When set for secure operation, the automatic sliding entrance(s) shall electrically latch in the closed position preventing door panels from sliding manually, returning the system to its locked status.

3. During a power interruption the solenoid lock shall be disengaged allowing doors to slide manually.
- C. Uninterruptible Power Supply (UPS): Provide UPS on designated sliding automatic entrances in accordance with the following:
1. UPS shall be a fully integrated unit designed to fit within the door header and shall be UL listed for operation with the automatic door system provided herein.
 2. Upon main power interruption to the door:
 - a. The UPS shall supply power to the operator, controls, activation, and safety systems of the sliding automatic entrance door.
 - b. The UPS shall provide up to 1 hour of normal operation.
 3. UPS unit shall include a low battery shut down feature to safely open or close the door prior to complete battery discharge.
 4. UPS unit shall include an audible battery replacement alarm to indicate that the battery will no longer accept a charge and replacement is required.
- D. Control Switch: Provide manufacturer's standard rocker control switch mounted on the interior jamb, and door position switch, to allow for full control of the automatic entrance door. Controls to include, but are not limited to Open/Closed/Automatic.
- E. Power Switch: Sliding automatic entrances shall be equipped with a two position, On/Off, illuminated rocker switch to control power to the door.
- F. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- G. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of door bottom.

2.9 FABRICATION

- A. General: Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
1. Form aluminum shapes before finishing.
 2. Use concealed fasteners to greatest extent possible.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.

- B. Framing: Provide automatic entrances as prefabricated assemblies.
 - 1. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
 - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - 3. Form profiles that are sharp, straight, and free of defects or deformations.
 - 4. Prepare components to receive concealed fasteners and anchor and connection devices.
 - 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.
- F. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

2.10 ALUMINUM FINISHES

- A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.
- B. Class I, Color Anodic Finish: AA-M12C22A42/A44 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.70 mils minimum complying with AAMA 611-98, and the following:
 - 1. Color: Black.
 - 2. AAMA 606.1
 - 3. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.
- D. Glazing: Glaze sliding automatic entrance door panels in accordance with, published recommendations of glass product manufacturer, and sliding automatic entrance manufacturer's instructions.
- E. Sealants: Comply with requirements specified in Division 7 Section "Joint Sealants".

3.3 FIELD QUALITY CONTROL

- A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

- A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.10.

3.5 CLEANING AND PROTECTION

- A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish. Comply with

requirements in Division 8 Section "Glazing", for cleaning and maintaining glass.

- - - E N D - - -

SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies glazed aluminum curtain wall system.
 - 1. Thermally isolated, pressure equalized on interior.
 - 2. Type: Stick system to include following:
 - a. Glass.
 - b. Integral reinforcing.
 - c. Closures, trim, subsills and flashings.
 - d. Column covers.
 - e. Fasteners, anchors, and related reinforcement.

1.2 RELATED WORK:

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Structural Steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- C. Miscellaneous Metal Members: Section 05 50 00, METAL FABRICATIONS.
- D. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- E. Aluminum and Glass Hinged Entry Doors and Storefront Construction: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- F. Glazing: Section 08 80 00, GLAZING.
- G. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 QUALITY ASSURANCE:

- A. Qualifications:
 - 1. Approval by Contracting Officer Representative (COR) is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
 - a. Manufacturers Qualifications: Manufacturer with five (5) years continuous documented experience in design, fabrication, and installation of glazed aluminum curtain wall systems of similar type and for projects of equivalent size.
 - b. Installer: Manufacturer approved in writing who has continuously installed glazed aluminum curtain walls systems of similar type and for projects of equivalent size for previous five (5) years.
 - c. Manufacturer is to provide technical field representation at project site, as a minimum, at start of project, during middle,

towards end of project, and during field testing of field mockup panel.

- d. Manufacturers Professional Engineer Qualifications: A Professional Engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of glazed aluminum curtain walls that are similar to those indicated for this Project in material, design, and extent.
- e. Testing Laboratory: Contractor is to retain AAMA accredited commercial testing laboratory to perform tests specified. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to perform testing specified in this section.
- f. Product Options: Information on construction documents establishes requirements for aesthetic effects and performance characteristics of glazed aluminum curtain wall system. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one (1) or more methods including preconstruction testing, field testing, or in-service performance.
 - 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
- g. Qualification of Welders:
 - 1) Welding is to be performed by certified welders qualified in accordance with AWS D1.2/D1.2M, using procedures, materials, and equipment of the type required for this work.

B. Mockup:

1. Construct, at job site, full size typical wall unit which incorporates horizontal and vertical joints, framing, glazing, sealants, and other accessories as detailed and specified. Mock-up wall unit location, size and design are to be as indicated on construction documents. Orient mockup to be facing full sun when constructed.

2. Performance Test
 - a. Conduct performance test of mockup after approval of visual aspects has been obtained. Testing is to be performed on mockup according to requirements in "Field Quality Control" Article.
 - b. Refer to Performance Requirements and Field Quality Control Articles, this section, for testing requirements.
3. After completion and approval of performance test results of job site mockup, as directed by COR, approved mock up panel is to be used as minimum standard of comparison for entire curtain wall system.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Contractor.
 - d. Installer.
 - e. Manufacturer's field representative.
 - f. Other installers responsible for adjacent and intersecting work.
 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Other items affecting successful completion.
 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS:

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Manufacturer's Literature and Product Data:
1. Manufacturer's standard details and fabrication methods.
 2. Data on finishing, components, and accessories.
 3. Instructions: Submit descriptive literature, detail specifications, performance test data and instructions for installation, and adjustments.
 4. Recommendations for maintenance and cleaning of exterior surfaces.
- D. Shop Drawings:
1. Show elevations of glazed curtain wall system at 1:48 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, flashing and coping details, glazing details, firestopping assemblies at edge of slabs and details of installation. Show interfaces and relationships to work of other trades and continuity with adjacent thermal, weather, air and vapor barriers.
 2. Submit for curtain wall system, accessories, and mock-up. Tentative approval of drawings is to be received before fabrication of mock-up. Final approval of drawings is to be deferred pending approval of mock-up and accessories.
 3. Operation and Maintenance Manuals
 - a. Submit cleaning and maintenance instructions.
- E. Samples:
1. Submit pairs of samples of each specified color and finish on 305 mm (12-inch) long section by width of each tubular, or extruded shape section or 305 mm by 305 mm (12-inch by 12-inch) wide sections of sheet shapes.
 2. Submit corner section of framing members showing fasteners, panels, glazing methods, glazing materials, and weather-stripping. Submit one (1) sample minimum 305 mm by 305 mm (12 inches by 12 inches). In lieu of submitting separate samples for corner section, intermediate section, and panel, one (1) composite sample incorporating all components and features listed may be submitted.
 3. Where normal color variations are anticipated, include two (2) or more units of each sample indicating extreme limits of color variations.
- F. Glass:

1. Specified in Section 08 80 00, GLAZING.
- G. Quality Assurance Submittals:
1. Design Data:
 - a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings signed and sealed by a Professional Engineer (PE).
 2. Factory Test Reports:
 - a. Test Reports: Submit certified test reports, for each of following listed tests, from a qualified independent testing laboratory showing that glazed aluminum curtain wall system assembly has been tested in accordance with specified test procedures and complies with performance characteristics as indicated by manufacturer's testing procedures. Submit factory tests required except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested within last year, under conditions specified herein, resulting test reports may be submitted in lieu of listed testing. Submit appropriate testing reports for specific tests indicated below:
 - 1) Deflection and structural tests.
 - 2) Water penetration tests.
 - 3) Air infiltration tests.
 - 4) Delamination tests.
 - 5) Thermal conductance tests.
- H. Manufacturer's Certificates:
1. Submit Certificates of Compliance, with specification requirements, for the following:
 - a. Metal extrusions.
 - b. Metal accessories.
 - c. Statement(s) that aluminum has been given specified thickness of anodizing or organic coating finish.
 - d. Statement(s) indicating manufacturers and installers conform with qualifications as specified.
 - e. Submit list (minimum of five (5)) of equivalent project size installations for both manufacturer and installer.
- I. Manufacturer's Field Reports:
1. Submit field reports of manufacturer's field representative observations of curtain wall installation indicating observations

made during inspection at beginning of project, during middle of installation and at conclusion of project.

- J. Welders: Submit welders qualifications as specified.
- K. Testing Laboratory: Submit Testing Laboratory qualifications.
- L. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.
 - 1. Show location and magnitude of loads applied to building structural frame.
 - 2. Identify deviations from details shown on drawings.
 - 3. Blast Design Calculations
 - a. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant curtain wall systems, verifying curtain wall assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1,W2 and GP1,GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the structural engineer blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant curtain walls to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection sequence.
- C. Prior to shipment from factory, place knocked-down lineal curtain wall members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape, or

strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.

- D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and to permit easy access for inspection and handling. Sealing and caulking compounds, including handling, is to be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.

1.7 PROJECT CONDITIONS:

- A. Field Measurements: Where glazed aluminum curtain wall systems are 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 Work.

1.8 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
- 501.8-14.....Test Method for Determination of Resistance of
Human Impact of Window Systems Intended for Use
in Psychiatric Applications
- MCWM-1-89.....Metal Curtain Wall Manual
- CW 10-12.....Care and Handling of Architectural Aluminum
from Shop to Site
- CW 11-85.....Design Windloads for Buildings and Boundary
Layer Wind Tunnel Testing
- CW 13-85.....Structural Sealant Glazing Systems (A Design
Guide)
- TIR A11-04.....Maximum Allowable Deflection of Framing Systems
for Building Cladding Components of Design Wind
Loads
- 501-05.....Methods of Test for Exterior Walls
- 503-08.....Field Testing of Metal Storefronts, Curtain
walls and Sloped Glazing Systems
- 2605-13.....High Performance Organic Coatings on
Architectural Extrusions and Panels

- C. American Society of Civil Engineers (ASCE):
- ASCE 7-10.....Minimum Design Loads for Buildings and Other
Structures
- D. ASTM International (ASTM):
- A36/A36M-12.....Structural Steel
- A123/A123M-13.....Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products
- A193/A193M-14a.....Alloy-Steel and Stainless Steel Bolting
Materials for High Temperature Service
- A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI
Tensile Strength
- B209-14.....Aluminum and Aluminum Alloy Sheet and Plate
- B209M-14.....Aluminum and Aluminum Alloy Sheet and Plate
(Metric)
- B211-12.....Aluminum and Aluminum Alloy Bar, Rod, Wire
- B211M-12.....Aluminum and Aluminum Alloy Bar, Rod, Wire
(Metric)
- B221-14.....Aluminum and Aluminum Alloy Extruded Bars,
Rods, Wire, Shapes and Tubes
- B221M-13.....Aluminum and Aluminum Alloy Extruded Bars,
Rods, Wire, Shapes and Tubes (Metric)
- B316/B316M-10.....Aluminum and Aluminum Alloy Rivet and Cold-
Heading, Wire, and Rods
- C578-14a.....Rigid Cellular Polystyrene Thermal Insulation
- C612-14.....Mineral Fiber Block and Board Thermal
Insulation
- C920-14a.....Elastomeric Joint Sealants
- C794-10.....Standard Test Method for Adhesion-In-Peel of
Elastomeric Joint Sealants.
- C1193-13.....Guide for Use of Joint Sealants
- C1363-11.....Thermal Performance of Building Materials and
Envelope Assemblies by Means of a Hot Box
Apparatus
- C1521-13.....Practice for Evaluating Adhesion of Installed
Weatherproofing
- D1037-12.....Evaluating the Properties of Wood-Base Fibers
and Particle Panel Materials

- E84-14.....Surface Burning Characteristics of Building Materials
- E330/E330M-14.....Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- E331-00 (R2009)Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference
- E413-10.....Classification for Rating Sound Insulation
- E783-02 (R2010)Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- E1105-00 (R2008)Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors By Uniform or Cyclic Static Air Pressure Differences
- E. American Welding Society, Inc. (AWS):
 - D1.2/D.1.2M-06 (R2014) ..Structural Welding Code-Aluminum
- F. Military Specifications (MIL):
 - MIL-C-18480.....(Rev. B) Coating Compound, Bituminous Solvent, Coal Tar Base
- G. National Association of Architectural Metal Manufacturers (NAAMM):
 - 500 Series (2006)Metal Finishes Manual
- H. Society for Protective Coatings (SSPC)
 - Paint 25-97 (2004)Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type 1 and Type II
 - Paint 20-82 (2019)Zinc-Rich Coating, Type I-Inorganic, and Type II-Organic.
- I. U.S. Veterans Administration:
 - Physical Security Design Manual for VA Facilities (VAPSDG); Life Safety Protected
 - Physical Security Design Manual for VA Facilities (VAPSDG); Mission Critical Facilities
 - Architectural Design Manual for VA Facilities (VASDM)
- J. Environmental Protection Agency (EPA):
 - 40 CFR 59 (2014)National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

1.9 WARRANTY:

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their glazed aluminum curtain wall system for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

PART 2 - PRODUCTS**2.1 SYSTEM DESCRIPTION:**

- A. Design Requirements:
 - 1. Curtain Wall System: Tubular aluminum sections with thermal break condition, self-supporting framing, factory prefinished, vision glass; related flashings, anchorage and attachment devices.
 - 2. System Assembly: Site assembled.
 - 3. Maximum wall framing member deflection, in a direction normal to plane of wall: 1/175 of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of AAMA TIR A11 and tested in accordance with ASTM E330/E330M.
 - 4. Maximum wall framing member deflection when a gypsum wallboard surface is affected: 1/360 of span.
 - 5. Maximum Framing Member Permanent Deformation: 0.2 percent of its clear span when tested in accordance with ASTM E330/E330M for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements.
- B. No glass breakage, or damage to fasteners, hardware or accessories is permitted due to deformation design requirements indicated.
 - a. Provide system complete with framing, mullions, trim, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing wall to structure as specified or indicated. Unless noted otherwise, comply with AAMA MCWM-1.
 - b. Obtain all components of curtain wall system, including framing and entrances from single manufacturer.
 - c. Fully coordinate system accessories directly incorporated and adjacent to contiguous related work and ensure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified. Coordinate

continuity with adjacent thermal, weather, air and vapor barriers.

- d. Provide system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from -18 degrees C to 49 degrees C (0 degrees F to 120 degrees F).
 - e. Provide wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified.
- C. Calculations: Submit professionally prepared calculations to indicate how design requirements for structural loading, thermal, and other performance criteria have been satisfied.

2.2 PERFORMANCE REQUIREMENTS:

- A. Delegated Design: Engage a qualified Professional Engineer, to design glazed aluminum curtain walls.
- B. Conform with system performance requirements specified.
- C. Provide curtain wall components tested in accordance with requirements below and meeting performance requirements specified:
 - 1. System Design: Design and size components to withstand loads caused by positive and negative wind pressures acting normal to plane of wall as calculated in accordance with codeto a design pressure as indicated on construction documents. See structural design criteria in structural drawings. Water Penetration:
 - a. No water penetration is to occur when wall is tested in accordance with ASTM E331 at a differential static test pressure of 20 percent of inward acting design wind pressure as indicated on structural drawings, but not less than 479 Pa (10 psf).
 - b. Make provision in wall construction for adequate drainage to outside of water leakage or condensation that occurs within outer face of wall. Leave drainage and weep openings in members and wall open during test.
 - 2. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783.
 - a. Static-Air-Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.

- b. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.
- 3. Deflections Test: ASTM E330/E330M, Procedure B:
 - a. No member is to deflect in a direction parallel to plane of wall, when carrying its full design load, more than an amount which will reduce edge cover or glass bite below 75 percent of design dimension. No member after deflection under full design load, is to have a clearance between itself and top of panel, glass, sash, or other part immediately below it less than 3 mm (1/8 inch); clearance between member and an operable window or door is to be minimum 1.5 mm (1/16 inch).
- 4. Physical Security Mission Critical Facilities:
 - a. Provide glazed aluminum curtain walls designed to meet or exceed the design and construction standards as provided in the Physical Security Design Manual for VA Facilities: Mission Critical Facilities.
 - 1) Blast Resistance: Design level vehicle threat (W2) located at the standoff distance, but not greater than GP2. The standoff distances vary. See site plan for standoff distances

2.3 MATERIALS:

- A. Extruded Aluminum Framing Members: ASTM B221M (B221); 6063-T5 extruded aluminum for non-structural components or 6063-T6 extruded aluminum for structural members; temper and alloy as recommended by manufacturer.
- B. Sheet Aluminum: ASTM B209M (B209); 6065-T5 temper and alloy as recommended by manufacturer.
 - 1. Formed flashing and closures: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
 - 2. Extruded sill members: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
- C. Steel Sections: ASTM A36/A36M.
- D. Primer: TS TT-P-645; red, for shop application and field touch-up.
- E. Fasteners:
 - 1. For Exterior Cap Retainers: ASTM A193/A193M B8 300 series, stainless steel screws.
 - 2. For Framework Connections: ASTM B211M (B211) 2024-T4 aluminum, ASTM A193/A193M B8 300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.

3. For Anchoring Glazed Aluminum Curtain Wall to Support Structure:
ASTM A307 zinc plated steel fasteners.
- F. Shims: Metal or plastic.
- G. Joint Sealants and Accessories:
1. In accordance with requirements specified in Section 07 92 00, JOINT SEALANTS.
 2. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
 3. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
 4. Sealants used inside the weatherproofing system are to have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).
 5. Structural silicone sealant performance requirements: ASTM C920.
 - a. Hardness: Type A, 30 durometer.
 - b. Ultimate Tensile Strength: 1172 kPa (170 psi).
 - c. Tensile at 150% Elongation (of original bench mark distance): 55 kPa (80 psi).
 - d. Joint Movement Capability after 14 Day Cure: +/- 50%.
 - e. Peel Strength Aluminum, After 21 Day Cure: 599 g/mm (34 pounds per inch).
 6. Structural silicone is not to be used to support dead weight of vertical glass or panels.
 7. Comply with recommendations of sealant manufacturer for specific sealant selections.
 8. Provide only sealants that have been tested per ASTM C794 to exhibit adequate adhesion to samples of glass and metal equivalent to those required for project.
 9. Exposed Metal to Metal Joints: Silicone sealant selected from manufacturer's standard colors.
- H. Glazing Materials:
1. As specified under Section 08 80 00, GLAZING.
 2. Glazing Gaskets:
 - a. Exterior: Continuous EPDM gaskets at each glass and spandrel panel.
 - b. Interior: Continuous, closed cell PVC foam sealant tape, sealed at corners.

3. Glass Sizes and Clearances:

- a. Accommodate up to 31 mm (1 1/4 inch) glazing.
- b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove flares or to reduce oversized dimensions. All cutting is to occur in factory.

4. Glass Setting Materials:

- a. Provide head bead and drive wedge required for glass installation to suit curtain wall system in accordance with manufacture's recommendations.

- I. Column Covers Exterior and Interior Surfaces: Prefinished aluminum with finish to match curtain wall mullion sections.

2.4 FABRICATION:

- A. Curtain wall components are to be of materials and thickness indicated in construction documents. Details indicated are representative of required design and profiles. Maintain sightlines. Unless specifically indicated or specified otherwise, methods of fabrication and assembly are to be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices are to permit adjustment in three directions. No exposed fasteners are permitted.
- B. Joints: Joints exceeding +1.5 mm (+1/16") are to be mechanically fastened.
- C. Ventilation and Drainage: Direct water leakage to exterior by means of concealed drainage system and weeps. Flashings and other materials used internally are to be non-staining, noncorrosive, and nonbleeding.
- D. Protection and Treatment of Metals:
 1. Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving shop.
 2. Provide protection against galvanic action wherever dissimilar metals are in contact, except in case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint conforming to MIL-C-18480 or apply appropriate caulking material or nonabsorptive, noncorrosive, and non-staining tape or gasket between contact surfaces.

- E. Metal sills and Closures: Fabricate accessories, spandrel panels, trim closures of sizes and shapes indicated from similar materials and finish as specified for wall system.
- F. Concealed Interior Mullion Reinforcing: ASTM A36/A36M steel shapes as required for strength and mullion size limitations, hot dip galvanized after fabrication in accordance with ASTM A123/A123M.

2.5 METAL FINISHES:

- A. In accordance with NAAMM AMP500 series.
- B. Anodized Aluminum:
 - 1. AA-C22A44 Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class 1 Architectural, 0.7-mil thick finish. Dyes will not be accepted.
 - a. Black.
- C. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 zinc oxide.
- D. Touch-Up Primer for galvanized Steel Surfaces: SSPC Paint 20 zinc rich.
- E. Concealed Steel Items: Galvanized in accordance with ASTM A123/A123M to 610 gm/sq. m (2.0 oz./sq. ft.). Primed with iron oxide paint.
- F. Apply one (1) coat of bituminous paint to concealed aluminum and steel surfaces one (1) coat(s) in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.
- B. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.

3.2 PREPARATION:

- A. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be

performed to verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

- B. Contact between aluminum and dissimilar metals are to receive a protective coating of bituminous paint for prevention of electrolytic action and corrosion.

3.3 INSTALLATION:

- A. Install and erect glazed curtain wall system and all components in accordance with written directions of curtain wall manufacturer. Match profiles, sizes, and spacing indicated on approved shop drawings.
- B. Bench Marks and Reference Points: Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of marks, stop erection work in that area until discrepancies have been corrected.
- C. Ensure that drainage system operates properly in accord with AAMA 501 procedures.
- D. Do not proceed with structural silicone work when metal temperature is below 0 degrees C (32 degrees F).
- E. Isolate between aluminum and dissimilar metals with protective coating or plastic strip to prevent electrolytic corrosion.
- F. Install glazed aluminum curtain wall system so as to maintain a virtually flat face cap, with no visible bowing.
- G. Install entire system so that fasteners are not visible.
- H. Tolerances:
 - 1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3657 mm (1/8 inch per 12 feet) of length up to not more than 13 mm (1/2 inch) in any total length.
 - 2. Maximum offset from true alignment between two (2) identical members abutting end to end in line: 0.8 mm (1/32 inch).
 - 3. Sealant Space Between Curtain Wall Mullion and Adjacent Construction: Maximum of 19 mm (3/4 inch) and minimum of 6 mm (1/4 inch).
- I. Joint Sealants:
 - 1. Joint Sealants: Are to be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.
 - 2. Surfaces to be primed and sealed are to be clean, dry to touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out

grooves to proper depth. Joint dimensions are to conform to approved detail drawings with a tolerance of plus 3 mm (1/8 inch).

Do not apply compound unless ambient temperature is between 5 and 35 degrees C (40 and 90 degrees F). Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings are to be of type that leave no residue on metals.

3. Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound is to be uniformly smooth and free of wrinkles and, unless indicated otherwise, is to be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four (4) hours, but at no time is this amount exceed 19 liters (5 gallons).
4. Apply primer to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after sealant work is completed.
5. Tightly pack backing in bottom of joints which are over 13 mm (1/2 inch) in depth with specified backing material to depth indicated in construction documents. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.
6. Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.
7. Remove compound smears from surfaces of materials adjacent to sealed joints as work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with solvent approved by sealant and curtain wall manufacturers. Upon completion of sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

J. Glass:

1. Refer to Section 08 80 00, GLAZING, and drawings for glass types. Install in accordance with manufacturer's recommendations as modified herein.
2. Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open

joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.

3. Clean sealing surfaces at perimeter of glass and sealing surfaces of rebates and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets.
4. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer and by curtain wall manufacturer.
5. Provide sashes designed for outside glazing.
6. Provide continuous snap in glazing beads to suit glass as specified.
7. Insulating and tempered glass, and glass of other types that exceed 2540 mm (100 united inches) in size: Provide void space at head and jamb to allow glass to expand or move without exuding sealant. Provide perimeter frames and ventilator sections with glazing rebates for unobstructed glazing surface 19 mm (3/4 inch) in height. Glazing rebate surfaces must be sloped to shed water.
8. Provide adequate means to weep incidental water and condensation away from sealed edges of insulated glass units and out of wall system. Provide weeping of lock-strip gaskets in accordance with recommendation of glass manufacturer.

3.4 CLEANING:

- A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

3.5 FIELD QUALITY CONTROL:

- A. Testing Agency: Engage an AAMA accredited commercial qualified independent testing and inspecting agency to perform field quality-control tests specified, and to prepare test reports: Submit information regarding testing laboratory's facilities and qualifications of technical personnel to COR for approval.
- B. Conduct field check test for water leakage on designated wall areas after erection to comply with AAMA MCWM-1. Conduct test on two (2) wall areas, two (2) bays wide by two (2) stories high where directed. Conduct test and take necessary remedial action as directed by COR.
- C. Test Specimen:
 - 1. Test specimen is to include curtain wall assembly and construction. Test chamber is to be affixed to exterior side of test specimen and test is to be conducted using positive static air pressure.
 - 2. Test specimens are to be selected by COR after curtain wall system has been installed in accordance with construction documents.
- D. Sealant Adhesion Tests: Test installed sealant, in presence of sealant manufacturer's field representative, in a minimum of two (2) areas and as follows:
 - 1. Test structural silicone sealant according to field adhesion test method described in AAMA CW 13.
 - 2. Test weatherseal sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
- E. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783 and to values indicated below, whichever is more stringent.
 - 1. Field air leakage testing is not required for continuous curtain wall systems.
 - 2. Static-Air-Pressure Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
 - 3. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.
- F. Water Penetration: Test glazed aluminum curtain wall system for compliance with requirements according to AAMA 503, which requires testing according to ASTM E1105.
 - 1. Uniform Static-Air-Pressure Difference: 20 percent of positive design wind load, but not less than 479 Pa (10 psf). No uncontrolled water is to be present.

G. Retesting:

1. Should system fail field test, system may be modified or repaired, and retested.
2. Should system fail second field test, system may be additionally modified or repaired, and retested.
3. All modifications and repairs made to tested areas are to be recorded, and same modifications and repairs made to all system and adjacent construction on project.
4. Should second test fail, COR may require testing of additional areas of the curtain wall.

H. Rejection:

1. Failure of any of specimens to meet test requirements of third test is cause for rejection of wall system and adjacent construction on project.

3.6 DEMONSTRATION, TESTING, AND ACCEPTANCE:

- A. Instruct Government's personnel in proper operation and maintenance of horizontal sliding entrance door equipment. Train personnel in procedures to follow in event of operational failures or malfunctions.
- B. Acceptance: At completion of project, and as a condition of acceptance, horizontal sliding entrance door equipment and systems are to be operated for a period of fifteen (15) consecutive calendar days without breakdown.

3.7 PROTECTION:

- A. After installation, protect windows, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods are to be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

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**SECTION 08 45 13
STRUCTURED POLYCARBONATE PANEL ASSEMBLIES**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The design and manufacture of an aluminum framed system, glazed with UV resistant translucent cellular polycarbonate glazing panels.
- B. All anchors, brackets, and hardware attachments necessary to complete the specified assembly, when included within project scope.
- C. Weatherability and water-tightness performance as specified.
- D. All flashings up to adjoining work supplied by others.
- E. Installation of the system.

1.2 RELATED REQUIREMENTS

- A. Structural Steel: Division 05
- B. Wood, Plastics, and Composites: Division 06
- C. Roofing: Division 07
- D. Sealants: Division 07
- E. Flashing and Sheet Metal: Division 07

1.3 SYSTEM DESCRIPTION

- A. Aluminum canopy frame glazed with translucent cellular polycarbonate standing seam panels joined one to another by continuous U-shaped battens.
- B. Design Requirements:
 - 1. Support structure, constructed of materials of adequate load bearing capacity and to maintain visual design concepts, and for attachment to and support of the specified system, supplied by other trades.
 - 2. Glazing panels, extruded and supplied in one single length
 - 3. Whenever possible, fasteners shall be concealed.
 - 4. System shall be dry glazed.
 - 5. Bottom edges of glazing panels shall rest on a continuous integral setting fin, which is designed to allow atmospheric air to reach their bottom edges, which shall be covered by a continuous air permeable tape. EPDM, silicone rubber, or neoprene setting blocks, or any other support method that would tend to restrict the flow of air through the panels is not acceptable.
 - 6. Air permeable tape shall also be applied to the top edge of the glazing panels.

7. Unrestricted thermal movement of the glazing panels shall be allowed to occur within the framing system without compromising its weathertightness.
8. The rabbet depth of all framing members shall, at a minimum, be based on a $\frac{3}{4}$ " (.75") engagement of the glazing panel, plus $\frac{1}{8}$ " (.125") cutting tolerance, plus $.005 \times$ the glazing dimension (in inches) that affects that rabbet. For example, a glazing panel that is 100" long will require a minimum rabbet depth of $.75" + .125" + (.005 \times 100") = 1.375"$.
9. The system shall be designed and manufactured so that the battens will be placed on the top side of the installation.

C. Performance Requirements:

1. Water Penetration: None when tested vertically at a pressure of 20 psf (0.0575 kPa) in accordance with ASTM E-331.
2. Structural Performance: The system shall be capable of supporting the design loading for this project as listed in the Drawings: Testing by a certified independent testing laboratory, in accordance with ASTM E-330, shall evidence adherence to the design loads. In addition, the deflection of all framing members oriented normal to the glazing plane shall not exceed $L/175$.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Submit three (3) each of the following to the Architect for review at the same time the Shop Drawings are submitted:
 1. Glazing gaskets - 6" long - each type.
 2. Samples of glazing, each minimum 6" x 6", in specified color.
 3. Test reports.
 4. Product Data.
- C. Shop Drawings:
 1. Shall include plans and/or elevations and details of the system and its installation. Flashings, sealants, and anchorage shall be clearly indicated.
 2. Shall note gauges of brake metal and any other information necessary to properly describe and install the system.

1.5 QUALITY ASSURANCE

- A. Materials and Products shall be manufactured by a company continuously and regularly employed in the manufacture of glazing systems using

cellular polycarbonate panel systems for a period of at least ten (10) years. Manufacturers shall provide a list of at least ten (10) projects having been in place a minimum of five (5) years.

- B. Erection shall be by the manufacturer or an installer experienced in erection of systems of the type specified.
- C. The manufacturer shall be responsible for the configuration and fabrication of the complete system, and will ensure that it fully meets all requirements of this specification.
- D. Approved Manufacturers: All manufacturers acceptable for use on this project under this section must be approved prior to bid. Manufacturers must submit evidence of compliance with all performance criteria specified herein. Any exceptions taken to this specification must be noted on the approval request. If approval is granted and non-compliance is subsequently discovered, the previously given approval will be invalidated and use of the product on the project will be disallowed. Requests for approval, with all test reports, submittals, and samples as specified herein, must be received no less than twelve (12) days prior to bid date. A list of all approved manufacturers and products will be issued by addendum. No verbal approvals will be given.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the jobsite in the manufacturer's original and unopened containers and bearing labels as to type of material and manufacturer's name. Delivered materials shall be identical to approved samples.
- B. Store materials under cover in a dry, clean location, off the ground. Remove from the jobsite any materials that are damaged or otherwise not suitable for installation and replace with acceptable materials.
- C. Protective coverings containing PVC shall not be used in contact with polycarbonate.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. The Manufacturer shall provide a written warranty certifying that if, within one (1) year from the shipment date of the system, the system experiences water leakage owing to defects in fabrication or materials, the Manufacturer will, in a timely manner, furnish (only) new components to replace all of those found to be defective.

- C. The above warranty does not apply in the cases of structural movement of the building(s), negative air pressure inside the building(s), acts of God, alteration or abuse of the products, or unreasonable use.
- D. The liability of the Warrantor shall be limited to the above and shall not include incidental or consequential damages of any kind.
- E. The polycarbonate or glass glazing materials or any other materials or system (example... finishes on metals) furnished and warranted by others, shall be covered by only those warranties.
- F. These additional written warranties will also be provided:
 - 1. The polycarbonate manufacturer's ten (10) year prorated warranty against defective materials, color change and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND PRODUCT

- A. EXTECH/Exterior Technologies, Inc., 200 Bridge Street, Pittsburgh, PA 15223; Phone (800) 500-8083, Fax (800) 500-8012, website www.extechinc.com or approved equal.
- B. Series #3100 Standing Seam Cellular Polycarbonate Translucent Canopy System.

2.2 MATERIALS

- A. Framing:
 - 1. Shall be extruded aluminum of 6063-T5, 6005-T5 or 6105-T5 alloy and temper. All sections shall be formed true to detail and free from defects impairing appearance, strength or durability.
 - 2. Aluminum batten end cover caps shall be provided where polycarbonate battens terminate. Plastic friction or adhered batten end caps shall not be permitted.
 - 3. Non-thermally broken perimeter aluminum framing members.
- B. Glazing Gaskets:
 - 1. Shall be elastomeric, having low friction surfaces on all interfaces between glazing and polycarbonate.
 - 2. Shall be tested for chemical compatibility with the glazing, and test reports evidencing same shall be presented to the Architect.
- C. Fasteners:
 - 1. Where exposed, shall be stainless steel, 300 Series, with stainless steel backed neoprene washers.
 - 2. Concealed fasteners they may be stainless or zinc-plated steel in accordance with ASTM Specifications A165-55 or A164-55.

3. Bolts, anchors and other fastening devices shall be as required for the strength of the connections and shall be suitable for conditions encountered. Washers shall be of the same metals as fasteners.

D. Polycarbonate Glazing Panels and Battens:

1. Appearance:

- a. The extruded panels shall be uniform in color with an integral extruded multi-cell core. The panel's exterior skins shall be interconnected and spaced apart by continuous perpendicular supporting ribs. The space between the two exterior skins, in a cross section, shall be divided by multiple parallel intermediate walls.
- b. Panels shall consist of a polycarbonate resin with permanent, co-extruded, ultraviolet (UV) protective layers on both sides of the panels. These protective layers shall be co-extruded by the manufacturer during the original extrusion of the panel and shall be a permanent part of both the interior and exterior of the panels. Post-applied coating or films of dissimilar materials are unacceptable. Battens shall be of similar UV resistant co-extruded polycarbonate materials.
- c. Panels shall be 20mm (25/32") thick, exclusive of the perpendicular toothed elements incorporated into each side, and shall be 600mm (23-5/8") wide.
- d. Panel weight shall be nominally 0.71 lbs. per sq. ft.
- e. Color (Panel): Opal
- f. Color (Batten): Opal
- g. Friction fit or adhered plastic batten end caps shall not be permitted.

2. Attachment:

- a. Two-piece sliding clips, consisting of an aluminum base portion and a stainless steel upper portion which constrains the polycarbonate sheets. The base shall be designed so as to hold the polycarbonate panels above the substrate as well as above the heads of the fasteners which attach it to the substrate. In addition, this base will incorporate low friction elastomeric cushions on which the panels can rest and/or move.

3. Flammability:

- a. The panel shall have a CC1 fire rating classification when tested in accordance with ASTM D-635 or equivalent.

- b. The panel shall have a Class A flame spread and smoke development rating when tested in accordance with ASTM E-84.

2.3 FABRICATION

- A. Construct canopy using extruded aluminum members.
- B. Carefully and accurately design, fabricate and assemble work with proper provision for thermal contraction and expansion. Work shall conform to profiles and sections noted on the shop drawings. Work shall be assembled with joints in a neat and finished manner.
- C. Field cutting or slitting of standing seam panel up-legs is not permitted.
- D. All framing members shall be factory fabricated and assembled to the greatest degree possible, including the following:
 - 1. Cutting members to length.
 - 2. Installation of glazing gaskets, to be glued within extruded gasket tracks.
 - 3. Drilling straight and countersunk mounting holes, fastener access holes, and weep holes.
 - 4. Fabricating miter joints with concealed joint reinforcements and joint gaskets.
 - 5. Installation of non-metallic thermal isolation spacers.
 - 6. Removal of extrusion portions to accommodate tight over-lapping joinery and connections, including coped ends, mid-span notches, etc.
 - 7. Fabrication and installation of splice plates at jointed connections.

2.4 FINISHES

- A. Exposed surfaces of the aluminum members shall be finished as follows:
 - 1. Anodized Coatings:
 - a. Architectural Class II (204-R1) Clear Anodized type AA-M10C22A31 complying with AAMA 611, 0.4 to 0.7 mil thick minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. All submitted sizes, dimensions and tolerances are to be field verified by the installer unless otherwise stipulated.
- B. Installer to examine site conditions to verify readiness. Notify general contractor or owner about any defects requiring correction, including but not limited to improperly sloping sill substrates and uneven planar substrates. Do not work until conditions are satisfactory.

3.2 INSTALLATION

- A. Install components in strict accordance with manufacturer's instructions and approved shop drawings. Use proper fasteners and hardware for material attachments as specified.
- B. Use methods of attachment to structure which include provisions for thermal movement.
- C. Glazing shall be installed in accordance with panel and system manufacturer's guidelines.
- D. Remove all protective coverings on polycarbonate panels during or immediately after installation.
- E. Installation shall be performed by a company with ten (10) years continuous experience in commercial construction.
- F. Protect contact points between unprotected dissimilar metals (except stainless steel) using continuous separators of FRP, PVC tape (or approved equal)
- G. Field or factory horizontal slitting of panel up-legs is not permitted.

3.2 CLEANING AND PROTECTION

- A. During installation, protect exposed surfaces against accumulation of paint, caulking, disfiguration and damage.
- B. Interior glazing surfaces shall be cleaned as the panels are being installed. The exterior shall be cleaned as each phase of the work is completed.
- C. Follow panel manufacturer instructions when cleaning exposed panel surfaces. Clean polycarbonate and frame at time of installation.
- D. Follow panel manufacturer's guidelines when removing foreign substances from panel surfaces. Use only solvents that are deemed acceptable for use.
- E. Before final acceptance, repair and/or replace any defective materials or work.

- - - E N D - - -

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

- A. Caulking: Section 07 92 00 JOINT SEALANTS.
- B. Application of Hardware: Section 08 14 00, WOOD DOORS, Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS, Section 08 71 13, AUTOMATIC DOOR OPERATORS, and Section 08 71 13.11, LOW ENERGY DOOR OPERATORS.
- C. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Painting: Section 09 91 00, PAINTING.
- E. Card Readers: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
- F. Electrical: Division 26, ELECTRICAL.
- G. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 GENERAL

- A. All hardware shall comply with ABAAS, (Architectural Barriers Act Accessibility Standard) unless specified otherwise.
- B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).
- C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.
- D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.
- E. The following items shall be of the same manufacturer, except as otherwise specified:
 - 1. Mortise locksets.
 - 2. Hinges for hollow metal and wood doors.
 - 3. Surface applied overhead door closers.

4. Exit devices.

1.4 WARRANTY

A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:

- 1. Locks, latchsets, and panic hardware: 5 years.
- 2. Door closers and continuous hinges: 10 years.

1.5 MAINTENANCE MANUALS

A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

1.6 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).

B. Hardware Schedule: AHC certified hardware consultant to prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

C. Samples and Manufacturers' Literature:

- 1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
- 2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

- D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.7 DELIVERY AND MARKING

- A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

1.8 PREINSTALLATION MEETING

- A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer's Representative. Review the following:
1. Inspection of door hardware.
 2. Job and surface readiness.
 3. Coordination with other work.
 4. Protection of hardware surfaces.
 5. Substrate surface protection.
 6. Installation.
 7. Adjusting.
 8. Repair.
 9. Field quality control.
 10. Cleaning.

1.9 INSTRUCTIONS

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number.

Each number designates a set of hardware items applicable to a door type.

- B. Keying: All cylinders shall be keyed into existing Falcon Great Grand Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 6 pin D keyway type. Keying information shall be furnished at a later date by the COR.

1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.

B. ASTM International (ASTM):

- F883-13.....Padlocks
- E2180-18.....Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):

- A156.1-06.....Butts and Hinges
- A156.2-03.....Bored and Pre-assembled Locks and Latches
- A156.3-08.....Exit Devices, Coordinators, and Auto Flush Bolts
- A156.4-08.....Door Controls (Closers)
- A156.5-14.....Cylinders and Input Devices for Locks.
- A156.6-05.....Architectural Door Trim
- A156.8-05.....Door Controls-Overhead Stops and Holders
- A156.11-14.....Cabinet Locks
- A156.12-05Interconnected Locks and Latches
- A156.13-05.....Mortise Locks and Latches Series 1000
- A156.14-07Sliding and Folding Door Hardware
- A156.15-06.....Release Devices-Closer Holder, Electromagnetic and Electromechanical
- A156.16-08.....Auxiliary Hardware
- A156.17-04Self-Closing Hinges and Pivots
- A156.18-06.....Materials and Finishes
- A156.20-06Strap and Tee Hinges, and Hasps
- A156.21-09.....Thresholds

- A156.22-05.....Door Gasketing and Edge Seal Systems
- A156.23-04.....Electromagnetic Locks
- A156.24-03.....Delayed Egress Locking Systems
- A156.25-07Electrified Locking Devices
- A156.26-06.....Continuous Hinges
- A156.28-07Master Keying Systems
- A156.29-07Exit Locks and Alarms
- A156.30-03High Security Cylinders
- A156.31-07Electric Strikes and Frame Mounted Actuators
- A156.36-10.....Auxiliary Locks
- A250.8-03.....Standard Steel Doors and Frames
- D. National Fire Protection Association (NFPA):
 - 80-10.....Fire Doors and Other Opening Protectives
 - 101-09.....Life Safety Code
- E. Underwriters Laboratories, Inc. (UL):
 - Building Materials Directory (2008)

PART 2 - PRODUCTS

2.1 BUTT HINGES

- A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
 1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
 2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.
- B. Provide quantity and size of hinges per door leaf as follows:
 1. Doors up to 1210 mm (4 feet) high: 2 hinges.
 2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
 3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.

4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
7. Provide heavy-weight hinges where specified.
8. At doors weighing 330 kg (150 pounds) or more, furnish 127 mm (5 inch) high hinges.

C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for hinges other than butts specified above and continuous hinges specified below.

2.2 CONTINUOUS HINGES

A. ANSI/BHMA A156.26, Grade 1-600.

1. Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete

C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.

1. Base Metal for Exterior Hinges: Stainless steel.

2. Base Metal for Interior Hinges: Stainless steel.

3. Base Metal for Hinges for Fire-Rated Assemblies: Stainless steel.

4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.

5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.

6. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.

7. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.

8. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

2.3 DOOR CLOSING DEVICES

- A. Closing devices shall be products of one manufacturer for each type specified.

2.4 OVERHEAD CLOSERS

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
 1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
 2. Where specified, closer shall have hold-open feature.
 3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
 4. Material of closer body shall be forged or cast.
 5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
 6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
 7. Closers shall have full size metal cover; plastic covers will not be accepted.
 8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
 9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
 10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
 11. Provide parallel arm closers with heavy duty rigid arm.
 12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.

13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.

14. All closers shall have a 1 ½" (38mm) minimum piston diameter.

2.5 DOOR STOPS

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Provide floor stops (Type L02141 or L02161) in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
- F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.
- G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.
- H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
- I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
- J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
- K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.
- L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.6 OVERHEAD DOOR STOPS AND HOLDERS

- A. Conform to ANSI Standard A156.8. Overhead holders shall be of sizes recommended by holder manufacturer for each width of door. Set overhead holders for 110 degree opening, unless limited by building construction or equipment. Provide Grade 1 overhead concealed slide type: stop-only at rated doors and security doors, hold-open type with exposed hold-open on/off control at all other doors requiring overhead door stops.

2.7 FLOOR DOOR HOLDERS

- A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

2.8 LOCKS AND LATCHES

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than six pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.
- B. In addition to above requirements, locks and latches shall comply with following requirements:
1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching basis of design listed in hardware groups. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead lined doors shall be lead lined before

applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.

2. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.36.

2.9 PUSH-BUTTON COMBINATION LOCKS

- A. ANSI/BHMA A156.5, Grade 1. Self-powered pushbutton entry.
- B. Construction: Heavy duty mortise lock housing conforming to ANSI/BHMA A156.13, Grade 1. Lever handles and operating components in compliance with the ABAAS and the ADA Accessibility Guidelines. Match lever handles of locks and latchsets on adjacent doors.
- C. Special Features: Key override to permit a master keyed security system and a pushbutton security code activated passage feature to allow access without using the entry code.

2.10 ELECTRIC STRIKES

- A. ANSI/ BHMA A156.31 Grade 1.
- B. General: Use fail-secure electric strikes at fire-rated doors.

2.11 KEYS

- A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each

Locks/Keys	Quantity
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

2.12 KEY CABINET

- A. ANSI Standard A156.11. Provide key cabinet made of cold rolled, 1.2 mm (0.0478 inch) thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano type hinge and be equipped with chrome plated locking door handles, hook cam and mechanical pushbutton door lock. Key Cabinet and Key Control System shall accommodate all keys for this project plus 25 percent. Provide minimum number of multiple cabinets where a single cabinet of largest size will not accommodate the required number of keys.
- B. Key tags shall consist of two sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 32 mm (1-1/4 inch) in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."
- C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number, key change number and door number. The contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.
- D. The Key Cabinet Manufacturer shall set up a three-way cross index system, including master keys, listing the keys alphabetically, the hooks numerically and the key changes numerically on different colored index cards. Index cards shall be typewritten and inserted in a durable binder. Attach the keys to the two sets of numbered tags supplied with the cabinet. (The permanent tag and the loan key tag). Instruct the owner in proper use of the system. Install cabinet as directed by the COR.

2.13 ARMOR PLATES, KICK PLATES, MOP PLATES

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates as specified below:

1. Kick plates, mop plates and armor plates of metal, Type J100 series.
2. Provide kick plates and mop plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
3. Kick plates and/or mop plates are not required on following door sides:
 - a. Armor plate side of doors;
 - b. Exterior side of exterior doors;
 - c. Closet side of closet doors;
 - d. Both sides of aluminum entrance doors.
4. Armor plates for doors are listed under Article "Hardware Sets". Armor plates shall be thickness as noted in the hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.
5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.
6. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge

guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

2.14 EXIT DEVICES

- A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.
- B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.
- C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.
- D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.
- E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.
- F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

2.15 FLUSH BOLTS (LEVER EXTENSION)

- A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.
- B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.
- C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).
- D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.
- E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

2.16 FLUSH BOLTS (AUTOMATIC)

- A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).
- B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire-rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

2.17 DOOR PULLS WITH PLATES

- A. Conform to ANSI A156.6. Pull Type J401, 152 mm CTC (6 inches CTC) length by 19 mm (3/4 inches) diameter minimum with plate Type J302, 90 mm by 381 mm (3-1/2 inches by 15 inches), unless otherwise specified. Provide pull with projection of 57.2 mm (2 1/4 inches) minimum and a clearance of 38.1 mm (1 1/2 inches) minimum. Cut plates of door pull plate for cylinders, or turn pieces where required.

2.18 PUSH PLATES

- A. Conform to ANSI A156.6. Metal, Type J302, 203 mm (8 inches) wide by 406.4 mm (16 inches) high. Provide metal Type J302 plates 102 mm (4 inches) wide by 406.4 mm (16 inches) high where push plates are specified for doors with stiles less than 203 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

2.19 COMBINATION PUSH AND PULL PLATES

- A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

2.20 COORDINATORS

- A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames,

unless coordinators are plated. Provide bar type coordinators, except where gravity coordinators are required at acoustic pairs. For bar type coordinators, provide filler bars for full width and, as required, brackets for push-side surface mounted closers, overhead stops, and vertical rod panic strikes.

2.21 THRESHOLDS

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. For thresholds at elevators entrances see other sections of specifications.
- C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) beyond face of frame.

2.22 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR LIGHT PROOF OR SOUND CONTROL DOORS

- A. Conform to ANSI A156.22. Provide mortise or under-door type, except where not practical. For mortise automatic door bottoms, provide type specific for door construction (wood or metal).

2.23 WEATHERSTRIPS (FOR EXTERIOR DOORS)

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m³/s/m).

2.24 MISCELLANEOUS HARDWARE

- A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E07213, conforming to ANSI A156.11. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.
- B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified. Provide cylinders to operate locking devices where specified for following partitions and doors:
 - 1. Fire-rated access doors-Engineer's key set.

- C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.25 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES

- A. ASTM E883, size 50 mm (2 inch) wide chain; furnish extended shackles as required by job conditions. Provide padlocks, with key cylinders, for each door in following areas as noted.
- B. Key padlocks as follows:
1. Chain Link Fence Gates for Electrical Substation and other Fenced Buildings or Areas: Engineer's set, except as otherwise specified.
 2. Chain Link Fence Gates for Oxygen Storage Buildings: Maintenance supply set.
 3. Roof Access and Scuttles: Engineer's set.

2.26 THERMOSTATIC TEMPERATURE CONTROL VALVE CABINETS

- A. Where lock is shown, equip each cabinet door (metal) with lock Type E06213, conforming to ANSI A156.36. Key locks in Key Sets approved by Contracting Officer. See mechanical drawings and specifications for location of cabinets.
- B. Cabinet manufacturer shall supply the hinges, bolts and pulls. Ship locks to cabinet manufacturer for installation.

2.27 FINISHES

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.
- B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.
- C. Miscellaneous Finishes:
1. Hinges --exterior doors: 626 or 630.
 2. Hinges --interior doors: 652 or 630.
 3. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
 4. Thresholds: Mill finish aluminum.
 5. Other primed steel hardware: 600.

- D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces except where otherwise specified.
- E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.

2.28 BASE METALS

- A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	Base Metal
652	Steel
626	Brass or bronze
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

- A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA COR for approval.
- B. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:
- C. Hardware Heights from Finished Floor:
1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
 2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
 3. Deadlocks centerline of strike 1219 mm (48 inches).
 4. Hospital arm pull 1168 mm (46 inches) to centerline of bottom supporting bracket.
 5. Centerline of door pulls to be 1016 mm (40 inches).
 6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
 7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
 8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with hex nuts and bolts; foot shall be fastened to frame with machine screws.

B. Hinge Size Requirements:

Door Thickness	Door Width	Hinge Height
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges; or, contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by COR. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.

E. Hinges Required Per Door:

Door Description	Number butts
Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

- F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.
- G. After locks have been installed; show in presence of COR that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 FINAL INSPECTION

- A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:
 - 1. Re-adjust hardware.
 - 2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
 - 3. Identify items that have deteriorated or failed.
 - 4. Submit written report identifying problems.

3.4 DEMONSTRATION

- A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

3.5 HARDWARE SETS

- A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.
- B. Basis of Design: Equal to Manufacturers listed. Architect approval required.

HW SET: 01 (NOT APPLICABLE)**HW SET: 02 (NOT APPLICABLE)****HW SET: 03 (NOT APPLICABLE)****HW SET: 04 (NOT APPLICABLE)****HW SET: 05 (NOT APPLICABLE)****HW SET: 07 (NOT APPLICABLE)****HW SET: 08 (NOT APPLICABLE)****HW SET: 09 (NOT APPLICABLE)****HW SET: 10**

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	TRANSFER HINGE	4-WIRE TYPE AS REQUIRED	IVE
1	EA	EU STOREROOM LOCK	RX-MA881 DG 24VDC (F07, E01- REX, E06)	FAL
1	EA	SURFACE CLOSER	SC81A/SC81A HD (C02011/C02021)	FAL
1	EA	KICK PLATE	J102	IVE
1	EA	WALL STOP	L02101 CONVEX	IVE
1	EA	GASKETING	ROY154	ZER
1	EA	CREDENTIAL READER	BY SECTION 28	B/O
1	EA	ALARM CONTACT	679-05	SCE
1	EA	POWER SUPPLY	REGULATED, FILTERED, 24VDC, AMPERAGE AS REQUIRED	VON

FUNCTION: ELECTRIFIED LOCK - FAIL SECURE. LATCH BOLT RETRACTED BY KEY.
OUTSIDE LEVER UNLOCKED BY CREDENTIAL. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 11 (NOT APPLICABLE)**HW SET: 12 (NOT APPLICABLE)****HW SET: 13 (NOT APPLICABLE)**

HW SET: 14

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	TRANSFER HINGE	4-WIRE TYPE AS REQUIRED	IVE
1	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	ELEC EXIT DEVICE	RX-QEL-99-NL-OP 24VDC (TYPE 1, F03, E01-REX, E06)	VON
1	EA	90 DEG OFFSET PULL	J402	IVE
1	EA	OH STOP	C01541-ADJUSTABLE	GLY
1	EA	AUTOMATIC OPERATOR	BY SECTION 08 71 13	LCN
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	ROY416	ZER
1	EA	THRESHOLD	PROFILE AS REQUIRED	ZER
1	EA	CREDENTIAL READER	BY SECTION 28	B/O
1	EA	ALARM CONTACT	679-05	SCE
1	EA	POWER SUPPLY	REGULATED, FILTERED, 24VDC, AMPERAGE AS REQUIRED	VON

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. LATCH ELECTRICALLY RETRACTED BY ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS. OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR WHILE LATCH IS RETRACTED. INSIDE ACTUATOR RETRACTS LATCH AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 15 (NOT APPLICABLE)**HW SET: 16 (NOT APPLICABLE)****HW SET: 17 (NOT APPLICABLE)****HW SET: 18 (NOT APPLICABLE)****HW SET: 19 (NOT APPLICABLE)****HW SET: 20**

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	PUSH/PULL BAR	J503	IVE
1	EA	OH STOP	C01541-ADJUSTABLE	GLY
1	EA	AUTOMATIC OPERATOR	BY SECTION 08 71 13	LCN

FUNCTION: PUSH/PULL. INSIDE OR OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR.

HW SET: 20A

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	PUSH/PULL BAR	J503	IVE
1	EA	OH STOP	C01541-ADJUSTABLE	GLY
1	EA	AUTOMATIC OPERATOR	BY SECTION 08 71 13	LCN
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	ROY416	ZER
1	EA	RAIN DRIP	R3Y976	ZER
1	EA	THRESHOLD	PROFILE AS REQUIRED	ZER

FUNCTION: PUSH/PULL. INSIDE OR OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR.

HW SET: 21

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	PUSH PLATE	J302	IVE
1	EA	PULL PLATE	J401 X J302	IVE
1	EA	SURFACE CLOSER	SC81A/SC81A HD (C02011/C02021)	FAL
1	EA	KICK PLATE	J102	IVE
1	EA	WALL STOP	L02101 CONVEX	IVE

FUNCTION: PUSH/PULL.

HW SET: 22

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	PUSH/PULL BAR	J503	IVE
1	EA	OH STOP	C01541-ADJUSTABLE	GLY
1	EA	SURFACE CLOSER	SC81A/SC81A HD (C02011/C02021)	FAL

FUNCTION: PUSH/PULL.

HW SET: 23

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	TRANSFER HINGE	4-WIRE TYPE AS REQUIRED	IVE
1	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	ELEC EXIT DEVICE	RX-QEL-99-NL-OP 24VDC (TYPE 1, F03, E01-REX, E06)	VON
1	EA	90 DEG OFFSET PULL	J402	IVE
1	EA	OH STOP	C01541-ADJUSTABLE	GLY
1	EA	SURFACE CLOSER	SC81A/SC81A HD (C02011/C02021)	FAL
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	ROY416	ZER
1	EA	THRESHOLD	PROFILE AS REQUIRED	ZER
1	EA	CREDENTIAL READER	BY SECTION 28	B/O
1	EA	ALARM CONTACT	679-05	SCE
1	EA	POWER SUPPLY	REGULATED, FILTERED, 24VDC, AMPERAGE AS REQUIRED	VON

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. LATCH ELECTRICALLY RETRACTED BY ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.

HW SET: 24

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	TRANSFER HINGE	4-WIRE TYPE AS REQUIRED	IVE
1	EA	EU STOREROOM LOCK	RX-MA881 DG 24VDC (F07, E01-REX, E06)	FAL
1	EA	SURFACE CLOSER	SC81A SS (C02011/C02021 WITH STOP ARM)	FAL
1	EA	KICK PLATE	J102	IVE
1	EA	GASKETING	ROY154	ZER
1	EA	DOOR SWEEP	ROY416	ZER
1	EA	THRESHOLD	PROFILE AS REQUIRED	ZER
1	EA	CREDENTIAL READER	BY SECTION 28	B/O
1	EA	ALARM CONTACT	679-05	SCE
1	EA	POWER SUPPLY	REGULATED, FILTERED, 24VDC, AMPERAGE AS REQUIRED	VON

FUNCTION: ELECTRIFIED LOCK - FAIL SECURE. LATCH BOLT RETRACTED BY KEY. OUTSIDE LEVER UNLOCKED BY CREDENTIAL. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 25

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	QTY & TYPE AS REQUIRED	IVE
1	EA	FLUSH BOLT	TYPE 27 LESS BOTTOM BOLT	IVE
1	EA	PASSAGE SET	MA101 DG (F01)	FAL
1	EA	COORDINATOR	TYPE 21A	IVE
2	EA	SURFACE CLOSER	SC81A/SC81A HD (C02011/C02021)	FAL
2	EA	KICK PLATE	J102	IVE
2	EA	WALL STOP	L02101 CONVEX	IVE
1	EA	GASKETING	ROY154	ZER
1	EA	OVERLAP ASTRAGAL	ROY634 X ROY154 X THRU-BOLTS	B/O

FUNCTION: (F01) PASSAGE LATCH. BOTH LEVERS ALWAYS UNLOCKED.

HW SET: 26

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HARDWARE	BY DOOR SUPPLIER	

HW SET: 27

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HARDWARE	BY DOOR SUPPLIER	
1	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	WALL STOP	CONCAVE	IVE

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SECTION 08 71 13
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL**1.1 SUMMARY**

A. Section Includes:

1. Automatic operators for swinging and sliding doors.

1.2 RELATED WORK

- A. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum Frames Entrance Work.
- B. Section 08 42 33, REVOLVING DOOR ENTRANCES: Revolving Door Operators.
- C. Section 08 71 00, DOOR HARDWARE: Door Hardware.
- D. Division 26, ELECTRICAL Electric General Wiring, Connections and Equipment Requirements.
- E. Division 28, ELECTRONIC SAFETY AND SECURITY: Access Control Devices.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 1. B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
 2. A1008/A1008M-20 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.
- C. Builders Hardware Manufacturers Association (BHMA):
 1. BHMA A156.10-11 - Power Operated Pedestrian Doors.
- D. National Fire Protection Association (NFPA):
 1. 101-15 - Life Safety Code.
- E. Underwriters Laboratories (UL):
 1. 325-13 - Standard for Doors, Drapery, Gate, Louver, and Window Operators and Systems.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 1. Description of each product.
 2. Installation instructions.
 3. Warranty.

- D. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- E. Test reports: Certify each product complies with specifications.
- F. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Manufacturer.
 - 2. Installer.
- G. Operation and Maintenance Data:
 - 1. Care instructions for each exposed finish product.
 - 2. Start-up, maintenance, troubleshooting, emergency, and shut-down instructions for each operational product.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Regularly manufactures specified products.
 - 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
 - a. Provide contact names and addresses for completed projects when requested by Contracting Officer's Representative.
- B. Installer's Qualifications: Experienced installer, approved by the manufacturer.

1.6 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant automatic door operators against material and manufacturing defects.
 - 1. Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Comply with requirements of BHMA A156.10. Unless otherwise indicated on Drawings, provide operators that move doors from fully closed to fully opened position in five seconds maximum time interval, when speed adjustment is at maximum setting.
- B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.
- C. Electrical Wiring, Connections and Equipment: Motors, starters, controls, associated devices, and interconnecting wiring required for installation. Equipment and wiring as specified in Division 26, ELECTRICAL.

2.2 PRODUCTS - GENERAL

- A. Provide door operators from one manufacturer.
- B. Provide one type of operator throughout project.
- C. Sustainable Construction Requirements:
 - 1. Steel Recycled Content: 30 percent total recycled content, minimum.
 - 2. Aluminum Recycled Content: 80 percent total recycled content, minimum.

2.3 SWING DOOR OPERATORS

- A. General:
 - 1. Type: Institutional type.
 - 2. Size: As recommended by manufacturer for door weight and sizes.
- B. Function:
 - 1. Provide operators, enclosed in housing, permitting opening of door by energizing motor and stopped by electrically reducing Voltage and stalling motor against mechanical stop.
 - 2. Door to close by means of spring energy, and closing force controlled by gear system and motor being used as dynamic brake without power, or controlled by hydraulic closer in electro-hydraulic operators.
 - 3. Opening and Closing Speeds: Field adjustable.
 - 4. Operators with checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle.
 - 5. Operators capable of recycling doors instantaneously to full open position from any point in closing cycle when control switch is activated.
 - 6. When automatic power is interrupted or shut-off, permit doors to easily open manually without damage to automatic operator system.
- C. Connect hardware with drive arm attached to door with pin linkage rotating in a self-lubricating bearing. Prevent doors from pivoting on shaft of operator.
- D. Operator Housing:
 - 1. ASTM B209, Type 6063-T5 aluminum alloy, 112 mm (4-1/2 inches) wide by 140 mm (5.5 inches) high by 3.2 mm (0.125 inch) thick, aluminum extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems.
- E. Power Operator:
 - 1. Completely assembled and sealed unit including gear drive transmission, mechanical spring and bearings, located in aluminum

case and filled with special lubricant for extreme temperature conditions. Rubber mounted units with provisions for easy maintenance and replacement, without removing door from pivots or frame.

F. Motors:

1. Provide with interlock to prevent operation when doors are electrically locked from opening.

G. Electrical Control:

1. Self-contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator.
2. Connecting Harnesses: Interlocking plugs.

H. Accessories:

1. Metal mounting supports, brackets and other accessories necessary for installation of operators at head of door frames.

I. Microprocessor Controls:

1. Multi-function microprocessor control providing adjustable hold open time (1-30 seconds) with fully adjustable opening speed, LED indications for sensor input signals and operator status and power assist close options. Control capable of receiving activation signals from any device with normally open dry contact output.
2. Hold doors held open by low Voltage applied to the continuous duty motor.
3. Controls:
 - a. Adjustable safety circuit that monitors door operation and stops opening direction of door if obstruction is sensed.
 - b. Recycle feature that reopens door if obstruction is sensed at any point during closing cycle.
 - c. Standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated on drawings.

2.4 SLIDING DOOR OPERATORS

A. Operator Function:

1. Electric motor pulling door from closed to open position, stopping door by electrically reducing Voltage and stalling door against mechanical stop.
2. Opening and Closing Speeds: Field adjustable.
3. System permitting manual control of door in event of power failure.

B. Power Operator:

1. Completely assembled and sealed electromechanical operating unit including 95 W (1/8 hp.) DC shunt-wound permanent magnet motor with sealed bearings, located in aluminum case and filled with special lubricant for extreme temperature conditions. Rubber mount units with provisions for easy maintenance and replacement, without removing door from pivots or frame.
2. Opening and Closing Cycle: Field adjustable.

C. Operator Housing:

1. ASTM B209, Type 6063-T5 aluminum alloy, 150 mm (6 inches) wide by 200 mm (8 inches) high by 3.2 mm (0.125 inch) thick, aluminum extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems.

2.5 SLIDING DOOR UNITS**A. Provide door panels in compliance with NFPA 101, allowing "breakout" to full open position to provide instant egress at any point in door's movement.**

1. Door Panels: ASTM A1008/A1008M, steel sheet, Type B, cold-rolled, reinforce frame structure, minimum 1.1-mm (0.043 inch) thick steel shapes.

B. Sliding Door Hardware Guide Rollers, Door Carrier:

1. Rollers: Steel or plastic rollers with sealed bearings with each door having two support rollers and one anti-rise roller.
 - a. Vertical Adjustment: Minimum 9 mm (0.35 inch) with positive mechanical locks.
 - b. Include two urethane covered oil impregnated bearing bottom rollers attached with 5 mm (3/16 inch) thick formed steel guide brackets at each door.
 - c. Door Carriers: For each door carrier supporting door leaf, include vertical steel reinforcing member to prevent sagging when door is swung under breakaway conditions.
 - 1) Carbon Steel Brackets And Fittings: Corrosion resistant.

C. Locking Hardware:

1. Locking hardware at interior doors not requiring physical security is not required.
2. Doors with flush concealed vertical rod panic hardware integrated into doors where physical security is required and free egress is required at all times.

3. Doors with manufacturers' standard hookbolt lock (keyed both sides) where physical security is required and free egress is not required at all times.

a. At doors with access control devices specified in Division 28 - ELECTRONIC SAFETY AND SECURITY, provide doors with electronic deadbolt locking to prevent doors from manually sliding open.

D. Door Closers: Breakout or swing-out panels with door closers concealed in top rail of door.

2.6 POWER UNITS

A. Self-contained, electric operated and independent of door operator.

1. Capacity and size of power circuits according to automatic door operator manufacturer's specifications and Division 26 - ELECTRICAL.

2.7 DOOR CONTROLS

A. Control Devices: BHMA A156.10; control opening and closing functions.

B. Open doors when control device is actuated; hold doors in open positions; then, close doors after an adjustable time period, unless safety device or reactivated control interrupts operation.

C. Manual Controls:

1. Push Plate Wall Switch: Recessed type, stainless steel push plate minimum 100 mm by 100 mm (4 inch by 4 inch), with 13 mm (1/2 inch) high letters "To Operate Door-Push" engraved on face of plate.

D. Motion Detector:

1. Mounting: Surface or concealed.

2. Detection Area: 1500 mm (60 inches) deep and 1500 mm (60 inches) across, plus or minus 150 mm (6 inches).

3. Response Time: 25 milliseconds, maximum.

4. Control Power: 24 Volt DC.

5. Design units to be unaffected by cleaning material, solvents, dust, dirt and outdoor weather conditions.

2.8 SAFETY DEVICES

A. Sliding Doors:

1. Two photoelectric beams mounted at heights of 600 mm (24 inches) and 1200 mm (48 inches) in door frame.

2. Overhead safety presence sensors at door head on both sides of opening.

3. Recycle doors to full open position when beams are interrupted.

4. Motion detector mounted on both sides of door for detection of traffic in both directions.

- B. Swing Doors: Install presence sensor on pull side of door to detect any person standing in door swing path and prevent door from opening.
 - 1. Time delay Switches: Adjustable between 3 to 60 seconds and control closing cycle of doors.
- C. Install decal signs with "In" or "Do Not Enter" on both faces of each door where shown.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 - 1. Verify door opening is correctly sized and within acceptable tolerances.
- B. Protect existing construction and completed work from damage.

3.2 INSTALLATION

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Coordinate door installation with other related work.
- C. Install manual controls and power disconnect switches recessed or semi-flush mounted in partitions.
- D. Secure operator components to adjacent construction with suitable fastenings.
- E. Conceal conduits, piping, and electric equipment, in finish work.
- F. Install power units in locations shown.
 - 1. Where units are mounted on walls, provide metal supports or shelves for units.
 - 2. Ensure equipment, including time delay switches, are accessible for maintenance and adjustment.
- G. Ensure operators are adjusted and function properly for type of expected traffic.
- H. Synchronize each leaf of pair doors to open and close simultaneously. Permit each door leaf to be opened manually, independent of other door leaf.
- I. Install controls at positions shown and ensuring convenience for expected traffic.
- J. Push Plate Wall Switches Mounting Height: 1000 mm (40 inches) maximum, unless otherwise approved by Contracting Officer's Representative.

3.3 DEMONSTRATION AND TRAINING

- A. Instruct VA personnel in proper automatic door operator operation and maintenance.
 - 1. Trainer: Manufacturer approved instructor.
- B. Coordinate instruction to VA personnel with VA Contracting Officer's Representative.

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**SECTION 08 71 13.11
LOW ENERGY POWER ASSIST DOOR OPERATORS**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Low-energy, power-assisted automatic swing door operators.

1.2 RELATED WORK

- A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Steel Doors.
- B. Section 08 14 00, INTERIOR WOOD DOORS: Wood Doors.
- C. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum Frames Entrance Work.
- D. Section 08 71 00, DOOR HARDWARE: Door Hardware.
- E. Section 08 71 13 AUTOMATIC DOOR OPERATORS: Automatic Door Operators.
- F. Section 09 06 00, SCHEDULE FOR FINISHES: Finish Color.
- G. Division 26, ELECTRICAL: Electric General Wiring, Connections and Equipment Requirements.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - B209-14Aluminum and Aluminum-Alloy Sheet and Plate.
 - B221-14Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. Builders Hardware Manufacturers Association, Inc. (BHMA):
 - 156.19-07Power Assist and Low Energy Power Operated Doors.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Contractor.
 - d. Installer.
 - e. Manufacturer's field representative.
 - f. Other installers responsible for adjacent and intersecting work, including electrical wiring installers.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Maintenance manuals.
 - 3. Installation instructions.
 - 4. Warranty.
- D. Samples:
 - 1. Door Operator: Full sized, complete assembly.
 - 2. Approved samples may be incorporated into work.
- E. Certificates: Certify products comply with specifications.
 - 1. Show door operator is UL Listed for specified application.
- F. Operation and Maintenance Data:
 - 1. Care instructions for each exposed finish product.
 - 2. Start-up, maintenance, troubleshooting, emergency, and shut-down instructions for each operational product.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Regularly manufactures specified products.
- B. Installer Qualifications:
 - 1. Regularly installs specified products.

1.7 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant automatic door operators against material and manufacturing defects.

1. Warranty Period: 2 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Power assisted automatic door equipment accommodating normal traffic as well as the weight of the doors; UL approved and comply with applicable codes.

2.2 SYSTEM PERFORMANCE

A. Opening Force: Maximum 67 N (15 pound force).

B. Cycle Tests: 300,000 cycles.

1. Use the widest and heaviest door specified as a test specimen. Narrower or lighter doors of the same configurations will be considered to meet the cycle test requirements.

2.3 MATERIALS

A. Aluminum:

1. Sheet: ASTM B209.

2. Extrusions: ASTM B221.

2.4 PRODUCTS - GENERAL

A. Provide automatic door operators from one manufacturer.

2.5 LOW-ENERGY AUTOMATIC DOOR OPERATORS

A. Conform to BHMA A156.19.

B. Mounting: Concealed, overhead and Surface-mounted.

C. Enclosure: Self-contained within an extruded aluminum housing (alloy 6063-T6) to conceal operator mechanism and mounting brackets and with removable access cover with an overall maximum size of 140 mm (5-1/2 inches) wide by 150 mm (6 inches) deep.

D. Safety Features:

1. Adjustable time delay.

2. Adjustable speed for opening and closing operations.

3. Adjustable backcheck.

4. Decals indicating "In" or "Do Not Enter" installed on both faces of each door where shown conforming to the requirements of ANSI/BHMA A156.19.

5. Re-activation sensor mounted on the push-side door face near the top detect any person standing in the door swing path and prevent the door from closing.

6. Motion sensor to detect any person standing in the door swing path and prevent the door from opening.

a. Adjustable door sensor system providing complete operation and safety zone coverage.

E. Power Units:

1. Self-contained electric circuits for automatic operators located on each floor of the building.

2. Interruption or failure of power circuits for operators located on one floor of the building shall not interfere with continuous performance of automatic operated doors located on other floors.

3. Power units designed to not interfere with continuous performance of automatic operated doors located on other floors in the case of power interruption or failure.

4. Capacity and size of power circuits according to automatic operator manufacturer's specifications.

2.6 OPERATION

A. Traffic Operation:

1. Single Door: Two way.

B. Operator: Electromechanical; surface-mounted.

1. Operators to have checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle.

2. Operators to recycle doors instantaneously to full open position from any point in closing cycle when control switch is reactivated.

3. Operators to allow manual door control in event of power failure.

C. Controls: Solid-state type.

D. Activation: Push-plate switch.

2.7 FINISHES

A. Aluminum Anodized Finish: NAAMM AMP 500.

1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.

B. Aluminum Paint finish:

1. Baked-Enamel or Powder-Coat: AAMA 2603; dry film thickness of 0.04 mm (1.5 mils).

2.8 ACCESSORIES

A. Signage: BHMA standard for operation and door type specified.

B. Guide Rails: Aluminum bar tubing with anodized baked-enamel or powder-coat finish.

C. Fasteners: Corrosion-resistant, compatible with adjoining materials.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine conditions effecting work, including door and frame preparation and electrical rough-ins.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Coordinate installation of equipment with other related work.
- C. Mount manual controls and power disconnect switches recessed or semi-flush in partitions.
- D. Secure operator components to adjacent construction with suitable fastenings. Conceal conduits, piping, and electric equipment in finish work.
- E. Install power units and controls in locations indicated.
 - 1. Where units are to be mounted on walls, provide metal supports or shelves for the units.

3.3 ADJUSTING

- A. All equipment, including time delay switches, to be accessible for maintenance and adjustment.
- B. Adjust operators to function properly for the type of traffic (pedestrians) expected to pass through doors.
- C. Adjust each door leaf of pairs of doors to open and close in synchronization.
- D. On pairs of doors, adjust operators allowing either door to be opened manually without the other door opening.

3.4 DEMONSTRATION AND TRAINING

- A. Instruct VA personnel in proper door operator operation and maintenance.
 - 1. Trainer: Manufacturer approved instructor.
- B. Submit training plan and trainer qualifications. See Section 01 91 00 - GENERAL COMMISSIONING REQUIREMENTS.
- C. Acceptance Condition: After completing work, operate door operators 15 consecutive calendar days without breakdown.

- - - E N D - - -

SECTION 08 80 00
GLAZING

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section specifies the following:
1. Glass.
 2. Glass clad polycarbonate glazing.
 3. Glazing materials and accessories for both factory and field glazed assemblies.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS: Sustainable Design Requirements.
- B. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, and Section 08 14 00, WOOD DOORS.
- C. Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES: Mirrors.
- D. Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS Glazed Curtain Walls: Glazed Curtain Walls.
- E. Section 08 41 26.24, INTERIOR PRIVACY GLASS WALLS AND ENTRANCES.
- F. Section 09 06 00, SCHEDULE FOR FINISHES: Color insulating and patterned glass.
- G. Section 08 34 53, SECURITY DOORS AND FRAMES: Ballistic Resistance (BR) rated doors and frames.
- H. Section 08 87 33, ARCHITECTURAL WINDOW FILM: Privacy Window Film.
- I. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER AND CONDUCTORS AND CABLES: Wiring (120 V AC, 15A or 20A).
- J. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Junction and Switch Boxes.
- K. Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS: Access Control Systems.

1.3 LABELS

- A. Temporary labels:
1. Provide temporary label on each light of glass and plastic material identifying manufacturer or brand and glass type, quality and nominal thickness.
 2. Label in accordance with NFRC label requirements.
 3. Temporary labels are to remain intact until glass and plastic material is approved by Contracting Officer Representative (COR).
- B. Permanent labels:

1. Locate in corner for each pane.
2. Label in accordance with ANSI Z97.1 and SGCC label requirements.
 - a. Tempered glass.
 - b. Laminated glass or have certificate for panes without permanent label.
3. Bullet resistance glass or plastic assemblies:
 - a. Bullet resistance glass assemblies in accordance with UL 752 requirements for level 3 power rating.
 - b. Identify each security glazing permanently with glazing manufacturer's name, date of manufacture, product number, and DOS Code number inconspicuously located in lower corner on protective side and visible after glazing is framed.
 - c. The "attack (threat) side" is to be identified in bold lettering on each side of glazing with removable label.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Design glazing system consistent with guidance and practices presented in the GANA Glazing Manual, GANA Laminated Glazing Manual, and GANA Sealant Manual, as applicable to project. Installed glazing is to withstand applied loads, thermal stresses, thermal movements, building movements, permitted tolerances, and combinations of these conditions without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; unsafe engagement of the framing system; deflections beyond specified limits; or other defects in construction.
- B. Glazing Unit Design: Design glass, including engineering analysis meeting requirements of authorities having jurisdiction. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.
 1. Design glass in accordance with ASTM E1300, and for conditions beyond the scope of ASTM E1300, by a properly substantiated structural analysis.
 2. Design Wind Pressures: As indicated on construction documents.
 3. Wind Design Data: As indicated on construction documents.
 4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than the structural capacity of the glazing unit, the threshold at

which frame engagement is no longer safely assured, 1/100 times the short-side length, or 19 mm (0.75 inch), whichever is less.

- C. Ballistic- and Blast- resistant glass or plastic glazing assemblies:
1. For blast-resistant and ballistic-resistant units comply with requirements in Physical Security Design Manual for VA Mission Critical Protected Facilities, and project-specific criteria provided on the drawings and specifications.
 2. Spall Resistance: Laminated glazing is not permitted to produce spall to interior (protected side) when impacted with scheduled ballistics.
 3. Tolerances:
 - a. Outside dimensions: Overall outside dimensions (height and width) of laminated security glazing is to maintain tolerance of ± 3 mm (± 0.12 inch).
 - b. Warpage: Out-of-flat (warpage or bowing) condition of laminates is not to exceed 2.5 mm per lineal meter (0.10 inch per 3.3 lineal foot). The condition, if present, is to be localized to extent not greater than 0.75 mm (0.03 inch) for any 0.3 meter (0.98 feet) section.
- D. Building Enclosure Vapor Retarder and Air Barrier:
1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
 2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Manufacturer's Certificates:
1. Certificate on solar heat gain coefficient when value is specified.
 2. Certificate on "R" value when value is specified.
 3. Certificate test reports confirming compliance with specified bullet resistive rating.
 4. Certificate that blast resistant glass meets the specified requirements.
- D. Manufacturer Warranty.

E. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Insulating glass units.
3. Transparent (one-way vision glass) mirrors.
4. Bullet resistive material.

F. Samples:

1. Size: 305 mm by 305 mm (12 inches by 12 inches).
2. Tinted glass.
3. Transparent (one-way vision glass) mirrors in bullet resistant assembly.

G. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.
- D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":
 1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling to comply with manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
 2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes

in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.

3. Temporary protections: The glass front and polycarbonate back of glazing are to be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces is to be approved and applied by manufacturer.
4. Edge protection: To cushion and protect glass clad, and polycarbonate edges from contamination or foreign matter, the four (4) edges are to be sealed the depth of glazing with continuous standard-thickness thermoplastic rubber tape. Alternatively, continuous channel shaped extrusion of thermoplastic rubber are to be used, with flanges extending into face sides of glazing.
5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 degrees C (60 to 75 degrees F), during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

1.7 PROJECT CONDITIONS:

- A. Field Measurements: Field measure openings before ordering tempered glass products to assure for proper fit of field measured products.

1.8 WARRANTY

- A. Construction Warranty: Comply with the FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their glazing from the date of installation and final acceptance by the Government as follows. Submit manufacturer warranty.
 1. Insulating glass units to remain sealed for ten (10) years.
 2. Laminated glass units to remain laminated for five (5) years.
 3. Polycarbonate to remain clear and ultraviolet light stabilized for five (5) years.

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
- 800Test Methods for Sealants
 - 810.1-77Expanded Cellular Glazing Tape
- C. American National Standards Institute (ANSI):
- Z97.1-14Safety Glazing Material Used in Building -
Safety Performance Specifications and Methods
of Test
- D. American Society of Civil Engineers (ASCE):
- 7-10Wind Load Provisions
- E. ASTM International (ASTM):
- C542-05(2017)Lock-Strip Gaskets
 - C716-06(2020)Installing Lock-Strip Gaskets and Infill
Glazing Materials
 - C794-18Adhesion-in-Peel of Elastomeric Joint Sealants
 - C864-05(2019)Dense Elastomeric Compression Seal Gaskets,
Setting Blocks, and Spacers
 - C920-18Elastomeric Joint Sealants
 - C964-20Standard Guide for Lock-Strip Gasket Glazing
 - C1036-16Flat Glass
 - C1048-18Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass.
 - C1172-19Laminated Architectural Flat Glass
 - C1349-17Standard Specification for Architectural Flat
Glass Clad Polycarbonate
 - C1376-15Pyrolytic and Vacuum Deposition Coatings on
Flat Glass
 - D635-18Rate of Burning and/or Extent and Time of
Burning of Self-Supporting Plastic in a
Horizontal Position
 - E84-20Surface Burning Characteristics of Building
Materials
 - E119-20Standard Test Methods for Fire Test of Building
Construction and Material
 - E1300-16Load Resistance of Glass in Buildings

- E1886-19Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
- E2190-19Insulating Glass Unit
- F1233-08(2019)Standard Test Method for Security Glazing Materials and Systems
- F1642/F1642M-17Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
- F. Code of Federal Regulations (CFR):
 - 16 CFR 1201-10Safety Standard for Architectural Glazing Materials
- G. Glass Association of North America (GANA):
 - 2010 EditionGANA Glazing Manual
 - 2008 EditionGANA Sealant Manual
 - 2009 EditionGANA Laminated Glazing Reference Manual
 - 2010 EditionGANA Protective Glazing Reference Manual
- H. International Code Council (ICC):
 - IBCInternational Building Code
- I. Insulating Glass Certification Council (IGCC)
- J. Insulating Glass Manufacturer Alliance (IGMA):
 - TM-3000North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use
- K. Intertek Testing Services - Warnock Hersey (ITS-WHI)
- L. National Fenestration Rating Council (NFRC)
- M. Safety Glazing Certification Council (SGCC) 2012:
 - Certified Products Directory (Issued Semi-Annually).
- N. Underwriters Laboratories, Inc. (UL):
 - 263-14Fire Tests of Building Construction and Materials
 - 752-11Bullet-Resisting Equipment.
- O. Department of Veterans Affairs:
- P. Physical Security Design Manual for VA Mission Critical Protected Facilities January 2015
- Q. Architectural Design Manual for VA Facilities (VASDM)
- S. Environmental Protection Agency (EPA):

40 CFR 59(2014)National Volatile Organic Compound Emission
Standards for Consumer and Commercial Products

PART 2 - PRODUCT

2.1 GLASS

- A. Provide minimum thickness stated and as additionally required to meet performance requirements.
 - 1. Provide minimum 6 mm (1/4 inch) thick glass units unless otherwise indicated.
- B. Obtain glass units from single source from single manufacturer for each glass type.
- C. Clear Glass:
 - 1. ASTM C1036, Type I, Class 1, Quality q3.
- D. Tinted Heat reflective and low emissivity coated glass:
 - 1. ASTM C1036, Type I, Class 2, Quality q3.

2.2 HEAT-TREATED GLASS

- A. Roller Wave Limits for Heat-Treated Glass: Orient all roller wave distortion parallel to bottom surface of glazing, and provide units complying with the following limitations:
 - 1. Measurement Parallel to Line: Maximum peak to valley 0.203 mm (0.008 inch).
 - 2. Measurement Perpendicular to Line: Maximum 0.0254 mm (0.001 inch).
 - 3. Bow/Warp: Maximum 50 percent of bow and warp allowed by ASTM C1048.
- B. Clear Heat Strengthened Glass:
 - 1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
- C. Tinted Heat Strengthened Glass:
 - 1. ASTM C1048, Kind HS, Condition A, Type I, Class 2, Quality q3.
- D. Clear Tempered Glass:
 - 1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
- E. Tinted Tempered Glass.
 - 1. ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3.

2.3 COATED GLASS

- A. Reflective-Coated Low-E Coated Tempered Glass:
 - 1. ASTM C1376 and ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3.
- B. Transparent Mirror (One-Way-Vision Glass):
 - 1. ASTM C1036, Type I, Class 1, Quality q2 or Class 3, Quality q3; Grey Glass.
 - 2. Thickness, as indicated.

3. Coated one face with a hard adherent reflective film of chromium or other coating of proven equivalent durability.
4. Visible light transmittance; eight percent, plus or minus two percent.
5. Visible reflectance; sixty percent, plus or minus five percent.
6. Light ratio; mirror side 10 or more; observer side one or less.
7. Assemble with coating covered and protected.
8. Clean interface glass prior to assembly.
9. Tape edge to seal interface and hold panes together.

2.4 PLASTIC GLAZING

- A. Clear Polycarbonate Sheet:
 1. ASTM C1349, Appendix X1, Type II, (coated mar-resistant, UV stabilized), with coating on both sides. Flame spread of 10 or less when tested per ASTM E84.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Two or more lites of heat treated glass bonded with polyvinyl butyral interlayer complying with interlayer manufacturer's written instructions. Minimum total laminated thickness of 5/16" for blast resistant glazing.
- B. Interlayer: Use min. 5 mm (0.060 inch) thick interlayer for vertical glazing unless otherwise indicated.
- C. Interlayer Color: Clear.

2.6 SECURITY GLAZING ASSEMBLY

- A. Provide ballistic level 3 in accordance with UL 752.
- B. Blast Resistance: Provide exterior glazing units that meet the specified blast pressures and impulses providing protection based upon hazard rating as scheduled, in accordance with Physical Security and Resilience Design Manual for Mission Critical Protected Facilities, October 2020.
- D. Laminated Glass Security Glazing Units: Fabricate from multiple lites of scheduled glass with polycarbonate interlayer between the layers of glazing.

2.7 INSULATING GLASS UNITS

- A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190. The exterior glass unit shall be fully tempered and the inner glass unit shall be laminated annealed at a minimum for all blast resistant glazing.

- B. Assemble units using glass types specified in Insulating Glass Schedule and Blast Glazing assembly requirements

2.8 GLAZING ACCESSORIES

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work are to have a finish that will not corrode or stain while in service. Fire rated glazing to be installed with glazing accessories in accordance with the manufacturer's installation instructions.
- B. Setting Blocks: ASTM C864:
 - 1. Silicone type.
 - 2. Channel shape; having 6 mm (1/4 inch) internal depth.
 - 3. Shore A hardness of 80 to 90 Durometer.
 - 4. Block lengths: 50 mm (2 inches) except 100 to 150 mm (4 to 6 inches) for insulating glass.
 - 5. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
 - 6. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
 - 1. Channel shape having a 6 mm (1/4 inch) internal depth.
 - 2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
 - 3. Lengths: 25 to 76 mm (1 to 3 inches).
 - 4. Shore A hardness of 40 to 50 Durometer.
- D. Glazing Tapes:
 - 1. Semi-solid polymeric based closed cell material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
 - 2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
 - 3. Complying with AAMA 800 for the following types:
 - a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.
- E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

- F. Glazing Gaskets: ASTM C864:
1. Firm dense wedge shape for locking in sash.
 2. Soft, closed cell with locking key for sash key.
 3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.
- G. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.
- H. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
 2. Class 25 or 50 as recommended by manufacturer for application.
 3. Grade NS.
 4. Shore A hardness of 25 to 30 Durometer.
 5. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L or less when calculating according to 40 CFR 59, (EPA Method 24).
- I. Structural Sealant: ASTM C920, silicone acetoxy cure:
1. Type S.
 2. Class 25.
 3. Grade NS.
 4. Shore a hardness of 25 to 30 Durometer.
- J. Color:
1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames to match color of the finished aluminum and be nonstaining.
 2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted are to be black, gray, or neutral color.
- K. Privacy Window Film (AWF-1) at Glass Type MG3: See Specification 08 87 33, ARCHITECTURAL WINDOW FILM.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
 2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer is approved shop drawings.

- B. Review for conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units.

3.2 PREPARATION

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION - GENERAL

- A. Install in accordance with GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, and IGMA TM-3000 unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- G. Transparent (One-Way Vision Glass) Mirror: Use continuous channel glazing gasket.
- H. Laminated Glass:
 - 1. Tape edges to seal interlayer and protect from glazing sealants.
 - 2. Do not use putty or glazing compounds.
- I. Insulating Glass Units:
 - 1. Glaze in compliance with glass manufacturer's written instructions.
 - 2. When glazing gaskets are used, they are to be of sufficient size and depth to cover glass seal or metal channel frame completely.
 - 3. Do not use putty or glazing compounds.

4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.

J. Bullet Resisting Material:

1. Glaze as recommended by manufacturer, using glazing material which will permit expansion and contraction of the bullet resistive material in the frame.
2. The polycarbonate surface is not to be cleaned by scraping, razor blade, squeegee, or use of highly alkaline cleaner.
3. At no time is polycarbonate material be exposed to chemical solvents (benzene, gasoline, acetone, paint thinners) or aromatic hydrocarbons (toluene or xylene), nor should any of these solvents or fumes be used or present in confined area such as a security guard booth.
4. Due care is to be exercised (paint formula, ventilation, protection of polycarbonate) when painting becomes necessary to interiors of rooms of hardline glazed units; exposure to chemical solvents could result in irreparable damage to security glazings (delaminations, distortions, cracks, severe stress crazing, air bubbles, etc.).

3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

- A. Cut glazing tape to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

- C. Place setting blocks at 1/4 points with edge block no more than 152 mm (6 inches) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
- F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line. Sealant type is to be compatible with glazing tape.
- G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.6 INSTALLATION - WET METHOD (SEALANT AND SEALANT)

- A. Place setting blocks at 1/4 points and install glazing pane or unit.
- B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.7 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- E. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line. Sealant type is to be compatible with glazing tape.
- F. Trim protruding tape edge.

3.8 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

- A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.
- B. Locate and secure glazing pane using glazers' clips.
- C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.9 REPLACEMENT AND CLEANING

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COR.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, and setting material in clean, whole, and acceptable condition.

3.10 PROTECTION

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.11 MONOLITHIC GLASS SCHEDULE

- A. Glass Type MG1: Clear float glass.
 - 1. Unit Thickness: 6 mm (0.23 inch).
- B. Glass Type MG2: Clear fully tempered float glass.
 - 1. Unit Thickness: 6 mm (0.23 inch).
 - 2. Safety glazing label required.
- C. Glass Type MG3: Clear fully tempered float glass.
 - 1. Unit Thickness: 14 mm (9/16 inch).
 - 2. Safety glazing label required.

3.12 LAMINATED GLASS SCHEDULE

- A. Glass Type LG1: Clear laminated glass with two (2) lites of annealed float glass.
 - 1. Delegated design: Contractor's professional engineer to analyze and select glazing thickness and interlayer thickness based on charge weight and standoff distance for locations subject to 50ft standoff distance.
 - 2. Minimum Thickness of Each Glass Lite: 3 mm (0.125 inch).
 - 3. Minimum Interlayer Thickness: 1.52 mm (0.060 inch).
- B. Glass Type LG2: Clear laminated glass with two (2) lites of fully tempered float glass.

1. Delegated design: Contractor's professional engineer to analyze and select glazing thickness and interlayer thickness based on charge weight and standoff distance for locations subject to 50ft standoff distance.
2. Minimum Thickness of Each Glass Lite: 3 mm (0.125 inch).
3. Minimum Interlayer Thickness: 1.52 mm (0.060 inch).
4. Safety glazing label required.

3.13 INSULATING GLASS SCHEDULE

- A. Glass Type IG1: Low-E-coated, tinted insulating glass.
1. Overall Unit Thickness: 25 mm (1 inch).
 2. Minimum Thickness of Each Glass Lite: 6 mm (0.23 inch).
 3. Outdoor Lite: Tinted annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
 - a. Tint Color: Gray.
 4. Interspace Content: Argon.
 5. Indoor Lite: Fully tempered float glass.
 6. Low-E Coating: Sputtered on second surface.
 7. Safety glazing label required.

3.14 INSULATING LAMINATED GLASS SCHEDULE (FORCE PROTECTION AND PHYSICAL SAFETY)

- A. Glass Type IL1: Tinted, low-e coated insulating laminated glass (for locations subject to 25ft standoff distance).
1. Overall Unit Thickness: 30 mm (1-1/4 inch).
 2. Outdoor Lite: Tinted annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
 - a. Minimum Thickness of Outdoor Lite: 6 mm (0.23 inch).
 - b. Tint Color: Gray.
 3. Interspace Content: Argon.
 4. Indoor Lite: Clear laminated glass with two lites of annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
 - a. Delegated design: Contractor's professional engineer to analyze, and select glazing thickness and interlayer thickness based on charge weight and standoff distance for locations subject to 25ft standoff distance.
 - b. Minimum Thickness of Each Glass Lite: 5mm (0.1875 inch).

- c. Interlayer Thickness: 1.52 mm (0.060 inch) minimum.
 5. Low-E Coating: Sputtered on second surface.
 6. Safety glazing label required.
- B. Glass Type IL2: Tinted, low-E coated, insulating laminated glass (for locations subject to 50ft standoff distance).
1. Overall Unit Thickness: 30 mm (1-1/4 inch).
 2. Outdoor Lite: Tinted annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
 - a. Minimum Thickness of Outdoor Lite: 6 mm (0.23 inch).
 - b. Tint Color: Gray.
 3. Interspace Content: Argon.
 4. Indoor Lite: Clear laminated glass with two lites of annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
 - a. Delegated design: Contractor's professional engineer to analyze and select glazing thickness and interlayer thickness based on charge weight and standoff distance for locations subject to 50ft standoff distance.
 - b. Minimum Thickness of Each Glass Lite: 3 mm (0.125 inch).
 - c. Interlayer Thickness: 1.52 mm (0.060 inch) minimum.
 5. Low-E Coating: Sputtered on second surface.
 6. Safety glazing label required.

3.15 SECURITY GLAZING SCHEDULE

- A. Glass Type SG1: Heat Strengthened Glass Clad Polycarbonate Security (one way vision) Glazing Unit:
1. Outer Glass Pane (impact side): Heat strengthened; 3 mm (0.12 inch) thick.
 2. Interlayers: Minimum 1.3 mm (0.050 inch) polyurethane sheeting, in thickness required to meet performance requirements.
 3. Core: Clear polycarbonate sheeting thickness required to meet performance requirements.
 4. Inner Glass Pane (secure side): Transparent mirror (one way vision glass): Annealed; 3 mm (0.12 inch) thick.
 5. Ballistic-Resistance Rating: UL Standard 752 Level 3 rating.

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**SECTION 08 87 33
ARCHITECTURAL WINDOW FILM**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Architectural window film.

1.2 RELATED REQUIREMENTS

- A. Section 08 80 00, GLAZING.
- B. Section 08 41 26.24, INTERIOR PRIVACY GLASS WALLS AND ENTRANCES.
- C. Pattern: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

- A. ASTM International (ASTM):
 - ASTM E84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
 - ASTM E308 - Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.
 - ASTM E903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's literature and data:
 - 1. Manufacturer's Data Sheets.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Warranty.
- C. Samples:
 - 1. For each film specified, two samples representing actual film color and pattern.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Follow Manufacturer's instructions for storage and handling.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.6 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:
 - 1. Flame Spread Index: no greater than 25.
 - 2. Smoke Developed Index: no greater than 450.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Material Properties:
 - 1. General: Glass and plastic finishes field-applied application to glass or plastic material as visual opaque or decorative film.
 - 2. Film: Polyester.
 - 3. Decorative Pattern:
 - a. AWF-1: Printed with Manufacturer's standard for Basis of Design pattern.
 - 4. Adhesive: Acrylic, Pressure Sensitive, Permanent.
 - 5. Liner: Silicone-coated Polyester.
 - 6. Thickness (Average): 3.2 mils (80 microns).

2.3 OPTICAL PERFORMANCE

- A. Decorative/privacy glazing film applied to 3mm thick clear glass (ASTM E903, ASTM E308):
 - 1. Ultraviolet Transmittance: 0.1 percent.
 - 2. Visible Light Transmittance: 21 percent.
 - 3. Visible Light Reflectance - Interior: 43 percent.
 - 4. Solar Heat Transmittance: 25 percent.
 - 5. Solar Heat Reflectance: 34 percent.
 - 6. Shading Coefficient at 90 Degrees (Normal Incidence): 0.44.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
- B. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.
- C. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
- D. Commencement of installation constitutes acceptance of conditions.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Film Installation, General:
 - 1. Install in accordance with manufacturer's instructions.
 - 2. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
 - 3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
 - 4. Apply film to glass and lightly spray film with slip solution.
 - 5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
 - 6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
 - 7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

3.4 CLEANING AND PROTECTION

1. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.
2. Touch-up, repair or replace damaged products before Substantial Completion.

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SECTION 09 05 16
SUBSURFACE PREPARATION FOR FLOOR FINISHES

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section specifies subsurface preparation requirements for areas to receive the installation of applied and resinous flooring. This section includes removal of existing floor coverings, testing concrete for moisture and pH, remedial floor coating for concrete floor slabs having unsatisfactory moisture or pH conditions, floor leveling and repair as required.

1.2 RELATED WORK

- A. Section 07 92 00, JOINT SEALANTS.
- B. Section 09 65 16, RESILIENT SHEET FLOORING, Section 09 65 19, RESILIENT TILE FLOORING, Section 09 67 23.30, RESINOUS HIGH PERFORMANCE FLOORING, Section 09 67 23.50, RESINOUS (Epoxy Terrazzo) FLOORING, and Section 09 68 00, CARPETING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and TEST DATA.
- B. Written approval confirming product compatibility with subfloor material manufacturer and the flooring manufacturer.
- C. Product Data:
1. Moisture remediation system
 2. Underlayment Primer
 3. Cementitious Self-Leveling Underlayment
- D. Test Data:
1. Moisture test and pH results performed by a qualified independent testing agency or warranty holding manufacturer's technical representative.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. ASTM International (ASTM):

D638-14(2014)	.....Standard Test Method for Tensile Properties of Plastics
D4259-18(2019)	.....Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.
C109/C109M-20b(2020)	...Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens
7234-19(2020)	.....Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
E96/E96M-16(2016)	.....Standard Test Methods for Water Vapor Transmission of Materials
F710-1e1(2020)	.....Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
F1869-16a	.....Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
F2170-19a(2020)	.....Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
C348-20(2020)	.....Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
C191-19(2020)	.....Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle

PART 2 - PRODUCTS

2.1 MOISTURE REMEDIATION COATING

- A. System Descriptions:
1. High-solids, epoxy system designed to suppress excess moisture in concrete prior to an overlayment. For use under resinous products, LVT, tile and carpet where issues caused by moisture vapor are a concern.
- B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up.
- C. System Components: Verify specific requirements as systems vary by manufacturer. Verify build up layers and installation method. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:

1. Liquid applied coating:
 - a. Resin: epoxy.
 - b. Formulation Description: Multiple component high solids.
 - c. Application: Per manufacturer's written installation requirements.
 - d. Thickness: minimum 10 mils
- D. Material Vapor Permeance: Application shall achieve a permeance rating of less than 0.1 perm in accordance with ASTM E96/E96M.
- E. Maximum RH requirement: 100% testing in accordance with ASTM F2170.

Property	Test	Value
2.2 Tensile Strength	ASTM D638	4,400 psi
Volatile Organic Compound Limits (V.O.C.)	SCAMD Rule 1113 (Amended) 02/05/2016)	25 grams per liter
Permeance	ASTM E96	0.1 perms
Tensile Modulus	ASTM D638	1.9X10 ⁵ psi
Percent Elongation	ASTM D638	12%
Cure Rate	Per manufacture's Data	4 hours Tack free with 24hr recoat window
Bond Strength	ASTM D7234	100% bond to concrete failure

CEMENTITIOUS SELF-LEVELING UNDERLAYMENT

- A. System Description:
 1. High performance self-leveling underlayment resurfacer. Single component, self-leveling, cementitious material designed for easy application as an underlayment for all types of flooring materials. It is used for substrate repair and leveling.
- B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up. Gypsum-based products are unacceptable.
- C. System Characteristics:
 1. Wearing Surface: smooth

2. Thickness: Per architectural drawings, ranging from feathered edge to 1", per application. Applications greater than 1" require additional 3/8" aggregate to mix or as recommended by manufacturer.
- D. Underlayment shall be calcium aluminate cement-based, containing Portland cement. Gypsum-based products are unacceptable.
- E. Compressive Strength: Minimum 4100 psi in 28 days in accordance with ASTM C109/C109M.
- F. Flexural Strength: Minimum 1000 psi in 28 days in accordance with ASTM C348.
- G. Dry Time: Underlayment shall receive the application of moisture insensitive tile in 6 hours, floor coverings in 16 hours, and resinous flooring in 3-7 days.
- H. Primer: compatible and as recommended by manufacturer for use over intended substrate
- I. System Components: Manufacturer's standard components that are compatible with each other and as follows:
1. Primer:
 - a. Resin: copolymer
 - b. Formulation Description: single component ready to use.
 - c. Application Method: Squeegee and medium nap roller.
 - d. All puddles shall be removed, and material shall be allowed to dry, 1-2 hours at 70F/21C.
 - e. Number of Coats: (1) one.
 2. Grout Resurfacing Base:
 - a. Formulation Description: Single component, cementitious self-leveling high-early and high-ultimate strength grout.
 - b. Application Method: colloidal mix pump, cam rake, spike roll.
 - 1) Thickness of Coats: Per architectural scope, 1" lifts.
 - 2) Number of Coats: More than one if needed.
 - c. Aggregates: for applications greater than linch, require additional 3/8" aggregate to mix.

Property	Test	Value
Compressive Strength	ASTM C109/C109M	2,200 psi @ 24 hrs 3,000 psi @ 7 days
Initial set time Final Set time	ASTM C191	30-45 min. 1 to 1.5 hours
Bond Strength	ASTM D7234	100% bond to

		concrete failure
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PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before testing and not less than three days after testing.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation.
- C. Do not install materials when the temperatures of the substrate or materials are not within 60-85 degrees F/ 16-30 degrees C.

3.2 SURFACE PREPARATION

- A. Existing concrete slabs with existing floor coverings:
 - 1. Conduct visual observation of existing floor covering for adhesion, water damage, alkaline deposits, and other defects.
 - 2. Remove existing floor covering and adhesives. Comply with local, state and federal regulations and the RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to the floor covering being removed.
- B. Concrete shall meet the requirements of ASTM F710 and be sound, solid, clean, and free of all oil, grease, dirt, curing compounds, and any substance that might act as a bond-breaker before application. As required prepare slab by mechanical methods. No chemicals or solvents shall be used.
- C. General: Prepare and clean substrates according to flooring manufacturer's written instructions for substrate indicated.
- D. Prepare concrete substrates per ASTM D4259 as follows:
 - 1. Dry abrasive blasting.
 - 2. Wet abrasive blasting.
 - 3. Vacuum-assisted abrasive blasting.
 - 4. Centrifugal-shot abrasive blasting.
 - 5. Comply with manufacturer's written instructions.

- E. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.
- F. Verify that concrete substrates are dry.
- G. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of per flooring manufactures formal and project specific written recommendation.
- H. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity per flooring manufacture's formal and project specific written recommendation.
- I. Provide a written report showing test placement and results.
- J. Prepare joints in accordance with Section 07 92 00, JOINT SEALANTS and material manufacturer's instructions.
- K. Alkalinity: Measure surface pH in accordance with procedures provided in ASTM F710 or as outlined by qualified testing agency or flooring manufacturer's technical representative.
- L. Tolerances: Subsurface shall meet the flatness and levelness tolerance specified on drawings or recommended by the floor finish manufacturer. Tolerance shall also not to exceed 1/4" deviation in 10'. As required, install underlayment to achieve required tolerance.
- M. Other Subsurface: For all other subsurface conditions, such as wood or metal, contact the floor finish or underlayment manufacturer, as appropriate, for proper preparation practices.

3.3 MOISTURE REMEDIATION COATING

- A. Where results of relative humidity testing (ASTM F2170) exceed the requirements of the specified flooring manufacturer, apply remedial coating as specified to correct excessive moisture condition.
- B. Prior to remedial floor coating installation mechanically prepare the concrete surface to provide a concrete surface profile in accordance with ASTM D4259.
- C. Mix and apply moisture remediation coating in accordance with manufacturer's instructions.

3.4 CEMENTITIOUS UNDERLAYMENT

- A. Install cementitious self-leveling underlayment as required to correct surface defects, floor flatness or levelness corrections to meet the tolerance requirements as or detailed on drawings, address non-moving

cracks or joints, provide a smooth surface for the installation of floor covering, or meet elevation requirements detailed on drawings.

B. Mix and apply in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, tempered hardwood, or other suitable protection course

3.6 FIELD QUALITY CONTROL

A. Where specified, field sampling of products shall be conducted by a qualified, independent testing facility.

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SECTION 09 06 00
SCHEDULE FOR FINISHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

1.2 MANUFACTURERS

A. Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

1.3 SUBMITALS

A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES—provide quadruplicate samples for color approval of materials and finishes specified in this section.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. MASTER PAINTING INSTITUTE: (MPI)

6/1/2019.....Architectural Painting Specification Manual

PART 2 - PRODUCTS

2.1 DIVISION 03 - CONCRETE

A. SECTION 03 45 00, PRECAST ARCHITECTURAL CONCRETE

Material	Texture	Finish	Manufacturer	Mfg. Color Name or No.
Concrete "Limestone" Finish	-	Sandblast	Gage Brothers Concrete Products	#0721-19; Architect Approval
Concrete "Exposed Quartz Aggregate" Finish	-	Exposed Aggregate	Gage Brothers Concrete Products	#0721-18; Architect Approval
Modular Thin Brick	Colonial	-	Sioux City Brick	70% Granite Red; 30% Plum; Architect Approval

2.2 DIVISION 06 WOOD, PLASTICS, AND COMPOSITES

A. SECTION 06 20 00, FINISH CARPENTRY

1. SHELVES AND RODS		
Component	Material	Manufacturer/Color/No.
Combination Garment Rod and Shelf Support	Steel	Enamel/White; Architect Approval
Shelf	Plastic Laminate:PL-2	Formica, Pecan Woodline/#5883-58; Architect Approval
Rod	Steel	Chrome Plating; Architect Approval

2. PLASTIC LAMINATE			
Code	Application	Manufacturer	Color/No.
PL-2	Custom Cabinetry	Formica	Pecan Woodline/#5883-58;

			Architect Approval
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3. ACRYLIC SOLID SURFACE			
Code	Application	Manufacturer	Color/No.
S-1	Window Sills	LG HI-MACS	Shadow Concrete/#M322; Architect Approval
S-2	Countertops, Divider Wall Top Cap, and Display Wall Elements	LG HI-MACS	Milky Way/#T009; Architect Approval

4. PLASTIC RESIN DECORATIVE PANEL					
Code	Manufacturer	Product	Texture/Finish	Thickness	Color/Image
ACR-1	3Form	Varia Ecoresin, Wave	Wave Emboss/ Sandstone F01	1/2" (12.7mm)	Lago/#B47; Opaque Backer at Info Desk Soffit Only: + Avalanche Architect Approval
ACR-2	3Form	Varia Ecoresin, Digital Printing	Sandstone F01	1/2" (12.7mm)	Custom Image provided by Owner; Architect Approval of custom digital printing

5. DECORATIVE PROTECTION PANEL			
Code	Manufacturer	Product Name	Color Name/No.
DPP-1	Formica	Hardstop Panels	Pecan Woodline/#5883-58; Architect Approval
DPP-2	Formica	Hardstop Panels	Neutral Twill/#8826-58; Architect Approval

6. ACCESSORIES AND MISCELLANEOUS ITEMS

Item	Manufacturer	Product Name/No.	Finish/Color/No.
Outside Corners/TRIM-3	Formica	HardStop/#AT20010103	Dark Bronze/#103; Architect Approval
End Caps/TRIM-4	Formica	HardStop/#AT40010103	Dark Bronze/#103; Architect Approval
Cabinet Vinyl Edge Strip	-	-	Match Plastic Laminate Color; Architect Approval
Cabinet Liner	-	-	White; Architect Approval
Grommets	Hafele	Flexi-Top, One-Piece, Plastic Cable Grommet/#631.43.302	Black; Architect Approval
Countertop Support Bracket	Hafele	SpeedBrace/#287.77.003	Stainless Steel; Architect Approval

2.3 DIVISION 07 - THERMAL AND MOISTURE PROTECTION

A. SECTION 07 42 13.23, METAL COMPOSITE WALL PANELS

Item	Material	Finish
Panels	See Specification 07 42 13.23	Petersen Aluminum Corp., PAC-CLAD, Kynar PVDF, Color: Musket Gray; Architect Approval

B. SECTION 07 60 00, FLASHING AND SHEET METAL

Item	Material	Finish
Copings	See Specification 07 60 00	Petersen Aluminum Corp., PAC-CLAD, Kynar PVDF, Color: Musket Gray; Architect Approval

Gravel Stops	See Specification 07 60 00	Petersen Aluminum Corp., PAC-CLAD, Kynar PVDF, Color: Musket Gray; Architect Approval
Scuppers	See Specification 07 60 00	Petersen Aluminum Corp., PAC-CLAD, Kynar PVDF, Color: Musket Gray; Architect Approval

DIVISION 08 - OPENINGS

C. SECTION 08 11 13, HOLLOW METAL DOORS AND FRAMES

1. Paint both sides of door and frames same color including ferrous metal louvers, and hardware attached to door.	
Component	Color of Paint Type and Gloss
Door	P-4: Sherwin Williams, Pro Industrial Semi-Gloss B66W 651; Color: Match Diamond Vogel, Drifting Sand #0218; Architect Approval
Frame	P-4: Sherwin Williams, Pro Industrial Semi-Gloss B66W 651; Color: Match Diamond Vogel, Drifting Sand #0218; Architect Approval
Window frame	P-4: Sherwin Williams, Pro Industrial Semi-Gloss B66W 651; Color: Match Diamond Vogel, Drifting Sand #0218; Architect Approval

D. SECTION 08 14 00, INTERIOR WOOD DOORS

Component	Manufacturer/Product/No.	Finish/Color/No.
Swing Doors	CS Acrovyn/Impact Resistant Door/#SCL5-NR	Fossil Teak/#1352; Architect Approval
Sliding Doors	AD Systems/ExamSlide	Door: CS Acrovyn/Fossil Teak/#1352; Arch. Approval; Track and Valance: Anodized Aluminum, Color be selected from Manufacturer's standard Kynar finishes; Architect Approval

E. SECTION 08 31 13, ACCESS DOORS AND FRAMES

Material	Finish/Color
Steel	Match wall or ceiling color; Architect Approval
Stainless steel	No. 6 Fine Satin; Architect Approval

F. SECTION 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

Material	Finish	Manufacturer	Manufacturer Color Name
Aluminum	Anodized	-	Black Anodized; Architect Approval
Glass	See Specification 08 80 00	-	-

G. SECTION 08 41 26.24, INTERIOR PRIVACY GLASS WALLS AND ENTRANCES

Manufacturer	Product
Innovative Glass Corp.	LC Privacy Glass; Architect Approval

H. SECTION 08 44 13, GLAZED ALUMINUM CURTAIN WALLS

Material	Finish	Manufacturer	Manufacturer Color Name
Aluminum	Anodized	-	Black Anodized; Architect Approval
Aluminum	Anodized	-	Black Anodized. Clear at tie into existing clerestory curtainwall.
Glass	See Specification 08 80 00	-	-

I. SECTION 08 80 00, GLAZING

Glazing Type	Manufacturer	Manufacturer Product Name/No.
IG1	-	Gray; Mfr. Full Range; Architect Approval

IL1	-	Gray; Mfr. Full Range; Architect Approval
IL2	-	Gray; Mfr. Full Range; Architect Approval
MPG1	Architectural Glass	Premium Decorative Glass; Sonora; #GL 1013-5; Architect Approval

J. SECTION 08 87 33 ARCHITECTURAL WINDOW FILM

Finish Code	Product	Manufacturer	Size	Color Name/No.	Texture
AWF-1	Fasara	3M	50" Wide	Milky Milky/SH2MAMM	Frosted/Matte; Architect Approval

2.4 DIVISION 09 - FINISHES

A. SECTION 09 30 13, CERAMIC/PORCELAIN TILING

1. TILE				
Finish Code	Application	Size	Manufacturer	Product Name/Color /No.
PT-1	Floors	12" x 24" Field Tile 6" x 12" Cove Base Straight Joint	Daltile	Portfolio/Noce/#PF11; Matte Finish; Architect Approval
PT-2	Walls	6" x 18" Installed Horizontally	Daltile	Articulo/Column Grey/#AR-09; Architect Approval
PT-3	Wall Accent	12" x 24" Installed Vertically	Daltile	Museo/Grey Mix/#MU37; Matte Finish; Architect Approval

2. GROUT		
Finish Code	Manufacturer	Product Name/Color/No.

GT-1	Bostik	TruColor RapidCure/Match TEC Sable/#925; Architect Approval
GT-2	Bostik	TruColor RapidCure/Match TEC Mist/#939; Architect Approval

3. METAL DIVIDER STRIPS			
Finish Code	Manufacturer	Product Name/No.	Material
TRIM-1	Schluter	INDEC Recess Corner Trim/#IN100AE	Polished Chrome Anodized Aluminum; Architect Approval
TRIM-2	Schluter	DILEX 135° Corner/#AHK	Anodized Aluminum; Architect Approval
TRIM-6	Schluter	SCHEINE	Stainless Steel; Architect Approval

B. SECTION 09 51 00, ACOUSTICAL CEILINGS

Finish Code	Component	Color	Manufacturer	Product Name/No.
N/A	Exposed Suspension System	White	-	Architect Approval
AT-1	Type III	White	Armstrong	Cortega 15/16" Angled Tegular/#704; Architect Approval

C. SECTION 09 54 23, LINEAR METAL CEILINGS

Finish Code	Strip Material	Strip Face Size	Manufacturer	Mfg Name/No.	Color/No.
AMP-1 (Interior)	Electrogalvanized Steel	6"	Armstrong	MetalWorks Linear, Classics/M2 - Microperforated	Effects Cocoa Bean/#FXCB; Architect Approval

AMP-2 (Exterior)	Electrogalvanized Steel	6"	Armstrong	MetalWorks Linear, Classics/M1 - Unperforated	Effects Cocoa Bean/#FXCB2; Architect Approval
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D. SECTION 09 65 19, RESILIENT TILE FLOORING

1. RESILIENT TILE				
Finish Code	Size	Material	Manufacturer	Product Name/Color/No.
RF-2	40" x 20"	Rubber	Nora	Noramant Arago/Calm/#5178; Architect Approval

2. EDGE STRIPS			
Finish Code	Manufacturer	Product Name	Material
TRIM-5	Schluter	RENO-U	Stainless Steel; Architect Approval

E. SECTION 09 65 16, RESILIENT SHEET FLOORING

1. RESILIENT SHEET			
Finish Code	Pattern name	Manufacturer	Color Name/No.
RF-1	Noraplan Sentica	Nora	Down Feathers/#6504; Architect Approval
WSF-1	Forestscapes HPD, Modern Collection	Teknoflor	Steel/#88069; Architect Approval

2. WELDING RODS		
At Finish Code	Manufacturer	Color Name/No.
WSF-1	Teknoflor	Manufacturer's standard to match WSF; Architect Approval

3. EDGE STRIPS			
Finish Code	Manufacturer	Product No./Color Name	Material
TS-2	Johnsonite	#CTA-32-HT/Pebble; Architect Approval	Rubber

F. SECTION 09 65 13, RESILIENT BASE AND ACCESSORIES

Finish Code	Item	Height	Manufacturer	Product No./Color Name/No.
RB-1	Resilient Base	4"	Johnsonite	Pebble/#32; Architect Approval
TS-3	Reducer Strip	-	Johnsonite	#CRS-32-B/Pebble; Architect Approval

G. SECTION 09 68 00, CARPETING

Finish Code	Size	Pattern/Install	Manufacturer	Color Name/No.
CPT-1	18" x 36"	Straight Shift 54810/Monolithic	Philadelphia Commercial	Screw/#00505; Architect Approval
CPT-3	12' roll	SuccessionII BL 54694	Philadelphia Commercial	French Roast/#00701; Architect Approval

1. SECTION 09 68 00, CARPET EDGE STRIP

Finish Code	Material	Manufacturer	Product Name or No./Color Name
TRIM-5	Stainless Steel	Schluter	RENO-U; Architect Approval
TS-1	Rubber	Johnsonite	#SLT-32-A/Pebble; Architect Approval
TS-2	Rubber	Johnsonite	#SLT-32-C/Pebble; Architect Approval

H. SECTIONS 09 67 23.30 RESINOUS HIGH PERFORMANCE FLOORING; SECTION 09 67 23.50 RESINOUS TERRAZO FLOORING; and 09 67 23 RESINOUS EPOXY BROADCAST WITH URETHANE TOPCOAT

Finish code	Manufacturer	Product	Color Name/No.
RES-1	Terrazzo and Marble Supply Companies	Terroxy Resin Systems	#10-2142; Architect Approval
RES-2	Dur-A-Flex, Inc.	Primer: Dur-A-Glaze #4 WB resin and hardener; Broadcast and Grout Coat: Shop Floor resin and hardener; Aggregate: Flintshot or Q-Rok quartz; Topcoat: Armor Top resin, hardener, and grit; Shallow Fill Material: Dur-A-Glaz #4 Cove Rez; Deep Fill and Sloping Material: Dur-A-Crete.	Color to selected by COR from Manufacturer's standard colors; Architect Approval

I. SECTION 09 91 00, PAINTING

1. MPI Gloss and Sheen Standards

		Gloss @60	Sheen @85
Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-"a velvet-like" finish	max 10 units, and	10-35 units
Gloss Level 3	a traditional "egg-shell like" finish	10-25 units, and	10-35 units
Gloss Level 4	a "satin-like" finish	20-35 units, and	min. 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6	a traditional gloss	70-85 units	
Gloss level 7	a high gloss	more than 85 units	

2. PAINT					
Paint code	MPI	Gloss	Manufacturer	Product	Color Name/No.
P-1	N/A	Equal to Level 5	Benjamin Moore	Ultra Spec SCUFF-X 487	Match Diamond Vogel, Hidden Cove/#0210; Architect Approval
P-2	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Hidden Cove/#0210; Architect Approval
P-3 NOT USED	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Thistle Gray/#0197; Architect Approval
P-4 (Interior HM Doors & Frames)	153	Level 5	Sherwin Williams	Pro Industrial Acrylic B66W651	Match Diamond Vogel, Drifting Sand/#0218; Architect Approval
P-4A (Linear Diffusers)	153	Level 5	Sherwin Williams	Pro Industrial Acrylic B66W651	Match Diamond Vogel, Hidden Cove/#0210; Architect Approval
P-4B (Return Grilles)	153	Level 5	Sherwin Williams	Pro Industrial Acrylic B66W651	Match Sherwin Williams, Original White/#SW 7077; Architect Approval

P-4C (Wall Diffusers)	153	Level 5	Sherwin Williams	Pro Industrial Acrylic B66W651	Match RWP-1; Architect Approval
P-5 NOT USED	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Always Neutral/#0559; Architect Approval
P-6	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Indian Tears/In the Blue/#0504; Architect Approval
P-7	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Restful Retreat/#0497; Architect Approval
P-8 NOT USED	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Howdy Neighbor/#0385; Architect Approval
P-9 NOT USED	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Dancing in the Rain/#0644; Architect Approval
P-10 (Interior Columns)	N/A	-	Zolatone Interior Coatings	Luminations	Bronze/#ZFX-5112; Architect Approval
P-11 (GWB Ceilings/Horiz. Face of Wide Soffits; AMP-1 Soffits)	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Match Sherwin Williams, Original White/#SW 7077; Architect Approval
P-12 (Header Accent)	147	Level 5	Diamond Vogel	Zero Plus Interior Zero VOC Latex	Ocean Storms/#0506; Architect Approval
P-13 (Exterior Steel Canopy; Exterior Steel Doors and Frames)	9	Level 4	Diamond Vogel	CoteALL 340 Multi- Purpose Enamel	Bronze/#AZ-8437; Architect Approval

J. SECTION 09 72 16, VINYL COATED FABRIC WALLCOVERINGS

Finish Code	Manufacturer	Product or Pattern/Color/No.
VWC-1	Designtex	Bespoke DW12 with UV2 Guardian Coating; Architect Approval/ Custom Design - Artwork provided by Owner

2.5 DIVISION 10 - SPECIALTIES

A. SECTION 10 12 00, DISPLAY CASES

Manufacturer	Product	Size	Finishes
Glasbau REIER represented by Case[werks]	Freestanding Cases	24"W x 54"L x 70"H	Base: Formica, Pecan Woodline/#5883-58; Architect Approval Glass: Clear white, laminated, UV-protecting, safety glass; Architect Approval

B. SECTION 10 21 23, CUBICLE CURTAIN TRACKS

Finish Code	Manufacturer	Product Name/Color
CCT-1	InPro Corporation	Ultra Cube CE9038, CE8042, CE8094/White; Architect Approval

C. SECTION 10 21 23.13, CUBICLE CURTAINS

Finish Code	Manufacturer	Product Name/Color
PC-1	Phoenix Textile	Fabric: Respite/Vessel; Mesh: White; Architect Approval

D. SECTION 10 21 13, TOILET COMPARTMENTS

Finish Code	Component	Material	Manufacturer/Product	Color Name/No.
TP-1	Partitions	Plastic Laminate	Bobrick/HPL AccentSeries 1530	Pewter Mesh/#4878-38; Architect Approval
-	Edge Trim	Stainless Steel	Bobrick	Architect Approval

E. SECTION 10 26 00, WALL AND DOOR PROTECTION

Item/Code	Product Name/No.	Manufacturer	Color Name/No./Texture
Corner Guards/CG-1	90° Stainless Steel Corner Guard/#CG-51-8	Pawling	Stainless Steel/#4 Satin; Architect Approval
End Wall Guard/EG-1	Stainless Steel Flush Mount End Wall Protector	InPro Corporation	Stainless Steel/#4 Satin; Architect Approval
Wall Guard/Handrail Combo/HR-1	Handrail/#3510FVfV	InPro Corporation	Handrail and Wall Guard Color: Barrel Oak/#5E048; Architect Approval Handrail Return: Stainless Steel; Architect Approval Wall Guard Return: Barrel Oak/#5E048/Texture: Velvet; Architect Approval
Wall Guard/WG-1	NuTree Wall Guard/#NT-140	InPro Corporation	Weather Wood/#05; Architect Approval
Rigid Sheet Wall Protection/RWP-1	Palladium Rigid Vinyl Sheet/#406	InPro Corporation	Slate/#0237/Texture: Velvet; Architect Approval
Horizontal Top Cap Board for RWP-1	Palladium 3D Trim/#P-3DHTC2	InPro Corporation	Brushed Nickel/#5E026; Architect Approval

F. SECTION 10 44 16 FIRE EXTINGUISHER CABINETS

Manufacturer	Model	Type	Fire Class	Nominal Capacity	Cylinder Diameter	Overall Size	UL Rating
Activar, Inc.	Cosmic 10E; Architect Approval	ABC Dry Chemical	ABC	10 lbs.	5-1/8"	21"H x 7-3/4"W	4A-80B:C

G. SECTION 10 51 16 LOCKERS

Manufacturer	Product	Material	Color/No.
Scranton Products	TuffTec, Z-Locker	HDPE Plastic	Charcoal; Architect Approval

2.6 DIVISION 12- FURNISHINGS

A. SECTION 12 31 00, MANUFACTURED METAL CASEWORK

Component	Material and Finish	Manufacturer
Cabinet/Frame/ Doors	Stainless Steel Type 304/Finish No. 4	Mott Manufacturing; Architect Approval

B. SECTION 12 34 00, MANUFACTURED MODULAR CASEWORK

Component	Finish	Manufacturer/Product/No.	Color/No.
Modular Storage Cabinets and Drawers	3D Laminate	Herman Miller/Compass System	Light Teak/#125; Architect Approval
Trim and Supports	Varies	Herman Miller/Compass System	Manufacturer's Standard; Architect Approval
Pulls	Vinyl	Herman Miller/Compass System - Flex Pull	Fog/#63; Architect Approval
Work Surface	Corian	Herman Miller/Compass System	Cameo White/#58; Architect Approval
Sink Module and Related Items	Corian	Herman Miller/Compass System/Sink #TW230 with faucet holes, Above Sink Tile #TW128; Sink Enclosure #TW232; Faucet #TW239 with battery powered faucet sensor	Sink: Cameo White/#58; Architect Approval Above Sink Tile and Sink Enclosure: Light Teak/#125; Architect Approval
Face Tiles	3D Laminate	Herman Miller/Compass System	Light Teak/#125; Architect Approval

C. SECTION 12 24 00, WINDOW SHADES

Code	Component	Material	Manufacturer	Color Name/No.
WT-1 NOT USED	Shade Cloth	SoHo Collection, 1100 Series 1% Density	MechoShade Systems	Light Grey/#1103; Architect Approval
WT-2 & WT-2A	Shade Cloth	SoHo Collection, 1100 Series 1% Density	MechoShade Systems	Slate/#1116; Architect Approval
-	Fascia	Extruded Aluminum	MechoShade Systems	Baked Enamel: Bronze; Architect Approval
-	Support Hardware	Varies	MechoShade Systems	Bronze; Architect Approval

2.7 DIVISION 23 - HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

A. SECTION 23 37 00, AIR OUTLETS AND INLETS

Item	Material	Finish	Manufacturer	Color Name
Relief Louver	Aluminum	R 2-Coat of 70% Kynar	Greenheck	Black Anodized; Architect Approval
Displacement Diffuser	Galvanized Steel and Aluminum	Powdercoat	Titus	Custom TBD Submit finish samples for selection and approval.
Wall Diffusers	Aluminum	Optional Finish	Titus	At RWP-1: RAL 7030 At DPP-1: RAL 1019 Submit finish samples for review and approval.
Return Grilles	Aluminum	Factory Primed	Titus	Field paint to match soffit color; Architect Approval

PART 3 - EXECUTION

3.1 ROOM FINISH SCHEDULE

A. See Drawings.

--- E N D---

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel studs wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

1.2 RELATED WORK

- A. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
B. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS and Section 09 29 00, GYPSUM BOARD.

1.3 TERMINOLOGY

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
B. Underside of Structure Overhead: In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
1. Studs, runners and accessories.
2. Hanger inserts.
3. Channels (Rolled steel).
4. Furring channels.
5. Screws, clips and other fasteners.
C. Shop Drawings:
1. Typical ceiling suspension system.
2. Typical metal stud and furring construction system including details around openings and corner details.
3. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.
D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
 - A641-09Zinc-Coated (Galvanized) Carbon Steel Wire
 - A653/653M-11Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - C11-10Terminology Relating to Gypsum and Related Building Materials and Systems
 - C635-07Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings
 - C636-08Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
 - C645-09Non-Structural Steel Framing Members
 - C754-11Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
 - C954-10Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

A. Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G40 or equivalent.

2.2 STEEL STUDS AND RUNNERS (TRACK)

- A. ASTM C645, modified for thickness specified and sizes as shown.
 1. Use C 645 steel, 0.75 mm (0.0296-inch) minimum base-metal (30 mil).
 2. Runners same thickness as studs.
 3. Exception: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation

report is acceptable to show conformance to this requirement. Use C 645 steel, 0.48mm (0.019 inch) minimum base-metal (19 mil).

- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.

2.3 FURRING CHANNELS

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
 - 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
 - 2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
 - 1. ASTM A641, soft temper, Class 1 coating.
 - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
 - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.

2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.

H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)

A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.

B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.

B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.

B. Space studs not more than 400 mm (16 inches) on center.

C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead.

D. Extend studs to underside of structure overhead.

E. Openings:

1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.

2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.

3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.

F. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

G. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

H. Form building expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the expansion joint.**I. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.****3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY**

- A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.
- B. Wall furring-Stud System:
 1. Framed with studs 400 mm (16 inches) on center.
 2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
 3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.5 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

- A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.

1. Space framing at 406 mm (16-inch) centers for gypsum board anchorage.
- B. New exposed concrete slabs:
1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
 2. Furnish for installation under Division 3, CONCRETE.
 3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.
- C. Concrete slabs on steel decking composite construction:
1. Use pull down tabs when available.
 2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.
- D. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.
- E. Existing concrete construction exposed or concrete on steel decking:
1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
 2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.
- F. Steel decking without concrete topping:
1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
 2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.
- G. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
1. Install only for ceilings to receive screw attached gypsum board.
 2. Install in accordance with ASTM C636.
 - a. Install main runners spaced 1200 mm (48 inches) on center.
 - b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
 - c. Install wall track channel at perimeter.
- H. Installing Ceiling Bracing System:
1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400

mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and overhead construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.

2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.

3.7 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

- - - E N D - - -

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL**1.1 DESCRIPTION**

A. This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

C. Shop Drawings:

1. Typical gypsum board installation, showing corner details, edge trim details and the like.
2. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Test Results:

1. Fire rating test, each fire rating required for each assembly.

E. Certificates: Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos material.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

A. In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing And Materials (ASTM):
- C11-15Terminology Relating to Gypsum and Related Building Materials and Systems
- C475-15Joint Compound and Joint Tape for Finishing Gypsum Board
- C840-13Application and Finishing of Gypsum Board
- C919-12Sealants in Acoustical Applications
- C954-15Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
- C1002-14Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
- C1047-14Accessories for Gypsum Wallboard and Gypsum Veneer Base
- C1178/C1178M-18Specification for Coated Glass Mat Water Resistant Backing Panel
- C1396-14Gypsum Board
- C. Underwriters Laboratories Inc. (UL):
- Latest EditionFire Resistance Directory
- D. Inchcape Testing Services (ITS):
- Latest EditionsCertification Listings

PART 2 - PRODUCTS**2.1 GYPSUM BOARD**

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise.
- B. Water Resistant Gypsum Backing Board: ASTM C1178, Type X, 16 mm (5/8 inch) thick.
- C. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 ACCESSORIES

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.3 FASTENERS

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- D. For fire rated construction, type and size same as used in fire rating test.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

- A. Extend all layers of gypsum board from floor to underside of structure overhead.

3.2 INSTALLING GYPSUM BOARD

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1178 where shown and in locations which might be subject to moisture exposure during construction.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F. Ceilings:
 - 1. For single-ply construction, use perpendicular application.
- G. Walls (Except Shaft Walls):
 - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.

2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
 3. Stagger screws on abutting edges or ends.
 4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
 5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
 6. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply application requirements.
 7. Control Joints ASTM C840 and as follows:
 - a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
 - b. Not required for wall lengths less than 9000 mm (30 feet).
 - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
 2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
- H. Electrical and Telecommunications Boxes:
1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
- I. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
 2. Install in one piece, without the limits of the longest commercially available lengths.
 3. Corner Beads:
 - a. Install at all vertical and horizontal external corners and where shown.
 - b. Use screws only. Do not use crimping tool.

4. Edge Trim (casings Beads):

- a. At both sides of expansion and control joints unless shown otherwise.
- b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
- c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
- d. Where shown.

3.3 FINISHING OF GYPSUM BOARD

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to view. Provide Level 2 finish at concealed areas above ceilings.
- B. Before proceeding with installation of finishing materials, assure the following:
 1. Gypsum board is fastened and held close to framing or furring.
 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of smoke barrier, fire rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, and fire rated construction. Sanding is not required of Level 2 finish at concealed areas above ceilings.

3.6 REPAIRS

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in Level 2 finish surfaces to provide fire protection equivalent to the fire rated construction.

- - - E N D - - -

SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section specifies interior ceramic, porcelain tile, and waterproofing membranes for thin-set applications, crack isolation membranes, and tile backer board.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.
- B. Section 07 92 00, JOINT SEALANTS: Sealing of Joints.
- C. Section 09 06 00, SCHEDULE FOR FINISHES: Color, Texture, Pattern, and Size of Field Tile and Trim Shapes, and Color of Grout Specified.
- D. Section 09 65 19, RESILIENT TILE FLOORING: Metal Edge Strips at Joints with New Resilient Flooring.
- E. Section 09 68 00, CARPETING: Metal Edge Strips at Joints with Carpeting.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals as described below:
1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Samples:
1. Base tile, each type, each color, each size.
 2. Porcelain tile, each type, color, patterns and size.
 3. Wall tile, each color, size and pattern.
 4. Metal Trim, each type, color, and size.
- D. Product Data:
1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
 2. Urethane grout.
 3. Cementitious backer unit.
 4. Divider strip.
 5. Bonded Elastomeric Waterproofing and Crack Isolation membrane.
 6. Reinforcing tape.
 7. Leveling compound.
 8. Latex-portland cement mortar.
 9. Fasteners.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.5 QUALITY ASSURANCE

- A. Installers to be from a company specializing in performing installation of products specified and have a minimum of three (3) years' experience.
- B. Each type and color of tile to be provided from a single source.
- C. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.6 WARRANTY

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
 - A10.20-06(R2016)Safe Operating Practices for Tile, Terrazzo and Marble Work
 - A108/A118/A136.1:2019 ..Installation of Ceramic Tile
 - A108.01-18Subsurfaces and Preparations by Other Trades
 - A108.02-19Materials, Environmental, and Workmanship
 - A108.5-10Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
 - A108.6-10Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy
 - A108.10-17Grout in Tilework
 - A108.11-18Interior Installation of Cementitious Backer Units
 - A108.13-16Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone
 - A108.17-16Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone

- A118.3-13Chemical Resistant, Water Cleanable Tile-
Setting and -Grouting Epoxy and Water Cleanable
Tile-Setting Epoxy Adhesive
- A118.4-19Modified Dry-Set Cement Mortar
- A118.6-19Standard Cement Grouts for Tile Installation
- A118.7-1High Performance Cement Grouts for Tile
Installation
- A118.9-19Cementitious Backer Units
- A118.10-14Load Bearing, Bonded, Waterproof Membranes for
Thin-Set Ceramic Tile and Dimension Stone
Installation
- A118.12-14Crack Isolation Membranes for Thin-Set Ceramic
Tile and Dimension Stone Installation
- A137.1-17American National Standard Specifications for
Ceramic Tile
- C. ASTM International (ASTM):
- A666-15Annealed or Cold-Worked Austenitic Stainless
Steel Sheet, Strip, Plate and Flat Bar
- A1064/A1064M-18aCarbon-Steel Wire and Welded Wire
Reinforcement, Plain and Deformed, for Concrete
- C109/C109M-20bStandard Test Method for Compressive Strength
of Hydraulic Cement Mortars (Using 2 inch. or
[50-mm] Cube Specimens)
- C348-20Standard Test Method for Flexural Strength of
Hydraulic-Cement Mortars
- C627-18Evaluating Ceramic Floor Tile Installation
Systems Using the Robinson-Type Floor Tester
- C954-18Steel Drill Screws for the Application of
Gypsum Board on Metal Plaster Base to Steel
Studs from 0.033 in (0.84 mm) to 0.112 in (2.84
mm) in thickness
- C1002-18Steel Self-Piercing Tapping Screws for the
Application of Panel Products
- C1127/C1127M-15Standard Guide for Use of High Solids Content,
Cold Liquid-Applied Elastomeric Waterproofing
Membrane with an Integral Wearing Surface
- D2240-15e1Test Method for Rubber Property - Durometer
Hardness

D. Code of Federal Regulation (CFR):

40 CFR 59Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Marble Institute of America (MIA)/ Building Stone Institute (BSI): Dimension Stone Design Manual VIII-2016

F. Tile Council of North America, Inc. (TCNA): Handbook for Ceramic Tile Installation (2020)G. TCNA DCOF AcuTest-2012, Dynamic Coefficient of Friction Test

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN: SECTION 09 06 00, SCHEDULE FOR FINISHES.

2.2 TILE

A. Comply with ANSI A137.1, Standard Grade, except as modified:

1. Inspection procedures listed under the Appendix of ANSI A137.1.

2. Abrasion Resistance Classification:

- a. Tested in accordance with values listed in Table 1, ASTM C1027.
- b. Class IV, 6000 revolutions for remaining areas.

3. Slip Resistant Tile for Floors:

a. Coefficient of friction, when tested in accordance with ANSI A137.1 and measured per the TCNA DCOF AcuTest.

- 1) Equal to or greater than .42 for level interior tile floors that will be walked on when wet.

4. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one (1) package show the same range in colors as those taken from other packages and match approved samples.

5. Factory-Applied Temporary Protective Coating:

- a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of hot applied petroleum paraffin wax.
- b. Do not coat unexposed tile surfaces.
- c. Pre-wax tiles set or grouted with latex modified mortars.

B. Through-Body Porcelain Floor and Base Tile (PT-1): Nominal 7.9 mm (5/16 inch).

C. Glazed Ceramic Wall Tile (PT-2): Nominal 9.5 mm (3/8 inch).

D. Through-Body Porcelain Wall Tile Accent (PT-3): Nominal 7.9 mm (5/16 inch).

E. Trim:

1. Internal and External Corners: (TRIM-1 and TRIM-2)

- a. Basis of Design: See products in Section 09 06 00 SCHEDULE FOR FINISHES.

2.3 BACKER UNITS

A. Cementitious Backer Units:

1. Use in all areas to receive tile.
2. Conform to ASTM C1325; Type A.
3. Use in maximum lengths available to minimize end to end butt joints.

2.4 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-portland cement mortar complying with ANSI A108.01.
- C. Joint material, including reinforcing tape, and tape embedding material, are to be as specifically recommended by the backer unit manufacturer.

2.5 FASTENERS

A. Screws for Cementitious Backer Units.

1. Standard screws for gypsum board are not acceptable.
2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
3. ASTM C954 for steel 1 mm (0.033 inch) thick.
4. ASTM C1002 for steel framing less than 0.0329 inch thick.

B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

2.6 SETTING MATERIALS OR BOND COATS

A. Conform to TCNA Handbook for Ceramic Tile Installation.

B. Latex-Portland Cement Mortar: ANSI A118.4.

1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.4.
2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

C. Bonded Elastomeric Waterproofing and Crack Isolation Membrane:

1. TCNA F122-20 (on ground concrete) and TCNA F112A-20 (above ground concrete).

2. ANSI A118.10 and A118.12.
3. One component, liquid applied material having the following additional physical properties:
 - a. Hardness: Shore "A" between 40-60.
 - b. Elongation: Between 300-600 percent.
 - c. Tensile strength: Between .27 - .41 Newton per square millimeter (40-60 pounds per square inch gauge).
 - d. No volatile compounds (VOC).
4. Coal tar modified urethanes are not acceptable.

2.7 GROUTING MATERIALS

- A. Premium Pre-Mixed Urethane Polymer Resin Grout (GT-1 and GT-2):
 1. ANSI A118.3.
 2. Water-based.
 3. Color-coated quartz aggregate.
 4. Built-in urethane sealer.
 5. Antimicrobial.
 6. Chemical and stain-resistant.
 7. Crack-resistant.
 8. UV-stable.

2.8 PATCHING AND LEVELING COMPOUND

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Provide a patching and leveling compound with the following minimum physical properties:
 1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
 2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
 3. Tensile strength - 4.1 MPa (600 psi) per ANSI 118.7.
 4. Density - 1.9.
- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 101 mm (4 inches) thick with fillers, being brought to a feather edge, and being troweled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

2.9 METAL DIVIDER STRIPS (TRIM-6)

- A. Heavy top type strip. Height to match tile and setting-bed thickness.
- B. Embedded leg perforated and deformed for keying to mortar.

C. Stainless-steel, ASTM A666, 300 Series, exposed-edge material.

2.10 WATER

A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.11 CLEANING COMPOUNDS

A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

B. Materials containing acid or caustic Material are not acceptable.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature of work areas at not less than 16 degrees C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three (3) days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after third day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

- A. Variation in plane of sub-floor, including concrete fills and leveling compounds:
 - 1. Not more than 6 mm in 3048 mm (1/4 inch in 10 feet) from required elevation where portland cement mortar setting bed is used.
 - 2. Not more than 3 mm in 3048 mm (1/8 inch in 10 feet) where latex-portland cement mortar setting bed is used.
- B. Variation in Plane of Wall Surfaces:
 - 1. Not more than 6 mm in 2438 mm (1/4 inch in 8 feet) from required plane where portland cement mortar setting bed is used.
 - 2. Not more than 3 mm in 2438 mm (1/8 inch in 8 feet) where latex-portland cement mortar material is used.

3.3 SURFACE PREPARATION

A. Cleaning New Concrete or Masonry:

1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.

B. Patching and Leveling:

1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
 - a. Thickness of compound as required to bring finish tile system to elevation shown on construction documents.
 - b. Finish smooth for elastomeric waterproofing.
 - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

C. Walls:

1. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
2. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

D. Existing Floors and Walls:

1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose

uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.

2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate.

3.4 CEMENTITIOUS BACKER UNITS

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A118.9 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a "V" joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 203 mm (8 inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Do not install joint treatment for seven (7) days after installation of cementitious backer unit.
- F. Joint Treatment:
 1. Fill horizontal and vertical joints and corners with latex-portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
 2. Leave 6 mm (1/4 inch) space for sealant at lips of sinks or other plumbing receptors.

3.5 METAL DIVIDER STRIPS (TRIM-6)

- A. Install metal divider strips in floor joints between tile floors and adjacent flooring of other materials. Install in accordance with manufacturer's instructions.
- B. Set divider strip in mortar to line and level centered under doors or in openings.

3.6 TILE - GENERAL

- A. Comply with ANSI A108/A118/A136 series of tile installation standards applicable to methods of installation and TCNA Installation Guidelines.
- B. Setting Beds or Bond Coats:
 1. Set floor tile in latex-portland cement mortar, ANSI A108.5, over bonded elastomeric waterproofing and crack isolation membrane as per

ANSI 108.13 and ANSI 108.17, TCNA System F122-20 (on-ground concrete) and TCNA F112A-20 (above-ground concrete).

2. Set wall tile installed over concrete backer board in latex-portland cement mortar, ANSI A108.5.
3. Set corner trim (TRIM-1 and TRIM-2) in same material specified for setting adjoining tile. Install in accordance with manufacturer's instructions.

C. Workmanship:

1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise on construction documents.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
 - a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
 - b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work is to be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
 - a. TCNA F122-20 (on-ground concrete) and TCNA F122A-20 (above-ground concrete).
 - b. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
 - c. Align finish surface of new tile work flush with other and existing adjoining floor finish where indicated in construction documents.
 - d. In areas where floor drains occur, slope tile to drains.
 - e. Push and vibrate tiles over 203 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
 - a. Typical: TCNA W244C-20.

- b. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights as indicated in construction documents with tile.
 - c. Finish reveals of openings with tile, except where other finish materials are indicated in construction documents.
 - d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
- a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise on construction documents.
 - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108/A118/A136 series of tile installation standards:
- a. Tile wall installations composed of tiles 203 by 203 mm (8 by 8 inches) or larger.

3.7 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH LATEX-PORTLAND CEMENT MORTAR

- A. Installation of Tile: ANSI A108.5, except as specified otherwise.
- B. Slope tile work to drains at not less than 3 mm in 305 mm (1/8 inch per foot).
- C. Installation of Bonded Elastomeric Waterproofing and Crack Isolation Membrane:
 - 1. ANSI 108.13 and 108.17; TCNA F125.
 - 2. Spread no more material than can be covered with tile before material starts to set.

3.8 GROUTING

- A. Grout Type: Urethane Polymer Resin.
- B. Workmanship:
 - 1. Install and cure grout in accordance with the applicable standard.
 - 2. Water-Cleanable Grout: ANSI A118.3.

3.9 MOVEMENT JOINTS

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.

- B. TCNA details EJ 171-20.
- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.
- D. Rake out grout at joints between tile, service sink, and at toe of base, not less than 6 mm (1/4 inch) deep.

3.10 CLEANING:

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used are not permitted to damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile as recommended by the manufacturers of the grout and bond coat.

3.11 PROTECTION

- A. Keep traffic off tile floor, until grout and setting material is fully set and cured.
- B. Where traffic occurs over tile floor is unavoidable, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.12 TESTING FINISH FLOOR

- A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

- - - E N D - - -

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Acoustical units.
 2. Metal ceiling suspension system for acoustical ceilings.

1.2 RELATED REQUIREMENTS

- A. Adhesive VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Color, pattern, and location of each type of acoustical unit: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Linear Metal Ceilings: Section 09 54 23, LINEAR METAL CEILINGS.
- D. Ceiling Suspension System: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
1. A641/A641M-09a(2014) - Zinc-coated (Galvanized) Carbon Steel Wire.
 2. A653/A653M-15e1 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
 3. C423-09a - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 4. C634-13 - Terminology Relating to Environmental Acoustics.
 5. C635/C635M-13a - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 6. C636/C636M-13 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 7. D1779-98(2011) - Adhesive for Acoustical Materials.
 8. E84-15b - Surface Burning Characteristics of Building Materials.
 9. E119-16 - Fire Tests of Building Construction and Materials.
 10. E413-16 - Classification for Rating Sound Insulation.
 11. E1264-14 - Classification for Acoustical Ceiling Products.
- C. International Organization for Standardization (ISO):
1. ISO 14644-1 - Classification of Air Cleanliness.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Ceiling suspension system indicating manufacturer recommendation for each application.
 - 3. Installation instructions.
 - 4. Warranty.
- C. Samples:
 - 1. Acoustical units, 150 mm (6 inches) in size, each type.
 - 2. Suspension system, trim and molding, 300 mm (12 inches) long.
 - 3. Colored markers for access service.
- D. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
 - 2. Biobased Content:
 - a. Show type and quantity for each product.
 - b. Show volatile organic compound types and quantities.
- E. Operation and Maintenance Data:
 - 1. Care instructions for each exposed finish product.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Regularly manufactures specified products.
 - 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight, conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions continuously, beginning 48 hours before installation until Government occupancy.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS**2.1 SYSTEM DESCRIPTION**

- A. Ceiling System: Acoustical ceilings units on exposed grid suspension systems.

2.2 SYSTEM PERFORMANCE

- A. Design product complying with specified performance:
1. Maximum Deflection: 1/360 of span, maximum.
- B. Surface Burning Characteristics: When tested according to ASTM E84.
1. Flame Spread Rating: 25 maximum.
 2. Smoke Developed Rating: 450 maximum.

2.3 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
-
- B. Provide acoustical units from one manufacturer.
1. Provide each product exposed to view from one production run.
- C. Provide suspension system from same manufacturer.
-
- D. Sustainable Construction Requirements:
1. Mineral Base Recycled Content: 65 percent, total recycled content, minimum. Select products with recycled content to achieve overall Project recycled content requirement.
 2. Steel Recycled Content: 30 percent total recycled content, minimum.
 3. Biobased Content: 37 percent by weight biobased material, minimum.

4. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:

- a. Non-flooring adhesives and sealants.

2.4 ACOUSTICAL UNITS

A. General:

1. Ceiling Panel and Tile: ASTM E1264, bio-based content according to USDA Bio-Preferred Product requirements.
 - a. Mineral Fiber: 3.6 kg/sq. m (3/4 psf) weight, minimum.
2. Classification: Provide type and form as follows:
 - a. AT-1: Type III Units - Mineral base with water-based painted finish maximum 10 g/l VOC; Form 2 - Water felted, minimum 16 mm (5/8 inch) thick.
 - b. NRC (Noise Reduction Coefficient): ASTM C423, minimum 0.55 unless specified otherwise.
 - c. CAC (Ceiling Attenuation Class): ASTM E413, 33 range unless specified otherwise.
 - d. LR (Light Reflectance): Minimum 0.80.
3. Lay-in panels: Sizes as indicated on Drawings, with square edges and reveal edges.
 - a. Sizes:
 - 1) Edge and Joint Detail: Angled Tegular edges and joints as required to suit suspension and access system.

2.5 METAL SUSPENSION SYSTEM

- ### **A. General: ASTM C635, heavy-duty system, except as otherwise specified.**
1. Suspension System: Provide the following:
 - a. Galvanized cold-rolled steel, bonderized.
 2. Main and Cross Runner: Use same construction Do not use lighter-duty sections for cross runners.
- ### **B. Exposed Grid Suspension System: Support of lay-in panels.**
1. Grid Width: 22 mm (7/8 inch) minimum with 8 mm (5/16 inch) minimum panel bearing surface.
 2. Molding: Fabricate from the same material with same exposed width and finish.
 3. Finish: Baked-on enamel flat texture finish.
 - a. Color: To match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

C. Carrying Channels Secondary Framing: Cold-rolled or hot-rolled steel, black asphaltic paint finish, rust free.

1. Weight per 300 m (per thousand linear feet), minimum:

Size		Cold-rolled		Hot-rolled	
mm	inches	kg	pound	kg	pound
38	1-1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

D. Anchors and Inserts: Provide anchors or inserts to support twice the loads imposed by hangers.

1. Hanger Inserts: Steel, zinc-coated (galvanized after fabrication).

E. Clips: Galvanized steel, designed to secure framing member in place.

F. Tile Splines: ASTM C635.

G. Wire: ASTM A641.

1. Size:

a. Wire Hangers: Minimum diameter 2.68 mm (0.1055 inch).

b. Bracing Wires: Minimum diameter 3.43 mm (0.1350 inch).

2.6 ACCESSORIES

A. Perimeter Seal: Vinyl, polyethylene or polyurethane open cell sponge material, density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.

1. Thickness: As required to fill voids between back of wall molding and finish wall.

2. Size: Minimum 9 mm (3/8 inch) wide strip.

B. Access Identification Markers: Colored markers with pressure sensitive adhesive on one side, paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) diameter.

1. Color Code: Provide the following color markers for service identification:

Color	Service
Red	Sprinkler System: Valves and Controls
Green	Domestic Water: Valves and Controls
Yellow	Chilled Water and Heating Water
Orange	Ductwork: Fire Dampers
Blue	Ductwork: Dampers and Controls

Color	Service
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Remove existing acoustical panels and suspension system to permit new installation.
 1. Dispose of other removed materials.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 ACOUSTICAL UNIT INSTALLATION

- A. Applications:
 1. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Layout acoustical unit symmetrically, with minimum number of joints.
- C. Installation:
 1. Install acoustic tiles after wet finishes have been installed and solvents have cured.
 2. Install lay-in acoustic panels in exposed grid with minimum 6 mm (1/4 inch) bearing at edges on supports.
 - a. Install tile to lay level and in full contact with exposed grid.
 - b. Replace cracked, broken, stained, dirty, or tile.
 3. Markers:
 - a. Install color coded markers to identify the various concealed piping, mechanical, and plumbing systems.
 - b. Attach colored markers to exposed grid on opposite sides of the units providing access.
 - c. Attach marker on exposed ceiling surface of upward access acoustical unit.
- D. Touch up damaged factory finishes.
 1. Repair painted surfaces with touch up primer.

3.4 CEILING SUSPENSION SYSTEM INSTALLATION

- A. General: Install according to ASTM C636.
1. Use direct or indirect hung suspension system or combination of both.
 2. Support a maximum area of 1.48 sq. m (16 sq. ft.) of ceiling per hanger.
 3. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
 4. Provide additional hangers located at each corner of support components.
 5. Provide main runners minimum 1200 mm (48 inches) in length.
 6. Install hanger wires vertically. Angled wires are not acceptable.
- B. Direct Hung Suspension System: ASTM C635.
1. Support main runners by hanger wires attached directly to the structure overhead.
 2. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.
- C. Anchorage to Structure:
1. Concrete:
 - a. Install hanger inserts and wire loops required for support of hanger wire. Install hanger wires with looped ends through steel deck when steel deck does not have attachment device.
 - b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger wire. Install in sides of concrete beams or joists at mid height.
 2. Steel:
 - a. Install carrying channels for attachment of hanger wires.
 - 1) Size and space carrying channels to support load within performance limit.
 - 2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
 - b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fireproofing is installed. Weld or use steel clips for beam attachment.
 - c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing

prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

3.5 CEILING TREATMENT

A. Moldings:

1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

B. Perimeter Seal:

1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

3.6 CLEANING

- #### **A. Clean exposed surfaces. Remove contaminants and stains.**

- - - E N D - - -

SECTION 09 54 23
LINEAR METAL CEILINGS

PART 1 - GENERAL**1.1 DESCRIPTION:**

- A. This Section Includes:
 - 1. Suspended metal grid ceiling system including trim.
 - 2. Decorative, linear, formed metal ceiling panels, mechanically mounted on a ceiling suspension system.
 - 3. Accessories:
 - a. Closures, trim, edge molding and all other items required to provide complete installation.
- B. Unit size, texture, finish, and color as specified.

1.2 RELATED WORK:

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Acoustical Ceilings: Section 09 51 00, ACOUSTICAL CEILINGS.
- D. Sprinkler System: Section 21 10 00, WATER-BASED FIRE-SUPPRESSION SYSTEMS.
- E. Air Outlets and Inlets: Division 23, HEATING, VENTILATING, and AIR CONDITIONING.
- F. Interior Lighting: Section 26 51 00, INTERIOR LIGHTING.

1.3 QUALITY CONTROL:

- A. Coordination of Work: Coordinate layout and installation of linear metal ceiling units and suspension system components with other work supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any):
 - 1. Sprinkler heads and light fixtures: Centered width of panel, unless indicated otherwise on construction documents.
 - 2. HVAC Air Outlets and Inlets: Planned to occur within center of panel systems or provide for equal distance on each side parallel to length of panels.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals as described below:
 - 1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.

C. Manufacturer's Literature and Product Data:

1. Manufacturer's standard details and fabrication methods.
2. Data on finishing, hardware, components, and accessories.
3. Recommendations for maintenance and cleaning of finish surfaces.

D. Shop Drawings:

1. Submit complete composite fabrication, and installation shop drawings including associated components.
2. Identify panel sections, trim, and other component parts, not included in manufacturer's product data, by name and material and showing design, construction, installation, and anchorage.
3. Layout and installation details, including relation to adjacent work such as walls and bulkheads.
4. Composite reflected ceiling plans, at 1:25 (1/4 inch) scale, showing location of all accessories, mechanical and electrical components.

Indicate the following:

- a. Joint pattern.
 - b. Ceiling suspension members.
 - c. Method of attaching hangers to building structure.
 - d. Ceiling-mounted items including light fixtures, air outlets and inlets, speakers, sprinkler heads, and access panels. Special moldings at walls, column penetrations, and other junctures with adjoining construction.
5. Provisions for expansion and contraction.
 6. Anchors and reinforcements.

E. Samples:

1. Submit pairs of samples of each specified color and finish on 305 mm (12 inch) long sections of extrusions or formed shapes for following:
 - a. Linear metal panel.
 - b. Each exposed molding and trim sections.
 - c. Suspension system members.
 - d. Filler strips.
 - e. Insulation.
 - f. End cap.
2. Where normal color variations are anticipated, include 2 units in set indicating extreme limits of color variations.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Materials: Deliver to site in manufacturer's original unopened containers with brand name and type clearly marked.
- B. Materials: Carefully handle and store in dry, watertight enclosures.
- C. Before installation, linear metal ceiling units are to be stored for not less than 48 hours at same temperature and relative humidity as space where they will be installed to assure temperature and moisture conditions in accordance with manufacturer's recommendations.

1.6 ENVIRONMENTAL REQUIREMENTS:

- A. Uniform temperature of not less than 16 degrees C, (60 degrees F) nor more than 27 degrees C, (80 degrees F) and a relative humidity of not more than 70 percent are to be maintained for a period of 48 hours before, during, and for 48 hours after installation of linear metal ceiling units. After above period, room temperature is not permitted to fall below 13 degrees C (55 degrees F).

1.7 SCHEDULING:

- A. Interior finish work such as gypsum board finishing, painting, and concrete work are to be complete and dry before installation. Mechanical, electrical, and other works above ceiling line are to be completed and heating, ventilating, and air conditioning systems are to be installed and operating in order to maintain temperature and humidity requirements.

1.8 WARRANTY:

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
2605-13High Performance Organic Coatings on
Architectural Extrusions and Panels
- C. ASTM International (ASTM):
A641/A641M-1Zinc-coated (Galvanized) Carbon Steel Wire
A653/A653M-20Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process

- A1008Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- B209-14Aluminum and Aluminum-Alloy Sheet and Plate
- C423Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C635/C635M-17Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
- C636/C636M-19Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
- E84Standard Test Method for Surface Burning Characteristics of Building Materials.
- E580/E580M-20Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
- E1111Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
- E1264Classification for Acoustical Ceiling Products E1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
- E1477Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

D. National Association of Architectural Metal Manufacturers (NAAMM):

E. Metal Finishes Manual (2006)

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

2.2 MATERIALS:

A. Linear Metal Ceiling System, General:

- 1. Sheet Metal Characteristics: Form metal panels from sheet metal free from surface blemishes where exposed to view in finished unit. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, stains, discolorations, or other imperfections.

2. Fabrication: Die-form linear metal panels into units standard with manufacturer and finished as specified herein.
 3. Sound-Absorptive Pads (AMP-1 only): Width and length to fill completely between carriers, joined at center of a panel, and to provide an NRC rating of 0.70 in accordance with ASTM C423.
 4. Recycled Content of Metal Ceiling Products: Post-consumer content plus one-half of preconsumer content not less than 30 percent.
- B. Accessories: Edge trim, support brackets, clips, splices, hold down clips, and pressure springs as required for suspended grid system.
- C. Linear Metal Panels (AMP-1 at Interior & AMP-2 at Exterior):
1. General: Formed to snap on and be securely retained on carriers without separate fasteners.
 2. Electrogalvanized Steel Panels: ASTM A653, roll-formed sheet, complying with following requirements:
 - a. Minimum Nominal Thickness: 0.028 inch.
 3. Panel Performance: As follows:
 - a. Light Reflectance Coefficient: LR 0.61.
 - b. Noise Reduction Coefficient (AMP-1 only): NRC 0.70. \
 4. Perforation Pattern (AMP-1 only): Round, diagonal.
 5. Texture: Smooth.
- D. Suspension Systems, General:
1. Standard for Metal Suspension Systems: Provide manufacturer's standard types, structural classifications, and finishes indicated that comply with ASTM C635/C635M requirements.
 2. Anchors: Type as recommended by manufacturer. Size for five (5) times design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.
- E. Wire for Carriers, Hangers, and Ties: ASTM A641/A641M, Class 1, zinc coating, soft temper.
1. Gage: Minimum 12 gage. Supporting a minimum of 1334 N, (300 pounds) ultimate vertical load without failure of supporting material or attachment.
- F. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- G. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- H. Angle Hangers: Angles with legs not less than 22 mm (7/8 inch) wide, formed with 0.82 mm (0.0365 inch) galvanized steel sheet complying with

ASTM A653/A653M, Coating Designation G90, with bolted connections and 7.6 mm (5/16 inch) diameter bolts.

- I. Edge Moldings and Trim: Manufacturer's standard molding for edges and penetrations of ceiling.
- J. Carriers: Comply with ASTM A653/A653M, cold-rolled, electro-galvanized, 0.55 mm (0.0219 inch) (25 gage) minimum nominal thickness steel.
- K. Access Identification: Refer to Section 09 91 00, PAINTING for requirements of identification markers for use, with various mechanical systems above ceiling, under this section.

2.3 FINISHES:

- A. Comply with NAAMM "Metal Finishes Manual".
- B. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent ceiling units are not acceptable. Noticeable variations in same piece are not acceptable.
- D. Steel Finish:
 - 1. Powder-coated.
 - 2. Color: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Ceiling Areas: Conform with details, dimensions and tolerances shown on approved linear metal ceiling system composite reflected ceiling plan shop drawings.
- B. Conditions which may adversely affect linear metal ceiling system installation are to be corrected prior to commencement of linear metal ceiling system installation.
- C. Where linear metal ceiling system is installed adjacent to masonry, wash-down of adjacent masonry is to be completed prior to erection of ceiling system to prevent damage to material finish by cleaning materials.

3.2 PREPARATION:

- A. Measure each ceiling area and establish layout of linear metal panel units to balance border widths at opposite edges of each ceiling. Avoid using units less than half wide at borders.

3.3 INSTALLATION:

- A. Suspend ceiling hangers from building structural members and as follows:
1. Install hangers plumb, free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers where required to avoid 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 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.
 3. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for structure to which hangers are attached as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail because of age, corrosion, and elevated temperatures.
 4. Space hangers not more than 1219 mm (48 inches) on center along each member supported directly from hangers, unless otherwise shown on construction documents.
- B. Install edge moldings at edge of each linear metal ceiling area and at locations where edge of units would otherwise be exposed after completion of Work. Level moldings with ceiling suspension system to level tolerance of 3 mm (1/8 inch) in 3657 mm (12 feet).
1. Masonry and Concrete: Fasten with machine screws into lead-shield-type anchors drilled into construction.
 2. Hollow Masonry or Stud Construction: Fasten with toggle bolts or similar self-expanding screw anchors.
- C. Scribe and cut metal panel units 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.

- D. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated in construction documents.
- E. Install panels with butt joints using internal concealed panel splices and in joint configurations shown on construction documents in reflected ceiling plan.
- F. Install sound absorptive pads as per ceiling panel manufacturer's instructions.

3.4 CLEANING:

- A. Following installation, dirty or discolored surfaces of linear metal ceiling units are to be cleaned, in accordance with manufacturer's written recommendations, and left free from defects. Units that are damaged or improperly installed are to be removed and new units provided as directed.

3.5 PROTECTION:

- A. Protect linear metal ceiling systems from damage until final inspection and acceptance.

- - - END - - -

**SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base adhered to interior walls and partitions.
 - 2. Resilient transition strip at existing flooring.

1.2 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - F1861-16Resilient Wall Base.

1.3 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Adhesives and primers indicating manufacturer's recommendation for each application.
 - 3. Installation instructions.
- C. Samples:
 - 1. Resilient Base: 150 mm (6 inches) long, each type and color.
 - 2. Resilient Transition Strip: 150 mm (6 inches) long, each type and color.
- D. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
 - 2. Low Pollutant-Emitting Materials:
 - a. Stair Treads and Sheet Rubber Flooring: Submit Floor Score label.
 - b. Show volatile organic compound types and quantities.
- E. Operation and Maintenance Data:
 - 1. Care instructions for each exposed finish product.

1.4 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.5 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage when handling and during construction operations.

1.6 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
 - 2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
 - 3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS**2.1 PRODUCTS**

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run.
- C. Sustainable Construction Requirements:
 - 1. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Flooring Adhesives and Sealants.

2.2 RESILIENT BASE (RB-1)

- A. Resilient Base: 3 mm (1/8 inch) thick, 100 mm (4 inches) high.
 - 1. Type: Rubber or vinyl; use one type throughout.
 - 2. ASTM F1861, Type TP thermoplastic rubber or Type TV thermoplastic vinyl, Group 2 - layered.
- B. Applications:
 - 1. Carpet Flooring Locations: Style A - Straight.
 - 2. Other Locations: Style B - Cove.

2.3 RESILIENT TRANSITION STRIP (TS-3)

- A. Beveled surface to finish flush with existing flooring for tight joint and other side to floor finish.
- B. Color as specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Applications: Transitions from new to existing flooring where shown on drawings.

2.4 ADHESIVES

- A. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.

- C. Remove existing base to permit new installation.
 - 1. Dispose of removed materials.
- D. Correct substrate deficiencies.
 - 1. Fill cracks, pits, and depressions with leveling compound.
 - 2. Remove protrusions; grind high spots.
 - 3. Apply leveling compound to achieve 3 mm (1/8 inch) in 3 m (10 feet) maximum surface variation.
- E. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
 - 1. Mechanically clean concrete floor substrate according to ASTM D4259.
 - 2. Surface Profile: ICRI Guideline No. 310.2R.
- F. Allow substrate to dry and cure.

3.2 INSTALLATION GENERAL

- A. Install products according to manufacturer's instructions.
 - 1. When instructions deviate from specifications, submit proposed resolution for Contracting Officer consideration.

3.3 RESILIENT BASE INSTALLATION

- A. Applications:
 - 1. Install resilient base in rooms scheduled on Drawings.
 - 2. Install resilient base on casework and locker toe spaces, and other curb supported fixed equipment.
 - 3. Extend resilient base into closets, alcoves, and cabinet knee spaces, and around columns within scheduled room.
- B. Lay out resilient base with minimum number of joints.
 - 1. Length: 600 mm (24 inches) minimum, each piece.
 - 2. Locate joints 150 mm (6 inches) minimum from corners and intersection of adjacent materials.
- C. Installation:
 - 1. Apply adhesive uniformly for full contact between resilient base and substrate.

2. Set resilient base with hairline butted joints aligned along top edge.

D. Factory form corners and end stops.

E. Roll resilient base ensuring complete adhesion.

3.4 RESILIENT TRANSITION STRIP INSTALLATION

A. Applications: Install transitions from new to existing flooring where shown on drawings.

B. Anchor edge strip to floor with adhesive.

3.5 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed resilient base surfaces. Remove contaminants and stains.

1. Clean with mild detergent. Leave surfaces free of detergent residue.

C. Polish exposed resilient base to gloss sheen.

3.6 PROTECTION

A. Protect products from construction traffic and operations.

1. Maintain protection until directed by Contracting Officer's Representative.

B. Replace damaged products and re-clean.

1. Damaged Products include cut, gouged, scraped, torn, and unbonded products.

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SECTION 09 65 16
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rubber sheet flooring with heat-welded seams.
2. Welded seam sheet flooring with heat welded seams.

1.2 RELATED REQUIREMENTS

- A. Color, Pattern and Texture: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Resilient Base over Base of Lockers, Equipment and Casework: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
1. D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
 2. D4259-88(2012) - Abrading Concrete.
 3. E648-15e1 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 4. E662-15a - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 5. F1303-04(2014) - Sheet Vinyl Floor Covering with Backing.
 6. F1859-14 - Rubber Sheet Floor Covering Without Backing.
 7. F1913-04(2014) - Vinyl Sheet Floor Covering Without Backing.
- C. International Concrete Repair Institute (ICRI):
1. 310.2R-13 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays, and Concrete Repair.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
1. Show size, configuration, and fabrication and installation details.
- B. Manufacturer's Literature and Data:
1. Description of each product.
 2. Installation instructions.
 3. Warranty.
- C. Samples:

1. Sheet material, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with welded seam using specified welding rod 300 mm (12 inches) square for each type, pattern and color.
2. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
3. Edge strips: 150 mm (6 inches) long each type.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A company specializing in installation with minimum three (3) years' experience and employs experienced flooring installers who have retained, and currently hold, an INSTALL Certification, or a certification from a comparable certification program.
 1. Installers to be certified by INSTALL or a comparable certification program with the following minimum criteria:
 - a. US Department of Labor approved four (4) year apprenticeship program, 160 hours a year.
 - b. Career long training.
 - c. Manufacturer endorsed training.
 - d. Fundamental journeyman skills certification.
- B. Furnish product type materials from the same production run.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight, conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 1. Work Area Ambient Temperature Range: Minimum 18 to 38 degrees C (65 to 100 degrees F) continuously, beginning 48 hours before installation. Maintain room temperature above 18 degrees C (65 degrees F) after installation.

2. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant resilient sheet flooring against material and manufacturing defects.
 1. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Sheet Flooring:
 1. Critical Radiant Flux: ASTM E648; 0.45 watts per sq.cm or more, Class I.
 2. Smoke Density: ASTM E662; less than 450.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide sheet colors and patterns from one production run.

2.3 RUBBER SHEET FLOORING (RF-1)

- A. Welded Seam Sheet Rubber Flooring (RSF): ASTM F1859; Type I Rubber, without backing.
 1. Wear Surface: Smooth.
 2. Thickness: 2 mm (0.080 inches).
 3. Material: Vulcanized rubber compound equal to material used in basis of design product, free from toxic heavy metals.
 4. Composition: Homogeneous rubber compound with random scattered design.
 5. Slip Resistance: ASTM D2047, 0.93 dry, 0.90 wet.
 6. Rolling Load Limit: ≤450 lbs/square inch, with no forklift traffic.
 7. Does not require coatings.
 8. Free of PVC, phthalate plasticizers, and halogens.
- B. Sheet Size: Provide maximum size sheet produced by manufacturer to minimize joints.
 1. Minimum Width: 1200 mm (48 inches).

2.4 WELDED SEAM SHEET FLOORING WITH HEAT WELDED SEAMS (WSF-1)

- A. Resilient Sheet Flooring: ASTM F1303; Type I, Grade 1, vinyl, with backing.
 - 1. Wear Surface: Embossed.
 - 2. Wear Layer Thickness: Minimum 20 mils, 0.51 mm (0.020 inches).
 - 3. Total Thickness: 2.3 mm (0.090 inches).
- B. Sheet Size:
 - 1. Width: 1829 mm (72 inches).

2.5 ACCESSORIES

- A. Welding Rod: Flooring manufacturer's standard, in color matching field color of sheet flooring.
- B. Adhesives: Water resistant type recommended by flooring manufacturer to suit application.
- C. Leveling Compound:
 - 1. Provide cementitious type with latex or polyvinyl acetate resins additive.
- D. Primer:
 - 1. Type recommended by adhesive or flooring manufacturer.
- E. Edge Strips (TS-2):
 - 1. Rubber.
 - 2. Basis of Design: See products in Section 09 06 00 SCHEDULE FOR FINISHES. Profiles and heights as required for floor transitions.
- F. Sealant:
 - 1. As specified in Section 07 92 00, JOINT SEALANTS.
 - 2. Compatible with flooring.
- G. Polish: Type recommended by flooring manufacturer to suit application and anticipated traffic.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Remove existing flooring to permit new installation.
 - 1. Do not use solvents for removing adhesives.
 - 2. Dispose of removed materials.
- D. Ensure interior finish work such as plastering, drywall finishing, concrete, terrazzo, ceiling work, and painting work is complete and dry before installation.

1. Complete mechanical, electrical, and other work above ceiling line.
 2. Ensure heating, ventilating, and air conditioning systems are installed and operating in order to maintain temperature and humidity requirements.
- E. Correct substrate deficiencies.
1. Fill cracks, pits, and dents with leveling compound.
 2. Grind, sand, or cut away protrusions. Grind high spots.
 3. Level flooring substrate to 3 mm (1/8 inch) maximum variation.
- F. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
1. Mechanically clean concrete floor substrate according to ASTM D4259.
 2. Surface Profile: ICRI 310.2R CSP 3 to CSP 4.
- G. Perform flooring manufacturer's recommended bond, substrate moisture content, and pH tests.
- H. Broom or vacuum clean substrates immediately before flooring installation.
- I. Primer: Apply primer according to manufacturer's instructions.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions.
1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 INSTALLATION OF FLOORING

- A. Flooring Layout:
1. Arrange pattern in one direction with side joints pattern matched.
 2. Extend flooring wall-to-wall, under cabinets, casework, laboratory and pharmacy furniture, and other equipment for seamless flooring installation.
 3. Arrange sheets to minimize seams.
 4. Locate seams in inconspicuous and low traffic areas, minimum 150 mm (6 inches) away from parallel joints in flooring substrates.
- B. Match edges of flooring for color shading and pattern at seams.
- C. Install flooring flush with adjacent floor finishes.
- D. Extend flooring into toe spaces, door reveals, closets, and similar openings.
- E. Install flooring fully adhered to substrate.
1. Air pockets or loose edges are not acceptable.

2. Trim sheet materials tight to flooring penetrations; seal joints at pipe with waterproof sealant specified in Section 07 92 00, JOINT SEALANTS.

F. Butt joints tight, without gaps and bulges.

G. Installation of Edge Strips:

1. Install edge strips at flooring transitions to other floor finishes.

2. Locate edge strips under center lines of doors unless otherwise indicated.

3. Set edge strips in adhesive.

4. Provide welding rod at flooring transitions shown on drawings in lieu of edge strips.

3.4 HEAT WELDING

A. Heat weld joints of flooring and base using welding rod.

B. Rout joint, insert welding rod into routed space, and fuse flooring and welding rods for seamless, watertight installation.

1. Fuse joints for seamless weld.

C. Finish joints flush, free from voids, and recessed or raised areas.

3.5 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean and polish materials.

C. Vacuum floor thoroughly.

D. Perform initial maintenance according to flooring manufacturer's instructions.

1. Delay washing flooring until adhesive is fully set and welded joints can contain wash water.

3.6 PROTECTION

A. Protect flooring from traffic and construction operations.

B. Keep traffic off sheet flooring for minimum 24 hours after installation.

C. Cover flooring with reinforced kraft paper, and plywood or hardboard.

D. Remove protective materials immediately before acceptance.

E. Repair damage.

F. Buff flooring to uniform sheen.

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SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies the installation of rubber tile, and accessories required for a complete installation.

1.2 RELATED WORK:

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.
- C. Subfloor Testing and Preparation: Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.
- D. Color, Pattern and Texture for Resilient Tile Flooring and Accessories: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals as described below:
1. Volatile organic compounds per volume as described in PART 2 - PRODUCTS
 2. Postconsumer and pre-consumer recycled content as described in PART 2 - PRODUCTS.
- C. Manufacturer's Literature and Data:
1. Description of each product.
 2. Resilient material manufacturer's recommendations for adhesives, underlayment, and primers.
 3. Application, installation and maintenance instructions.
- D. Samples:
1. Tile: Each type, color, thickness and finish.
 2. Edge Strips: Each type, color, thickness and finish.
- E. Shop Drawings:
1. Layout of patterns as shown on the construction documents.
 2. Edge strip locations showing types and detail cross sections.
- F. Test Reports:
1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory. Tested per ASTM F510/F510M.

2. Moisture and pH test results as per Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

1.4 DELIVERY:

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation are not acceptable.

1.5 STORAGE:

- A. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.6 QUALITY ASSURANCE:

- A. Installer Qualifications: A company specializing in installation with minimum three (3) years' experience and employs experienced flooring installers who have retained, and currently hold, an INSTALL Certification, or a certification from a comparable certification program.
 - 1. Installers to be certified by INSTALL or a comparable certification program with the following minimum criteria:
 - a. US Department of Labor approved four (4) year apprenticeship program, 160 hours a year.
 - b. Career long training.
 - c. Manufacturer endorsed training.
 - d. Fundamental journeyman skills certification.
- B. Furnish product type materials from the same production run.

1.7 WARRANTY:

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

1.8 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):

- D2047-11Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
- D2240-05 (R2010)Test Method for Rubber Property—Durometer Hardness
- E648-14cCritical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
- E662-14Specific Optical Density of Smoke Generated by Solid Materials
- E1155/E1155M-14Determining Floor Flatness and Floor Levelness Numbers
- F510/F510M-14Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
- F710-11Preparing Concrete Floors to Receive Resilient Flooring
- F925-13Test Method for Resistance to Chemicals of Resilient Flooring
- F1344-12 (R2013)Rubber Floor Tile
- F1869-11Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
- F2170-11Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes

C. Code of Federal Regulation (CFR):

- 40 CFR 59Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

D. International Standards and Training Alliance (INSTALL):

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

- A. Provide adhesives, underlayment, primers, and polish recommended by resilient floor material manufacturer.
- B. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
- C. Smoke Density: Less than 450 per ASTM E662.
- D. Slip Resistance - Not less than 0.5 when tested with ASTM D2047.

2.2 RUBBER TILE (RF-2):

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Tile Standard: ASTM F1344, Class I-B, homogeneous rubber tile, through mottled, Grade 2.
- C. Hardness: 82, measured using Shore, Type A durometer per ASTM D2240.
- D. Wearing Surface: Textured.
- E. Thickness: 3.5 mm (0.140 inch).
- F. Size: 1004 x 502 mm (40" x 20").

2.3 ADHESIVES:

- A. Provide water resistant type adhesive for flooring, base and accessories as recommended by the manufacturer to suit substrate conditions. VOC content to be less than the 50 grams/L when calculated according to 40 CFR 59 (EPA Method 24). Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

2.4 PRIMER FOR CONCRETE SUBFLOORS:

- A. Provide in accordance with Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

2.5 LEVELING COMPOUND FOR CONCRETE FLOORS:

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix in accordance with Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

2.6 EDGE STRIPS (TRIM-5):

- A. Basis of Design: See products in Section 09 06 00 SCHEDULE FOR FINISHES. Profiles and heights as required for floor transitions. Provide stainless steel types as indicated on the construction documents for both edges and transitions of flooring materials specified.

PART 3 - EXECUTION**3.1 ENVIRONMENTAL REQUIREMENTS:**

- A. Maintain flooring materials and areas to receive resilient flooring at a temperature above 20 degrees C (68 degrees F) for three (3) days before application, during application and two (2) days after application, unless otherwise directly by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 13 degrees C (55 degrees F) thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

- B. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

3.2 SUBFLOOR TESTING AND PREPARATION:

- A. Prepare and test surfaces to receive resilient tile and adhesive as per Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.
 - 1. Remove existing resilient floor and existing adhesive.
- B. Prepare concrete substrates in accordance with ASTM F710.

3.3 INSTALLATION:

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.
- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance is not acceptable.
- C. Tile Layout:
 - 1. If layout is not shown on construction documents, lay tile symmetrically about center of room or space with joints aligned.
 - 2. Vary edge width as necessary to maintain full size tiles in the field, no edge tile to be less than 1/2 the field tile size, except where irregular shaped rooms make it impossible.
 - 3. Place tile pattern in the same direction; do not alternate tiles unless specifically indicated in the construction documents to the contrary.
- D. Application:
 - 1. Adhere floor tile 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.
 - 2. 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.
 - 3. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
 - 4. Roll tile floor with a minimum 45 kg (100 pound) roller.
- E. Seal joints at pipes with sealants in accordance with Section 07 92 00, JOINT SEALANTS.
- F. Installation of Edge Strips:

1. Locate edge strips under center line of doors unless otherwise shown on construction documents.
 2. Set edge strips in adhesive.
 3. Where tile edge is exposed, butt edge strip to touch along tile edge.
 4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor tile and against the ceramic tile edge.
- F. Provide cold weld at transition from RF-2 at transitions shown on drawings in lieu of edge strips.

3.4 CLEANING AND PROTECTION:

- A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
- B. Keep traffic off resilient material for a minimum 72 hours after installation.
- C. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions and within the recommended time frame.
- D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by COR. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by COR.
- E. When protective materials are removed and immediately prior to acceptance, replace damaged tile and edge strips, re-clean resilient materials.

3.5 LOCATION:

- A. Unless otherwise indicated in construction documents, install tile flooring, under areas where casework, laboratory and pharmacy furniture and other equipment occur.
- B. Extend tile flooring for room into adjacent closets and alcoves.

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**SECTION 09 67 23
EPOXY BROADCAST WITH URETHANE TOPCOAT**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies quartz flooring system where scheduled on the drawings.

1.2 RELATED WORK

- A. Concrete and Moisture Vapor Barrier: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Floor Drains: Division 22, PLUMBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product to be provided.
 - 2. Application and installation instructions.
 - 3. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.
 - 4. Manufacturer's Safety Data Sheet (SDS) for each product being used.
- C. Qualification Data: For Installer.
- D. Sustainable Submittal:
 - 1. Product data for products having recycled content, submit documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
 - a. Include statements indicating costs for each product having recycled content.
 - 2. Product data for field applied, interior, paints, coatings, and primers, include printed statement of VOC content indicating compliance with environmental requirements.
- E. Samples:
 - 1. Samples for selection: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.
 - 2. Sample showing construction from substrate to finish surface in thickness specified and texture of finished surfaces.
 - 3. Finished flooring must match the selected sample in color and texture.

- F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
 - 1. Edge configuration.
- G. Certifications and Approvals:
 - 1. Manufacturer's certification of material and substrate compliance with specification.
 - 2. Manufacturer's approval of installers.
 - 3. Contractor's certificate of compliance with Quality Assurance requirements.
- H. Warranty: As specified in this section.

1.4 QUALITY ASSURANCE

- A. Manufacture Certificate: Manufacture shall certify that a particular resinous flooring system has been manufactured and in use for a minimum of ten (10) years.
- B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of five (5) years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
 - 2. Contractor shall have completed at least ten (10) projects of similar size and complexity. Include list of at least five (5) projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
 - 3. Installer's Personnel: Employ persons trained for application of specified product.
- C. Source Limitations:
 - 1. Obtain primary resinous flooring materials including primers, resins, hardening agents, grouting coats and finish or sealing coats from a single manufacturer.
 - 2. Provide secondary materials, including patching and fill material, joint sealant, and repair material of type and from source recommended by manufacturer of primary materials.

- D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and establish quality standards for materials and execution.
 - 1. Apply full-thickness mockups on 48 inch (1200 mm) square floor area selected by VA COR.
 - a. If applicable include 48 inch (1200 mm) length of integral cove base.
 - 2. Approved mockups not damaged during the testing may become part of the completed work if undisturbed at time of Substantial Completion.
 - 3. Sign off from VA COR on texture for slip resistance and clean ability must be complete before installation of flooring system.
- E. No requests for substitutions shall be considered that would change the generic type of the specified system.
- F. System shall be in compliance with the Indoor Air Quality requirements of California Section 01350 as verified by a qualified independent testing laboratory.
- G. Pre-Installation Conference:
 - 1. Convene a meeting not less than thirty days prior to starting work.
 - 2. Attendance:
 - a. Contractor
 - b. VA COR
 - c. Manufacturer and Installer's Representative
 - 3. Review the following:
 - a. Environmental requirements
 - 1) Air and surface temperature
 - 2) Relative humidity
 - 3) Ventilation
 - 4) Dust and contaminants
 - b. Protection of surfaces not scheduled to be coated
 - c. Inspect and discuss condition of substrate and other preparatory work performed
 - d. Review and verify availability of material; installer's personnel, equipment needed
 - e. Design and edge conditions.
 - f. Performance of the coating with chemicals anticipated in the area receiving the resinous flooring system
 - g. Application and repair
 - h. Field quality control

- i. Cleaning
 - j. Protection of coating systems
 - k. One-year inspection and maintenance
 - l. Coordination with other work
- H. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of resinous flooring systems.
- I. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the urethane and epoxy mortar/cement flooring materials installation. The Contractor shall maintain these records for one year after Substantial Completion.

1.5 MATERIAL PACKAGING DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc. in accordance with the manufacturer's recommendations.
- C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).
- D. Copies of Safety Data Sheets (SDS) for all components shall be kept on site for review by the COR or other personnel.
- E. Keep containers sealed until ready for use.
- F. Do not use materials beyond manufacturer's shelf life limits.
- G. Package materials in factory pre-weighed and in single, easy to manage batches sized for ease of handling and mixing proportions from entire package or packages. No On site weighing or volumetric measurements are allowed.
- H. Waste Disposal: The installer shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.6 PROJECT CONDITIONS

- A. Site Requirements:
 - 1. Application may proceed while air, material, and substrate temperatures are between 60°F and 90°F, providing the substrate temperature is above the dew point. Outside of this range, the manufacturer shall be consulted.

2. The relative humidity in the specific location of the application shall be less than 85%, and the surface temperature shall be at least 5°F above the dew point.
 3. The installer shall insure that adequate ventilation is available for the work area.
 4. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- B. Conditions of new concrete to be coated with epoxy material:
1. Concrete shall be moisture-cured for a minimum of seven days, and have fully cured a minimum of twenty eight days inf accordance with ACI-308 prior to the application of the coating system pending moisture tests.
 2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).
 3. Sealers and curing agents should not be used.
- C. Safety Requirements:
1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
 2. "NO SMOKING" signs shall be posted at the entrances to the work area.
 3. Non-related personnel in the work area shall be kept to a minimum.

1.7 WARRANTY

- A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.
- B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly (including substrata) for both material and workmanship for an extended period of three (3) full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of three (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

1.8 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM Standard C722-04 (2012), "Standard Specification for Chemical-Resistant Monolithic Floor Surfacing," ASTM International, West Conshohocken, PA, 2006, DOI: 10.1520/C0722-04R12, www.astm.org.

1. Specification covers the requirements for aggregate-filled, resin-based, monolithic surfacings for use over concrete.

C. ASTM International (ASTM):

- C413-18Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- C531-18Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- D523Standard Test Method for Specular Gloss
- D635Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
- D638-14Tensile Properties of Plastics
- D695Standard Test Method for Compressive Properties of Rigid Plastics
- D790-17Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D1308-02Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- D1737Method of Test for Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus
- D2047(2017)Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
- D2240-15e1Rubber Property-Durometer Hardness
- D2370Standard Test Method for Tensile Properties of Organic Coating
- D3363Standard Test Method for Film Hardness by Pencil Test
- D4060-19Abrasion Resistance of Organic Coatings by the Taber Abraser

- D4226-19Impact Resistance of Rigid (Poly-Vinyl Chloride) (PVC) Building Products
- D4259-18Abrading Concrete to alter the surface profile of the concrete and to remove foreign materials and weak surface laitance
- D4541Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- E84Standard Test Method for Surface Burning Characteristics of Building Materials
- E96/E96M-16)Water Vapor Transmission of Materials
- F1869-16aMeasuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
- F2170-19aDetermining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 501.....Finishes for Aluminum

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION FOR EPOXY BROADCAST WITH URETHANE TOPCOAT (RES-2)

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES
- B. System Description:
 - 1. Monolithic, multi-component epoxy chemistry resinous flooring system.
 - 2. Primer; broadcast of quartz aggregate; grout coat; and urethane topcoat; nominal thickness of 1/8 inch.
 - 3. Color and Pattern: As selected by COR from manufacturer's standard colors.
 - 4. Integral cove base.
- C. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up.
- D. System Components: Verify specific requirements as systems vary by manufacturer. Verify build up layers of broadcast and installation method. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:
 - 1. Primer:
 - a. Percent Solids: 56%
 - b. VOC: 2 g/L

- c. Bond Strength to Concrete ASTM D4541: 550 psi, substrates fails
 - d. Hardness, ASTM D3363: 3H
 - e. Elongation, ASTM D2370: 9%
 - f. Flexibility (1/4: Cylindrical mandrel), ASTM D1737: Pass
 - g. Impact Resistance, MIL D-2794: >160
 - h. Abrasion Resistance, ASTM D4060, CS-17 Wheel, 1,000 g Load: 30 mg loss
2. Broadcast and Grout Coat:
- a. VOC: 7.9 g/L
 - b. Compressive Strength, ASTM D695: 17,500 psi
 - c. Tensile Strength, ASTM D638: 4,000 psi.
 - d. Flexural Strength, ASTM D790: 6,250 psi.
 - e. Flexural Modulus of Elasticity, ASTM D790: 6.2×10^5
 - f. Abrasion Resistance, ASTM D4060, CS-10 Wheel, 1,000 g load, 1,000 cycles: 24 mg loss
 - g. Flame Spread/NFPA-101, ASTM E84: Class A
 - h. Flammability, ASTM D635: Self-extinguishing
 - i. Indentation, MIL D-3134: 0.025 max
 - j. Impact Resistance, MIL D-3134: Pass
 - k. Water Absorption, MIL D-24613: 0.04%
3. Topcoat:
- a. Percent Solids: 95%
 - b. VOC: 0 g/L
 - c. Tensile Strength, ASTM D2370: 7,000 psi
 - d. Adhesion, ASTM 4541: Substrate fails
 - e. Hardness, ASTM D3363: 4H
 - f. 60° Gloss, ASTM D523:
 - 1) Satin Finish: 50 +/-10
 - 2) Gloss Finish: 75 +/-10
 - g. Abrasion Resistance, ASTM D4060, CS-17 Wheel, 1,000 g Load, 1,000 cycles:
 - 1) Satin Finish:
 - a) With Grit: 8 mg loss
 - b) No Grit: 12 mg loss
 - 2) Gloss Finish:
 - a) With Grit: 4 mg loss
 - b) No Grit: 10 mg loss
 - h. Pot Life, 70°F, 50% RH: 2 hours

- i. Full Chemical Resistance: 7 days

2.2 SUPPLEMENTAL MATERIALS

- A. Patching and Fill Material: Resinous product of or approved by resinous coating manufacturer for application.

2.3 TROWELED COVE BASE

- A. Same physical properties as specified resinous system.

2.4 BASE CAP STRIP

- A. Aluminum, extruded: ASTM B221, Alloy 6063-T6.
- B. Shape for 3/16 inch (4.76 mm) depth of base material, "J" configuration.
- C. Finish:
 - 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
 - 2. Aluminum: NAAM Amp 501:
 - a. Clear anodic coating, AA-C22A41 chemically etched medium matte, with Architectural Class 1, 0.7 mils (0.018 mm) or thicker.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions where monolithic resinous system with integral base is to be installed with the VA COR.
- B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869 to determine the MVER of the substrate prior to commencement of the work. See section 3.4, 3.
- C. Verify that the substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PROJECT CONDITIONS

- A. Maintain temperature of rooms (air and surface) where work occurs, between 70- and 90-degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) during cure period.
- B. Maintain relative humidity less than 75 percent.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.
- D. Maintain proper ventilation of the area during application and curing time period.
 - 1. Comply with infection control measures of the VA Medical Center.

3.3 INSTALLATION REQUIREMENTS

- A. The manufacturer's instructions for application and installation shall be reviewed with the VA COR for the seamless resinous flooring system with integral cove base.
- B. Substrate shall be approved by manufacturer's technical representative.

3.4 PREPARATION

- A. General:
 - 1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
 - 2. Moisture Testing: Perform tests recommended by manufacturer and as follows:
 - a. Perform relative humidity in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.
 - b. If the relative humidity exceeds 75% then manufacturer's recommended moisture mitigation system must be installed prior to resinous flooring installation.
 - c. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch maybe used to dry the substrate.
 - d. Mechanical Surface preparation: In accordance with Section 09 05 16 and manufacturer's instructions.
 - e. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch according to manufacturer's written instructions.
- B. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- C. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.
- D. Prepare wall to receive integral cove base:
 - 1. Verify wall material is acceptable for resinous flooring application, if not, install material (e.g. cement board) to receive base.

2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
3. Install base prior to flooring if required by resinous flooring manufacturer.
4. Grind, cut or sand protrusions to receive base application.

3.5 APPLICATION

A. General:

1. The system shall be applied in seven distinct steps as listed below:
 - a. Substrate preparation
 - b. Priming
 - c. First broadcast coat application with first aggregate broadcast
 - d. Second broadcast coat with second aggregate broadcast
 - e. Grout coat application, sand floor (if required)
 - f. Topcoat application, urethane.
 2. Immediately prior to the application of any component to the system, the surface shall be dry, and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
 3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the manufacturer's instructions.
 4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified.
 5. A neat finish with well-defined boundaries and straight edges shall be provided.
 6. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate for all areas to receive integrated cove base.**
- C. Apply cove base: Trowel to wall surfaces at a 1-inch radius, before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, and troweling, sanding, and top coating of cove base. Round internal and external corners.**

D. Primer:

1. The primer shall consist of a liquid resin and hardener that is mixed at the ratio of 1 parts resin to 4 parts hardener per the manufacturer's instructions.
2. The primer shall be applied by flat squeegee and back-rolled at the rate of 200-250 sf/gal to yield a dry film thickness of 4 mils.

E. Broadcast Coat:

1. The broadcast coat shall be applied as a double broadcast system as specified.
2. The broadcast coat shall be comprised of two components, a resin and hardener as supplied by the manufacturer and mixed in the ratio of 2 parts resin to 1 part hardener.
3. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means.
4. The broadcast coat shall be applied over horizontal surfaces using "v" notched squeegee and back-rolled at the rate of 90-100 sf/gal.
5. Quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.5 lbs/sf.
6. Allow material to fully cure. Vacuum, sweep, and/or blow to remove all loose aggregate.
7. Apply a second coat of resin with a coverage rate of 90-100 sf/gal and broadcast aggregate to excess at the rate of 0.5 lbs/sf.
8. Allow material to fully cure. Vacuum, sweep, and/or blow to remove all loose aggregate.

F. Grout Coat:

1. The grout coat shall be comprised of liquid components combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high-speed paddle mixer.
2. The grout coat shall be squeegee applied with a coverage rate of 90 sf/gal or 50 sf/gal depending on aggregate used and per manufacturer's instructions.
3. The grout coat will be back-rolled and cross-rolled to provide a uniform texture and finish.

G. Topcoat:

1. The topcoat shall be roller applied at the rate of 500 sf/gal to yield a dry film thickness of 3 mils.

2. The topcoat shall be comprised of a liquid resin, hardener, and grit that is mixed per the manufacturer's instructions.
3. The finished floor will have a nominal thickness of 1/8 inch.

3.6 FIELD QUALITY CONTROL

A. Tests, Inspection:

1. The following tests shall be conducted by the installer:
 - a. Temperature: Air, substrate temperatures and, if applicable, dew point.
 - b. Coverage Rates: Rates for all layers shall be monitored by checking quantity of material used against area covered.

3.7 CLEANING AND PROTECTION

- A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process.
- B. Close area of application for a minimum of 24 hours.
- C. Protect resinous flooring materials from damage and wear during construction operation.
 1. Cover flooring with kraft type paper.
 2. Optional 6 mm (1/4 inch) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.
- D. Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

- - - E N D - - -

SECTION 09 67 23.50
RESINOUS TERRAZZO FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies resinous terrazzo flooring systems.
- B. Resinous (Epoxy Terrazzo) Flooring Systems:
 - 1. Thin set: Epoxy Matrix Terrazzo.

1.2 RELATED WORK

- A. Concrete and Moisture Vapor Barrier: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Substrate Preparation for Floor Finishes: Section 09 05 16.
- C. Sealants installed with Terrazzo: Section 07 92 00, JOINT SEALANTS.
- D. Color and location of each type of resinous flooring: Section 09 06 00, SCHEDULE FOR FINISHES.
- E. Floor Drains: Division 22, PLUMBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product to be provided.
 - 2. Application and installation instructions.
 - 3. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.
- C. Qualification Data: For Installer.
- D. Sustainable Submittal:
 - 1. Product data for products having recycled content, submit documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statements indicating costs for each product having recycled content.
 - 2. Product data for field applied adhesives include printed statement of VOC content indicating compliance with environmental requirements.
- E. Samples:
 - 1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.

2. Samples for verification: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.
 3. Sample showing construction from substrate to finish surface in thickness specified and color and texture of finished surfaces. Finished flooring must match the approved samples in color and texture.
 4. Accessories: (6 inches) 152 mm long sample of exposed strip item.
- F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
1. Patterns.
 2. Edge configurations.
 3. Divider strips.
 4. Control-joint strips.
 5. Accessory strips.
- G. Certifications and Approvals:
1. Manufacturer's certification of material and substrate compliance with specification.
 2. Manufacturer's approval of installers.
 3. Contractor's certificate of compliance with Quality Assurance requirements.
- H. Warranty: As specified in this section.

1.4 QUALITY ASSURANCE

- A. Manufacture Certificate: Manufacture shall certify that a particular resinous flooring system has been in use for a minimum of five years.
- B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of 5 years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
 2. Contractor shall have completed at least 10 projects of similar size and complexity. Include list of at least 5 projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.

3. Installer's Personnel: Employ persons trained for application of specified product
- C. Source Limitations:
1. Obtain primary resinous flooring materials including primers, resins, hardening agents, grouting coats and finish or sealing coats from a single manufacturer.
 2. Provide secondary materials, including marble chips, strips, patching and fill material, joint sealant, and repair material of type and from source recommended by manufacturer of primary materials.
 3. Obtain marble chips color, grade, type, and variety of granular materials from one source with resources to provide materials of consistent quality in appearance and physical properties.
 4. Material furnished shall meet NTMA Specifications.
- D. NTMA Standards: Comply with NTMA's "Terrazzo Specification and Design Guide" and written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and establish quality standards for materials and execution.
1. Apply full-thickness mockups on 48 inch (1200 mm) square floor area selected by VA COR.
 - a. Include 48 inch (1200 mm) length of integral cove base.
 2. Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.
 3. Sign off from VA COR on texture must be complete before installation of flooring system.
- F. Pre-Installation Conference:
1. Convene a meeting not less than thirty days prior to starting work.
 2. Attendance:
 - a. Contractor
 - b. VA COR
 - c. Manufacturer and Installer's Representative
 3. Review the following:
 - a. Environmental requirements
 - 1) Air and surface temperature
 - 2) Relative humidity
 - 3) Ventilation

- 4) Dust and contaminants
 - b. Protection of surfaces not scheduled to be coated
 - c. Inspect and discuss condition of substrate and other preparatory work performed
 - d. Review and verify availability of material; installer's personnel, equipment needed
 - e. Design and patterns and edge conditions.
 - f. Performance of the coating with chemicals anticipated in the area receiving the resinous (epoxy terrazzo) flooring system
 - g. Application and repair
 - h. Field quality control
 - i. Cleaning
 - j. Protection of coating systems
 - k. One-year inspection and maintenance
 - l. Coordination with other work
- G. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.
- H. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the terrazzo installation. The Contractor shall maintain these records for one year after Substantial Completion.

1.5 MATERIAL PACKAGING DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.
- C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).
- D. Keep containers sealed until ready for use.
- E. Do not use materials beyond manufacturer's shelf life limits.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring applications.

1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.
2. Concrete substrate shall be properly cured per referenced section 03 30 00, CAST-IN-PLACE CONCRETE. Standard cure time a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade.
 - a. Resinous flooring applications where moisture testing resulting in readings exceeding limits as defined in this specification under part 3, section 3.4, paragraph B, shall employ an multiple component 15 mil thick system designed to suppress excess moisture in concrete.
 - b. Application at a minimum thickness of 15 mils, over properly prepared concrete substrate as defined in section 3.4.
 - c. Moisture suppression system must meet the design standards as follows:

Property	Test	Value
Tensile Strength	ASTM D638	4,400 psi
Volatile Organic Compound Limits (V.O.C.)	EPA & LEED	25 grams per liter
Permeance	ASTM E96 @ 16mils/ 0.4mm on concrete	0.1 perms
Tensile Modulus	ASTM D638	1.9X10 ⁵ psi
Percent Elongation	ASTM D638	12%
Cure Rate	Per manufactures Data	4 hours Tack free with 24hr recoat window
Bond Strength	ASTM D7234	100% bond to concrete failure

- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

1.7 WARRANTY

- A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.
- B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly (including substrata) for both material and workmanship for a extended period of (3) full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

1.8 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASTM Standard C722-04 (2012), "Standard Specification for Chemical-Resistant Monolithic Floor Surfacing," ASTM International, West Conshohocken, PA, 2006, DOI: 10.1520/C0722-04R12, www.astm.org.
 - 1. Specification covers the requirements for aggregate-filled, resin-based, monolithic surfacings for use over concrete.
- C. ASTM International (ASTM) :
 - C579-18Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - C580-18Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - C1583-20Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)
 - D570-18Standard Test Method for Water Absorption of Plastics
 - D638-14Tensile Properties of Plastics
 - D695-15Standard Test Method for Compressive Properties of Rigid Plastics
 - D696-16Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics

- D790-17Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D130802(2013)Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- D2047-17Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
- D2240-15e1Rubber Property—Durometer Hardness
- D4060-19Abrasion Resistance of Organic Coatings by the Taber Abraser
- D4259-18Abrading Concrete to alter the surface profile of the concrete and to remove foreign materials and weak surface laitance
- D7234-19Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
- E96/E96M-16Water Vapor Transmission of Materials
- F1869-16aMeasuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
- F2170-19aDetermining Relative Humidity in Concrete Floor Slabs Using in situ Probes

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION FOR RESINOUS (EPOXY TERRAZZO) FLOORING (RES-

- A. System Descriptions:
 - 1. Monolithic, multi-layer, trowel applied multi-component epoxy composition terrazzo. UV stable and breathable where required.
- B. Systems shall meet or exceed all applicable NTMA and TTMAC standards.
- C. System Components: Verify specific requirements as systems vary by manufacturer. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:
 - 1. Bond Coat (Primer): Verify inclusion of primer in manufacturer's system. Some systems are self-priming.
 - a. Resin: Epoxy.
 - b. Formulation Description: 100 percent solids.
 - c. Binder: Formulated to meet physical properties of MIL-D-3134F.

- d. Physical properties of moisture mitigating primer shall have a maximum of 0.3 perms with 100% RH.
 - e. Application Method: According to manufacturer's instructions.
 - 1) Thickness of coats: Verify thickness as systems vary by manufacturer; approximate range from 5 to 6 mils (0.13 to 0.15 mm) to 150 to 250 square feet per gallon (52.76 to 87.93 square meters per liter).
2. Body Coat:
- a. Resin: Epoxy.
 - b. Formulation Description: 100 percent solids.
 - c. Application Method: Varies by manufacturer; hand or power troweled.
 - 1) Trowel application:
 - a) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from 3/16 inch or 1/4 inch or 3/8 inch (4.76 to either 6.35 mm or 9.5 mm).
 - b) Number of coats: One.
 - d. Aggregates: Verify amount per thickness as systems vary by manufacturer:
 - 1) Marble (#1 size maximum), glass, or granite chips or, colored resilient aggregates, acrylic, or other approved materials.
3. Grout Coat:
- a. Resin: Epoxy.
 - b. Formulation Description: 100 percent solids.
 - c. Application Method: Varies by manufacturer. Apply by red rubber squeegee or spring-steel trowel.
 - 1) Apply to rough ground mortar coat to completely fill all voids.
 - 2) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 8 to 10 mils (0.2 to 0.25 mm) to a maximum of 400 to 500 square feet per gallon (140.65 to 175.81 square meters per liter).
4. Seal Coat/Top Coat:
- a. Resin: Single- or multi-component Urethane.
 - b. Formulation Description: 22% solids. It shall have a pH factor between 7 and 10 and shall be a penetrating type specially prepared for use on terrazzo. It shall not discolor or amber the terrazzo and shall produce a slip resistant surface. Flash point

of sealer shall be a minimum of 80 degrees F (26 degrees C) when tested in accordance with ASTM D56.

- c. Application Method: Varies by manufacturer. Apply using notched squeegee and backroll or using a lambs wool applicator.
- 1) Apply to fine ground mortar coat to completely fill all voids.
 - 2) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 4 to 5 mils (0.1 to 0.13 mm) to a maximum of 500 to 750 square feet per gallon (175.81 to 263.74 square meters per liter).
 - 3) Number of coats: One.

D. System Characteristics:

1. Color and Pattern: As indicated in Section 09 06 00, SCHEDULE OF FINISHES//.
2. Overall System Thickness: Verify thickness as systems vary by manufacturer; approximate 3/8 inch (9.5 mm).
3. Finish: Standard slip resistant.

E. Physical Properties:

1. Conform to ASTM C722, Type A, Epoxy resin, and aggregate.
2. Other physical properties of seamless troweled (epoxy) resinous flooring system in addition to C722 when tested to be as follows:

Test	Property	Value
ASTM D695	Compressive Strength	12,000 PSI
ASTM D638	Tensile Strength	4,800 PSI
ASTM D2240	Hardness Shore D	75-85
ASTM D570	Water Absorption	< 0.010%
ASTM D696	Thermal Coefficient of Linear Expansion	25 x 10 ⁻⁶ inches per degrees
ASTM D638	Tensile Strength	4,800 psi
ASTM D790	Flexural Strength	4,500 psi
ASTM D4060, CS-17	Abrasive Resistance	0<0.035 gm max weight loss
ASTM D2047	Co-efficient of Friction	Dry - 0.924 Wet - 0.92
ASTM C1583	Bond Strength	100% bond to concrete failure

F. Chemical Resistance in accordance ASTM D1308 - 02(2007) "Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes". ASTM International, West Conshohocken, PA, 2006, DOI: 10.1520/D1308-02R07, www.astm.org. No effect to the following exposures:

1. Acetic acid (5%)
2. Hydrochloric acid (10%)
3. Sodium Hydroxide (10%)
4. Sulfuric acid (30%)

2.2 SUPPLEMENTAL MATERIALS

A. Waterproofing Membrane: Type recommended or produced by manufacturer of resinous (epoxy terrazzo) flooring for type of service and conditions.

B. Strips:

1. Edge strips "L" shaped as manufactured for use with resinous (Epoxy Terrazzo) flooring system.
 - a. White alloy zinc, 16 (1.518mm) gauge.
2. Control Joint double "L" shaped strips as manufactured for use with resinous (Epoxy Terrazzo) flooring system. Position strips back to back.
 - a. White alloy zinc, 16 (1.518mm) gauge.
3. Strip Adhesive: 100% solids epoxy resin adhesive recommended by manufacturer.

C. Patching and Fill Material: Resinous product of or approved by resinous (Terrazzo) flooring manufacturer for application indicated.

D. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service or joint conditioned indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where resinous (epoxy terrazzo) flooring system with integral base is to be installed with the VA COR.

B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869 to determine the MVER of the substrate prior to commencement of the work.

1. MVT threshold for resinous (terrazzo) flooring shall not exceed 3 pounds/1000 square feet in a 24 hour period.
2. When MVT emission exceeds this limit, apply manufacturer's recommended vapor control primer or other corrective measures as

recommended by manufacturer prior to application of flooring or membrane systems.

3. Perform additional substrata preparation as recommended by resinous flooring manufacturer's technical representative to obtain satisfactory results of moisture vapor transmission testing prior to commencement of the work.
4. Provide a written report showing test placement and results.

3.2 PROJECT CONDITIONS

- A. Maintain temperature of rooms (air and surface) where work occurs, between 70 and 90 degrees F (21 and 32 degrees C) for at least 72 hours, before, during, and after installation. Maintain temperature at least 70 degrees F (21 degrees C) thereafter.
- B. Maintain relative humidity less than 80 percent.
- C. Prior to and during each day of installation, the terrazzo contractor shall verify that the dew point is at least 5°F (-15°C) less than the slab and air temperature.
- D. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.
- E. Maintain proper ventilation of the area during application and curing time period.
 1. Comply with infection control measures of the VA Medical Center.

3.3 INSTALLATION REQUIREMENTS

- A. The manufacturer's instructions for application and installation shall be reviewed with the VA COR for the resinous (terrazzo) flooring system with integral cove base.
- B. Substrata shall be approved by manufacture technical representative.

3.4 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 1. Mechanically prepare substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

- b. Comply with ASTM D4259 requirements, unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
 3. Verify that concrete substrates are dry.
 - a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 85 percent.
 - b. Perform maximum moisture-vapor-emission test, ASTM F 1869. Proceed with application only after substrates has obtained satisfactory results. If needed perform additional moisture tests until substrates pass testing.
 4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.

3.5 APPLICATION

- A. General: Apply each component of resinous (epoxy terrazzo) flooring system with integral base according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.
 1. Verify that the substrate (dryness, pH level, etc.) is acceptable by the manufacturer's technical representative.
 2. Use manufacturer recommended cleaning products.
- B. Prepare substrata for resinous (terrazzo) flooring system:
 1. Apply waterproof membrane as recommended by resinous flooring manufacturer at all vertical junctures and the entire flooring substrata. Embed fabric reinforcement into waterproof membrane liquid. Overlap all seams a minimum of 2 inches (51 mm).

2. Apply substrata smoothing/patching underlayment as recommended by resinous flooring manufacturer.
- C. Resinous (epoxy terrazzo) flooring system: Per manufacturer's written instructions. Based on the porosity of the substrata additional coats may be required:
1. Primer (Bond) Coat.
 2. Strips: Set edge and control strips as indicated on plans. Strips shall be set in a full bed of epoxy adhesive and allowed to cure before proceeding with the work.
 3. Body Coat: Apply body coat (including aggregate) evenly over the primer (bond) coat to the desired thickness.
 4. Power grind to expose aggregate.
 5. Grout Coat.
 6. Progressively fine grind and polish floor. Cleanse terrazzo with potable water and rinse. Remove excess rinse water and apply grout using identical Portland cement, color pigments as used in topping, ensuring to fill all voids. Cure Grout as recommended by manufacturer.
 - a. Grout may be left on terrazzo until all heavy and messy work in project is completed.
 - b. Fine grind until all grout is removed from surface.
 - c. Upon completion, terrazzo flooring shall display a minimum of 70% of marble chips.
 7. Cleaning: Wash all surfaces with a neutral cleaner. Rinse with clean water and allow surface to dry
 8. Seal Coat (Top Coat). Apply sealing coats of type recommended by manufacturer to produce finish matching approved samples.

3.6 TOLERANCE

- A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring.

3.7 CURING, PROTECTION AND CLEANING

- A. Cure resinous terrazzo flooring in compliance with manufacturer's directions (during the application process), taking care to prevent contamination during stages of application and prior to completion of curing process.
- B. Close area of application for a minimum of 24 hours.
- C. Protect resinous (epoxy terrazzo) flooring materials from damage and wear during construction operation.

1. Cover flooring with wax paper or Kraft paper.
 2. Cover paper with 1/4 inch (6.35 mm) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.
- D. Remove temporary covering and clean resinous (Epoxy Terrazzo) flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous (Epoxy Terrazzo) flooring manufacturer.

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SECTION 09 68 00
CARPETING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies carpet, edge strips, adhesives, and other items required for complete installation.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.
- B. Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES: Testing of Concrete Floors Before Installation.
- C. Section 09 06 00, SCHEDULE FOR FINISHES: Manufacturer, Color and Style of Carpet and Edge Strip.
- D. Section 09 65 13, RESILIENT BASE AND ACCESSORIES: Resilient Wall Base.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A company specializing in carpet installation with a minimum three (3) years' experience and employing experienced flooring installers who have retained, and currently hold, an INSTALL Certification, or a certification from a comparable certification program, and a valid OSHA 10 certification.
 - 1. Installers to be certified by INSTALL or a comparable certification program with the following minimum criteria:
 - a. US Department of Labor approved four (4) year apprenticeship program, 160 hours a year.
 - b. Career long training.
 - c. Manufacturer endorsed training.
 - d. Fundamental journeyman skills certification.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals as described below:
 - 1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Product Data:
 - 1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.

2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.

D. Samples:

1. Carpet: "Production Quality" samples 305 x 305 mm (12 x 12 inches) of carpets, showing quality, pattern and color specified in Section 09 06 00, SCHEDULE FOR FINISHES.
2. Floor Edge Strips: 152 mm (6 inches) long of each color and type specified.

E. Shop Drawings: Installers layout plan showing seams and cuts for sheet carpet and carpet module.

F. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

G. Installer's Qualifications.

H. Manufacturer's warranty.

1.5 DELIVERY AND STORAGE

A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's brand name, size, dye lot number and related information. Transport carpet to job site in a manner that prevents damage and distortion that might render it unusable. When bending or folding is unavoidable for delivery purposes, unfold carpet and lay flat immediately.

B. Deliver adhesives in containers clearly labeled with manufacturer's brand name, number, installation instructions, safety instructions and flash points.

C. Store in a clean, dry, well-ventilated area, protected from damage and soiling. Before installation, acclimate carpet to the atmospheric conditions of the areas in which it will be installed for 2 days prior to installation.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain areas in which carpeting is to be installed at a temperature between 18 - 35 degrees C (65 - 95 degrees F) with a maximum relative humidity of 65 percent for two (2) days before installation, during installation and for three (3) days after installation.

B. Minimum Substrate Surface Temperature: 18 degrees C (65 degrees F) at time of installation.

- C. Three (3) days after installation, maintain minimum temperature of 10 degrees C (50 degrees F) for the duration of the contract.

1.7 WARRANTY

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their carpet for a minimum of ten (10) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
 - ANSI/NSF 140-10Sustainable Carpet Assessment Standard
- C. American Association of Textile Chemists and Colorists (AATCC):
 - 16-04Colorfastness to Light
 - 134-11Electric Static Propensity of Carpets
 - 165-08Colorfastness to Crocking: Textile Floor Coverings-AATCC Crockmeter Method
 - 174-11Antimicrobial Activity Assessment of New Carpets
- D. ASTM International (ASTM):
 - D1335-17e1Tuft Bind of Pile Yarn Floor Coverings
 - D3278-20Flash Point of Liquids by Small Scale Closed-Cup Apparatus
 - D5116-17Determinations of Organic Emissions from Indoor Materials/Products
 - D5252-20Operation of the Hexapod Tumble Drum Tester
 - D5417-16Operation of the Vettermann Drum Tester
 - E648-19ae1Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- E. Code of Federal Regulation (CFR):
 - 40 CFR 59Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating
- F. The Carpet and Rug Institute (CRI):
 - CISCarpet Installation Standard
- G. International Standards and Training Alliance (INSTALL)

- H. International Organization for Standardization (ISO):
 - 2551-81Machine-Made Textile Floor Coverings
- I. U.S. Consumer Product and Safety Commission (CPSC):
 - 16 CFR 1630Surface Flammability of Carpets and Rugs

PART 2 - PRODUCTS

2.1 PRODUCTS:

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

2.2 CARPET

- A. Physical Characteristics:
 - 1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects.
 - 2. Carpet (CPT-1):
 - a. Carpet Construction: Tufted.
 - b. Carpet Type: Modular tile 18 by 36 inches square with 0.15 percent growth/shrink rate in accordance with ISO 2551.
 - c. Pile Type: Multilevel loop. Pile type and thickness must conform to ADA requirements.
 - d. Pile Fiber: Commercial 100 percent branded (federally registered trademark), nylon continuous filament.
 - e. Backing Materials: Provide backing for release adhesive for modular tile installations. For healthcare installations, provide impervious moisture backing.
 - 1) Modular Tile:
 - a) Primary Backing/Backcoating: Manufacturer's standard composite materials.
 - b) Secondary Backing: Manufacturer's standard material.
 - 3. Carpet (CPT-3):
 - a. Carpet Construction: Tufted.
 - b. Carpet Type: Broadloom 3.65 m (12 feet).
 - c. Pile Type: Hobnail. Pile type and thickness must conform to ADA requirements.
 - d. Pile Fiber: High UV Polypropylene.
 - e. Backing Materials: Provide backing for glue-down installations.
 - 1) Broadloom:
 - a) Primary Backing: N/A
 - b) Secondary Backing: Manufacturer's standard material.

4. Static Control: Provide static control to permanently regulate static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134.
5. Appearance Retention Rating (ARR): Carpet to be tested and have the minimum 3.5 - 4.0 severe ARR when tested in accordance with either the ASTM D5252 (Hexapod) or ASTM D5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified in the ASTM standard.
6. Tuft Bind: Comply with ASTM D1335 for tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 36 N (8 pound) average force for modular carpet tile.
7. Colorfastness to Crocking: Dry and wet crocking and water bleed, comply with AATCC 165 Color Transference Chart for colors, minimum class 4 rating.
8. Colorfastness to Light (AATCC 16, Option 3): Color change between the exposed and unexposed carpet areas equivalent to a minimum of Grade 4 on the Gray Scale for Color Change after an exposure of 40 AFU (AATCC fading units) for all specified colors.
9. Delamination Strength: Minimum of 440 N/m (2.5 lb./inch) between secondary backing.
10. Flammability and Critical Radiant Flux Requirements:
 - a. Comply with 16 CFR 1630.
 - b. Test Carpet in accordance with ASTM E648.
 - c. Class I: Minimum critical radiant flux of 0.45 watts per square centimeter (2.9 watts per square inch).
 - d. Carpet in corridors, exits and Medical Facilities to be Class I.
11. Average Pile Yarn Density (APYD):
 - a. Corridors, lobbies, entrances, common areas or multipurpose rooms, open offices, waiting areas and dining areas: Minimum APYD 6000.
 - b. Other areas: Minimum APYD 4000.
12. VOC Limits: Use carpet that complies with the following limits for VOC content when tested according to ASTM D5116:
 - a. Carpet, Total VOCs: 0.5 mg/square meter x hour
 - b. Carpet, 4-PC (4-Phenylcyclohexene): 0.05 mg/square meter x hour
 - c. Carpet, Formaldehyde: 0.05 mg/square meter x hour

d. Carpet, Styrene: 0.4 mg/square meter x hour

2.3 ADHESIVE AND CONCRETE PRIMER

- A. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 60 degrees C (140 degrees F) in accordance with ASTM D3278. Materials are to have a VOC maximum of 50 g/L when calculated according to 40 CFR 59, (EPA Method 24).

2.4 EDGE STRIPS

- A. Metal (TRIM-5):
1. Basis of Design: See products in Section 09 06 00 SCHEDULE FOR FINISHES. Profiles and heights as required for floor transitions.
- B. Rubber Edge Strip (TS-1 and TS-2):
1. Beveled surface to finish flush with carpet for tight joint and other side to floor finish.
 2. Color as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Contractor to prepare and test surfaces to receive carpet and adhesives as per Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

3.2 GENERAL INSTALLATION

- A. Isolate area of installation from rest of building.
- B. Perform all work by manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions and CRI CIS.
- C. Protect edges of carpet meeting hard surface flooring with edge strips and install in accordance with the manufacturer's printed instructions.
- D. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least three (3) days following installation.
- E. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation.
- F. Complete other work which would damage the carpet prior to installation of carpet.
- G. Follow carpet manufacturer's recommendations for matching pattern and texture directions.

- H. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations. Bind or seal cut edge of sheet carpet. Use additional adhesive to secure carpets around pipes and other vertical projections.

3.3 BROADLOOM CARPET INSTALLATION

- A. Install broadloom carpet direct glue down smooth, uniform, and secure, with a minimum of seams.
- B. Apply regular, unnoticeable, and treated seams with a seam adhesive. Run side seams toward the light, where practical, and where such layout does not increase the number of seams. Install breadths parallel, with carpet pile in the same directions.
- C. Match patterns accurately. Neatly cut and fit cutouts, at door jambs, columns and ducts securely.
- D. Locate seams at doorways parallel to and centered directly under doors. Do not make seams perpendicular to doors or at pivot points.
- E. Provide seams at changes in directions of corridors to follow the wall line parallel to the carpet direction. Lay the carpet lengthwise down the corridors with widths less than 1.82 m (6 feet).

3.4 MODULAR TILE INSTALLATION

- A. Install per CRI CIS, Adhesive Application.
- B. Lay carpet modules with pile in same direction unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Install carpet modules so that cleaning methods and solutions do not cause dislocation of modules.
- D. Lay carpet modules uniformly to provide tight flush joints free from movement when subject to traffic.

3.5 EDGE STRIPS INSTALLATION

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor edge strip to floor with adhesive. Apply adhesive to edge strip and insert carpet into lip and press lip down over carpet.

3.6 PROTECTION AND CLEANING

- A. Once a carpet installation is complete, clean up scrap materials and debris, and vacuum the area, using manufacturer-approved equipment. Inspect seams carefully for evenness and protruding backing yarns, and inspect the perimeter of the installation for an acceptable finished appearance.

- B. Protect installed carpet if furniture is being moved, by laying plywood, fiberboard or porous non-staining sheeting material for minimum time practical. Based on manufacturer guidelines, protect carpet from rolling or foot traffic. Protect against other materials or renovation or construction activities, including dust, debris, paint, contractor traffic, until it is ready for its final use.
- C. Do not move furniture or equipment on unprotected carpeted surfaces.
- D. Just before final acceptance of work, remove protection and vacuum carpet clean.

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**SECTION 09 72 16
VINYL-COATED FABRIC WALL COVERINGS**

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies vinyl coated fabric wall covering and installation.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 09 06 00, SCHEDULE FOR FINISHES: Color, pattern, type, direction of hanging and areas to receive wall covering.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Samples:

1. Each type and pattern as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

2. Size: Full width of mill run not less than 450 mm (18 inches) in length.

D. Manufacturer's Literature and Data:

1. Wall covering primer and adhesive.

2. Installation instructions.

3. Maintenance instructions, including recommended materials and methods for maintaining wall covering with precautions in use of cleaning material.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver in original unopened containers bearing the manufacturer's name, brand name, and product designation.

B. Store in accordance with manufacturer's instructions.

C. Handle to prevent damage to material.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

E84-20Surface Burning Characteristics of Building Materials

G21-15Determining Resistance of Synthetic Polymeric
Materials to Fungi

C. Code of Federal Regulation (CFR):

40 CFR 59(2016) Subpart DNational Volatile Organic Compound
Emission Standards for Architectural Coatings

D. Wallcovering Association (WA):

W-101-17Quality Standard Polymer Coated Fabric
Wallcoverings

PART 2 - PRODUCTS

2.1 VINYL COATED FABRIC WALL COVERING (VWC-1)

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Comply with WA W-101.
- C. Fungi Resistance: ASTM G21, rating of zero (0).
- D. Factory-applied clear delustered polyvinyl-fluoride (PVF) coating:
 - 1. Minimum 0.0125 mm (1/2 mil) thickness.
 - 2. Do not include PVF coating weight in minimum total weight.
 - 3. Fire hazard classification with PVF coating: Class A unless specified otherwise.
- E. Type II (Medium Duty).
- F. Custom Digital Printing:
 - 1. Electronic file of custom image to be provided by Owner digitally printed on specified Type II wallcovering substrate.
 - 2. UV coating that provides flame retardant, stain resistant, and antimicrobial surface.

2.2 PRIMER AND ADHESIVE

- A. Adhesive shall have a VOC content of 50 gram/liter or less when calculated according to 40 CFR 59, (EPA Method 24).
- B. Vermin, mildew resistant and germicidal inhibiting type recommended by wall covering manufacturer for use on substrate to receive wall covering.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Temperatures:
 - 1. Do not perform work until surfaces and materials have been maintained at minimum of 16 degrees C (60 degrees F) for three (3) days before work begins.
 - 2. Maintain minimum temperatures of 16 degrees C (60 degrees F) until adhesives are dried or cured.

3. Allow digitally-printed vinyl wallcovering to acclimatize to the area of installation a minimum of 24 hours before installation.
- B. Lighting:
1. Do not proceed unless a minimum lighting level of 15 candela per 0.09 square meter (15 candela per square foot) is provided.
 2. Measure light level at mid-height of wall.
- C. Ventilation: Provide continuous ventilation as required to rid the spaces in which the wall coverings are being installed of volatile compounds given off by the wall coverings, sealers and adhesives and as recommended by the product manufacturer for full drying or curing.
- D. Protect other surfaces from damage resulting from installation of wall coverings. Provide drop cloths, shields and protective equipment to prevent primers, adhesives or wall covering from fouling adjacent surfaces and in particular, storage and preparation areas.
- E. Store flammable rubbish, waste, cloths and materials which may constitute a fire hazard, in closed metal containers. Daily remove and properly dispose of flammable wastes from the site.

3.2 SURFACE CONDITION AND PREPARATION

- A. Inspect surfaces to receive wall coverings to assure that:
1. Patches and repairs to substrates are completed.
 2. Surfaces are clean, smooth and prime painted.
 3. Masonry and concrete walls are to have flush joints. Coat these walls with cement plaster or wall/liner as substrate preparation.
- B. Surfaces to receive wall covering are to be dry. Test moisture content of plaster, concrete, and masonry walls with an electric moisture meter. The moisture content is not permitted to be more than 5 percent. Submit test results.
- C. Do not proceed until discovered defects have been corrected by other trades and surfaces are ready to receive wall covering.
- D. Carefully remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings, prior to starting work and store items for reinstallation.

3.3 APPLICATION OF ADHESIVE

- A. Mix and apply adhesives in accordance with manufacturer's directions.
- B. Prevent adhesive from getting on face of wall covering.
- C. Apply adhesive to wall covering back.

3.4 INSTALLATION

- A. Use wall covering of same batch or run in each area. Use fabric rolls in consecutive numerical sequence of manufacture.
- B. Install material completely adhered, smooth, clean, without wrinkles, air pockets, gaps or overlaps.
- C. Extend wall covering continuous behind non-built-in casework and other items which are not bolted to the walls.
- D. Install wall covering before installation of resilient base. Extend wall covering not more than 6 mm (1/4 inch) below top of resilient base.
- E. Install wall covering panels consecutively in order in which they are cut from the roll including filling spaces above or below windows, doors, or similar penetrations.
- F. Do not install horizontal seams.
- G. Except on match patterns, hang fabric by reversing alternate strips, except as recommended by the manufacturer.
- H. Cutting:
 - 1. Cut on a work table with a straight edge.
 - 2. Joints or seams that are not cut clean are unacceptable.
Trim additional selvage to achieve a color and pattern match at seams. Overlapped seams are not allowed.
 - 3. Do not double cut seams on wall unless specified.
 - 4. If double cutting on the wall is necessary, place a three inch strip of Type I wall covering under pasted edge.
 - a. Do not cut into wall surface.
 - b. After cutting, remove strip and excess adhesive from seam before proceeding to next seam.
 - c. Smooth down seam in adhesive for tight bond and joint.
- I. Trim strip-matched patterns which are not factory pre-trimmed.
- J. Inside Corners:
 - 1. Wrap wall covering around corners.
 - 2. Do not seam within 50 mm (2 inches) of inside corners.
 - 3. Double cut seams.
- K. Outside Corners:
 - 1. Wrap wall covering around corners.
 - 2. Do not seam within 152 mm (6 inches) of outside corners.
 - 3. Double cut seams.
- L. Custom Digitally-Printed Wall Covering (VWC-1):

1. Before cutting, examine image and color and determine that they are the correct size, image, quality, and color as specified for the correct location.
2. Read and follow the instructions in the Manufacturer's installation sheet contained in each roll of the digitally printed vinyl wall covering.
3. Use adhesive recommended by the Wallcovering Manufacturer.
4. Install each panel in sequence.
5. Avoid burnishing the face of the material. Use a wallcovering brush or a plastic scraper to smooth the wallcovering onto the wall.
6. Use a seam roller to fatten the edges at the seams, ceilings and baseboards. Use light pressure. Do not press hard enough to remove the adhesive from underneath the wallcovering.
7. If there are variations in size, image, quality, or color that are considered to be excessive, notify the Manufacturer's Representative for an inspection before any further wallcovering is installed.

3.5 PATCHING

- A. Replace surface damaged wall covering in a space as specified for new work:
 1. Replace full height of surface.
 2. Replace from break in plane to break in plane when same batch or run is not used.
 3. Double cut seams.
 4. Adjoining differential colors from separate batches or runs is not acceptable.
- B. Correct loose or raised seams with adhesives to lay flat with tight bonded joint as specified for new work.

3.6 CLEANING AND INSTALLING TEMPORARY REMOVED ITEMS

- A. Remove adhesive from wall covering as work proceeds.
- B. Remove adhesives where spilled, splashed or splattered on wall coverings or adjacent surfaces in a manner not to damage surface from which it is removed.
- C. Upon completion of work, leave wall covering free of dirt or soil.
- D. Remove all debris associated with wall covering installation.
- E. Reinstall previously removed electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings.

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SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:
1. Prime coats which may be applied in shop under other sections.
 2. Prime painting unprimed surfaces to be painted under this Section.
 3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
 4. Painting ferrous metal (except stainless steel) exposed to view.
 5. Painting gypsum drywall exposed to view.
 6. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
 7. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
 8. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
 9. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 RELATED WORK

- A. Section 01 35 26, SAFETY REQUIREMENTS: Activity Hazard Analysis.
- B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.
- C. Division 05 METALS: Shop prime painting of steel and ferrous metals.
- D. Division 08 OPENINGS: Shop prime painting of steel and ferrous metals.
- E. Section 09 06 00, SCHEDULE FOR FINISHES: Type of Finish, Color, and Gloss Level of Finish Coat.
- F. Section 09 96 59, SPECIALTY GLAZED COATINGS: Glazed wall surfacing or tile like coatings.

- G. Division 21 FIRE SUPPRESSION: Shop prime painting of steel and ferrous metals.
- H. Division 22 PLUMBING: Shop prime painting of steel and ferrous metals.
- I. Division 23 HEATING; VENTILATION AND AIR-CONDITIONING: Shop prime painting of steel and ferrous metals.
- J. Division 26 ELECTRICAL: Shop prime painting of steel and ferrous metals.
- K. Division 27 COMMUNICATIONS: Shop prime painting of steel and ferrous metals.
- L. Division 28 ELECTRONIC SAFETY AND SECURITY: Shop prime painting of steel and ferrous metals.
- M. Division 32 EXTERIOR IMPROVEMENTS: Shop prime painting of steel and ferrous metals.
- N. Section 32 17 23, PAVEMENT MARKINGS: Asphalt and concrete pavement marking.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals as described below:
 - 1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Manufacturer's Literature and Data:
 - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data.
- D. Sample Panels:
 - 1. After painters' materials have been approved and before work is started, submit sample panels showing each type of finish and color specified.
 - 2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
 - 3. Attach labels to panel stating the following:
 - a. Manufacturers name and product number of paints used.
 - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
 - c. Product type, color, and gloss level.
 - d. VA project title, VA project number, and VA contract number.
 - 4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 - 1. Name of manufacturer.
 - 2. Product type.
 - 3. Batch number.
 - 4. Instructions for use.
 - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 - 1. Federal Specification Number, where applicable, and name of material.
 - 2. Surface upon which material is to be applied.
 - 3. Specify Coat Types: Prime; body; finish; etc.
- C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

1.5 QUALITY ASSURANCE

- A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.
- B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

1.6 REGULATORY REQUIREMENTS

- A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.

1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.
 - d. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
3. Asbestos: Provide materials that do not contain asbestos.
4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints.

1.7 SAFETY AND HEALTH

- A. Apply paint materials using safety methods and equipment in accordance with the following:
 1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.
- B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.
- C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:
 1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
 2. 29 CFR 1910.1000.

3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
 - ACGIH TLV-BKLT-2012Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
 - ACGIH TLV-DOC-2012Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. ASME International (ASME):
 - A13.1-07(R2013)Scheme for the Identification of Piping Systems
- D. Code of Federal Regulation (CFR):
 - 40 CFR 59Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating
- E. Commercial Item Description (CID):
 - A-A-1272APlaster Gypsum (Spackling Compound)
- F. Federal Specifications (Fed Spec):
 - TT-P-1411APaint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):
 - 1Aluminum Paint
 - 9Exterior Alkyd Enamel MPI Gloss Level 6
 - 10Exterior Latex, Flat
 - 11Exterior Latex, Semi-Gloss
 - 18Organic Zinc Rich Primer
 - 47Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
 - 50Interior Latex Primer Sealer
 - 68Interior/ Exterior Latex Porch & Floor Paint, Gloss
 - 94Exterior Alkyd, Semi-Gloss
 - 95Fast Drying Metal Primer
 - 99Sealer, Water-based, for Concrete Floors
 - 134Galvanized Water Based Primer
 - 135Non-Cementitious Galvanized Primer

147.....Latex Interior Institutional Low Odor/VOC, Semi-Gloss, MPI Gloss Level 5

149.....Primer Sealer Interior Institutional Low Odor/VOC

153Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 5)

H. Society for Protective Coatings (SSPC):

SSPC SP 1-82 (R2004)Solvent Cleaning

SSPC SP 2-82 (R2004)Hand Tool Cleaning

SSPC SP 3-28 (R2004)Power Tool Cleaning

SSPC SP 10/NACE No.2 ...Near-White Blast Cleaning

SSPC PA Guide 10Guide to Safety and Health Requirements

I. U.S. National Archives and Records Administration (NARA):

29 CFR 1910.1000Air Contaminants

J. Underwriter's Laboratory (UL)

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

2.2 PAINT PROPERTIES:

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only to recommended limits.

D. VOC Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 gram/liter.

2. Non-flat Paints and Coatings: 150 gram/liter.

3. Primers, Sealers, and Undercoaters: 200 gram/liter.

4. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 gram/liter.

5. Zinc-Rich Industrial Maintenance Primers: 340 gram/liter.

- E. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

2.3 PLASTIC TAPE:

- A. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
- B. Pressure sensitive adhesive back.
- C. Widths as shown on construction documents.

2.4 BIOBASED CONTENT

- A. Paint products shall comply with following bio-based standards for biobased materials:

Material Type	Percent by Weight
Interior Paint	20 percent biobased material
Exterior Paint	20 percent biobased material
Wood & Concrete Sealer-Membrane Concrete Sealers	11 percent biobased content
Wood & Concrete Sealer-Penetrating Liquid	79 percent biobased content

- B. The minimum-content standards are based on the weight (not the volume) of the material.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.
- B. Atmospheric and Surface Conditions:
1. Do not apply coating when air or substrate conditions are:
 - a. Less than 3 degrees C (5 degrees F) above dew point.
 - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the

product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.

- c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will warm.
5. Apply only on clean, dry and frost-free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
 - b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.

3.2 INSPECTION:

- A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS:

- A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.
- B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.
- C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.
- D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

- E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.
- F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.
- G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.
- H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.

3.4 SURFACE PREPARATION:

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Gypsum Board: 12 percent.

B. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning).
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
 - a. Fill flat head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

C. Zinc-Coated (Galvanized) Metal, Aluminum, Copper and Copper Alloys
Surfaces Specified Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

D. Concrete:

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in Division 03, CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

E. Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.5 PAINT PREPARATION:

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.6 APPLICATION:

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.
- E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.
 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
 2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items

specified in "Building and Structural Work Field Painting"; "Work not Painted"; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

- F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.7 PRIME PAINTING:

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rabbets for face glazing of steel.
- E. Metals except boilers, incinerator stacks, and engine exhaust pipes:
 - 1. Steel and iron: MPI 95 (Fast Drying Metal Primer).
 - 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer).
 - 3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
 - 4. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
 - 5. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel).
 - 6. Asphalt coated metal: MPI 1 (Aluminum Paint).
 - 7. Metal to receive Paint P-10: Paint manufacturer's recommended primer.
- F. Gypsum Board:
 - 1. Use MPI 149 Primer Sealer Interior Institutional Low Odor/VOC.
 - 2. Surfaces scheduled to receive vinyl coated fabric wall covering:
 - a. Use MPI 149 Primer Sealer Interior Institutional Low Odor/VOC.
- G. Concrete Floors: MPI 99 (Water-based Acrylic Curing and Sealing Compound).

3.8 EXTERIOR FINISHES:

- A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Steel and Ferrous Metal (P-13 and P-13A):
 - 1. Two (2) coats of MPI 9 (Exterior Alkyd Enamel, Gloss) on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).

- C. Machinery without factory finish except for primer: MPI 9 (Exterior Alkyd Enamel).

3.9 INTERIOR FINISHES:

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Metal Work:
 - 1. Apply to exposed surfaces.
 - 2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
 - 3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
 - a. Door Frames, Diffusers, Grilles (P-4, P-4A, P-4B): Apply two (2) coats of MPI 153 Light Industrial Coating, Interior, Water-Based, Semi-Gloss, MPI Gloss Level 5.
 - b. Columns (P-10): Apply two (2) coats of waterbased, 100% acrylic, reflective and textured finish with ground mica.
 - c. Machinery: One (1) coat MPI 9 (Exterior Alkyd Enamel).
 - d. Asphalt Coated Metal: One (1) coat MPI 1 (Aluminum Paint).
- C. Gypsum Board:
 - 1. Corridor Walls (P-1): Two (2) coats Scuff-Resistant, High-Performance, One-Component, Low VOC, Latex Coating, Semi-Gloss, equal to MPI Gloss Level 5.
 - 2. Walls & Ceilings/Soffits (P-2, P-3, P-6, P-7, P-8, and P-11): Two (2) coats of MPI 147 Latex Interior Institutional Low Odor/VOC, Semi-Gloss, MPI Gloss Level 5.
- D. Miscellaneous:
 - 1. Interstitial floor markings: One (1) coat MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).

3.10 REFINISHING EXISTING PAINTED SURFACES:

- A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.
- B. Remove and reinstall items as specified under "General Workmanship Requirements".
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.

- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- G. Sand or dull glossy surfaces prior to painting.
- H. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.11 PAINT COLOR:

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".
- C. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.
 - 2. Color of body coat: Lighter than finish coat.
 - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
 - 1. Paint to match color of casework where casework has a paint finish.
 - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.12 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified below.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.

- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Color:
 - 1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
 - 2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
 - a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
 - b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
 - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
 - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
 - e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
- H. Apply paint systems on properly prepared and primed surface as follows:
 - 1. Exterior Locations:
 - a. Apply two (2) coats of MPI 9 (Exterior Alkyd Enamel) // to the following ferrous metal items:
Vent and exhaust pipes with temperatures under 94 degrees C (201 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
 - b. Apply two (2) coats of MPI 11 (Exterior Latex, Semi-Gloss) to galvanized and zinc-copper alloy metal.

2. Interior Locations:

a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:

1) Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.

2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.

3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.

b. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 94 (Exterior Alkyd, Semi-gloss) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

3. Other exposed locations:

a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two (2) coats of MPI 1 (Aluminum Paint).

b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 10 (Exterior Latex, Flat).

3.13 IDENTITY PAINTING SCHEDULE:

A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.

1. Legend may be identified using snap-on coil plastic markers or by paint stencil applications.

2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12.2 M (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.

3. Locate Legends clearly visible from operating position.

4. Use arrow to indicate direction of flow using black stencil paint.

5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:
- High Pressure - 414 kPa (60 psig) and above.
 - Medium Pressure - 104 to 413 kPa (15 to 59 psig).
 - Low Pressure - 103 kPa (14 psig) and below.
 - Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Green	White	Blow-off
Boiler Feedwater		Green	White	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Blue	White	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Green	White	H.P. _____*
High Pressure Condensate Return		Green	White	H.P. Ret _____*
Medium Pressure Steam		Green	White	M. P. Stm _____*
Medium Pressure Condensate Return		Green	White	M.P. Ret _____*
Low Pressure Steam		Green	White	L.P. Stm _____*
Low Pressure Condensate Return		Green	White	L.P. Ret _____*
High Temperature Water Supply		Green	White	H. Temp Wtr Sup
High Temperature Water Return		Green	White	H. Temp Wtr Ret
Hot Water Heating Supply		Green	White	H. W. Htg Sup
Hot Water Heating Return		Green	White	H. W. Htg Ret
Gravity Condensate Return		Green	White	Gravity Cond Ret
Pumped Condensate Return		Green	White	Pumped Cond Ret
Vacuum Condensate Return		Green	White	Vac Cond Ret
Fuel Oil - Grade	Brown	White		Fuel Oil-Grade

(Diesel Fuel included under Fuel Oil)

Boiler Water Sampling		Green	White	Sample
Chemical Feed		Green	White	Chem Feed
Continuous Blow-Down		Green	White	Cont. B D
Pumped Condensate		Green	White	Pump Cond
Pump Recirculating		Green	White	Pump-Recirc.
Vent Line		Green	White	Vent
Alkali		Orange	Black	Alk
Bleach		Orange	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Orange	Black	Acid Waste
Vent		Orange	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler	Red	Red	White	Auto Spr
Standpipe	Red	Red	White	Stand
Sprinkler	Red	Red	White	Drain

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000, 15000, 25000.

8. See Sections for methods of identification, legends, and abbreviations of the following:
 - a. Medical Gases and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES, and Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
 - b. Conduits containing high voltage feeders over 600 volts:
Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS,
Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and
Section 28 05 28.33, CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY.

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
4. Use semi-gloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:

1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (1.8 inches) below overhead structural slab.
3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
4. Color:
 - a. Use black on concrete columns.
 - b. Use white or contrasting color on steel columns.

3.14 PROTECTION CLEAN UP, AND TOUCH-UP:

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

**SECTION 10 12 00
DISPLAY CASES**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section covers manufactured display cases.

1.2 RELATED REQUIREMENTS

A. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's literature and data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include furnished specialties and accessories.

2. Shop Drawings: Scaled plans, elevations, sections, and details.

3. Maintenance Data: To include in maintenance manuals.

C. Initial Selection Samples: Interior deck finish.

D. Verification Samples: For pedestal base and glass finish specified, two samples, minimum size 3 inches square, representing actual specified finish.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

A. Do not deliver or install 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 at occupancy levels are established.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 DISPLAY CASES

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
 - 1. Style: Freestanding case with five-sided, frameless glass vitrine set within a metal rail that is fixed to and supported by a pedestal base.
 - 2. Size: 24"W x 54"L x 70"H.
 - 3. Base Construction: Plastic laminate on MDF construction with levelers.
 - 4. Glass: Clear white, laminated safety glass providing UV-protection.
 - 5. Features:
 - a. Removeable interior deck.
 - b. Hinged door.
 - c. High-quality locks.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install display cases at the location shown in accordance with the manufacturers' instructions for plumb and level installations.

3.2 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

- - - E N D - - -

**SECTION 10 14 19
DIMENSIONAL LETTER SIGNAGE**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies backlit, fabricated metal letters at retaining wall; and fabricated metal letters at Lobby Waiting F03 as drawn and specified.

1.2 RELATED WORK

- A. Division 26, ELECTRICAL.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings:
 - 1. Show layout and fabrication and mounting details.
 - 2. Show copy, typestyles, graphic elements, and layout for each sign.
 - 3. Show locations of electrical service connections.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Furnish sample indicating construction, material, finish, and mounting detail:
 - 1. Dimensional Characters: Full-size Sample of each type of dimensional character.
 - 2. Exposed Accessories: Full-size Sample of each accessory type.
 - 3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.
- D. Maintenance Data: For signs to include in maintenance manuals.

1.4 COORDINATION

- A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.6 WARRANTY

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

- B. Special Warranty: 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. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ILLUMINATED, FABRICATED CHANNEL DIMENSIONAL CHARACTERS (LIGHTING SOURCE INTEGRALLY CONSTRUCTED AS PART OF THE SIGN UNIT)

- A. Formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.
- B. Fabricated channel, backlighted character construction with metal face and side returns; with LED lighting including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
- C. 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.
- D. Material: Brushed aluminum; ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- E. Material Thickness: Manufacturer's standard for size and design of character.
- F. Finish: Clear Anodized; AAMA 611, Class I, 0.018 mm or thicker.
- G. Typeface: Myriad Pro Regular.
- H. Copy (confirm with Owner): ROYAL C. JOHNSON VETERANS MEMORIAL HOSPITAL
- I. Letter Height: 18 inches.
- J. Letter Depth: 2 inches.
- K. Power: As indicated on Drawings.
- L. Weeps: Provide weep holes to drain water at lowest part of characters.
- M. Mounting: Strap and stud mount, standoff of 1 inch from face of retaining wall.

N. Architect product approval required.

2.2 CAST DIMENSIONAL CHARACTERS

- A. Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows.
- B. Material: Cast aluminum; ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- C. Finish: Black Anodized; AAMA 611, Class I, 0.018 mm or thicker.
- D. Typeface: Georgia Regular.
- E. Copy (verify with Owner, see drawings for placement): "...to care for him who shall have borne the battle and for his widow and orphan..."
- Abraham Lincoln, 1865
- F. Letter Height: 5 1/2" inches.
- G. Letter Depth: 1/2 inch.
- H. Mounting: Concealed studs.
- I. Architect product approval required.

2.3 FABRICATION - GENERAL

- A. Provide manufacturer's standard sign assemblies according to requirements indicated.
- B. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
- C. Shall withstand the effects of gravity and other loads within limits and conditions of installation location.
- D. Allow for thermal movements from ambient and surface temperature changes.
- E. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
- F. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
- G. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

- H. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
- I. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- J. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish hot-dip galvanized devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.3 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. Anodic Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

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.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

- - - END - - -

**SECTION 10 21 13
TOILET COMPARTMENTS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies high-pressure laminate toilet partitions, urinal screens.

1.2 RELATED WORK

- A. Section 09 06 00, SCHEDULE FOR FINISHES: Color of high-pressure laminate finish.
- B. Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES: Grab bars and toilet tissue holders.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: High-pressure laminate.
- C. Manufacturer's Literature and Data: Specified items indicating all hardware and fittings, material, finish, and latching.
- D. Shop Drawings: Construction details at 1/2 scale, showing installation details, anchoring and leveling devices.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
FF-B-575CBolt, Hexagon and Square
- C. Code of Federal Regulations (CFR):
40 CFR 247Comprehensive Procurement Guidelines for
Products Containing Recovered Materials
- D. Commercial Item Descriptions (CID):
A-A-1925Shield, Expansion (Nail Anchors)
A-A-60003Partitions, Toilet, Complete

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

2.2 TOILET PARTITIONS (TP-1)

- A. 1 inch thick panels; HPL bonded to 45 lb (20.4 kg) density, industrial-grade, resin-impregnated, particle board core with adhesive specially formulated to prevent delamination.; Class B flame spread rating.

- B. Conform to Fed. CID A-A-60003, except as modified herein.
- C. Fabricate to dimensions shown or specified.
- D. Toilet Enclosures:
 - 1. Type 1, A (Floor supported with overhead brace)..
 - 2. Reinforce panels shown to receive toilet tissue holders or grab bars.
 - 3. Upper pivots and lower hinges adjustable to hold doors open 30 degrees.
 - 4. Manufacturer's standard clothes hook.
 - 5. Latching devices and hinges for handicap compartments shall comply with ADA requirements.
 - 6. Keeper:
 - a. U-slot to engage bar of throw latch.
 - b. Combined with rubber bumper stop.
 - 7. Wheelchair Toilets:
 - a. Upper pivots and lower hinges to hold out swinging doors in closed position.
 - b. Provide U-type doors pulls, approximately 100 mm (four inches) long on pull side.
 - 8. Finish:
 - a. High-pressure laminated plastic NEMA LDS-1985 minimum thickness 0.050 inch (1.33 mm) with matte finish.
 - b. Hardware: Stainless steel with satin finish.
 - c. Edge Trim: 18-8, Type 304 stainless steel channel with satin finish; channels mortised for flush fit with routed substrate; mitered corners.
- E. Urinal Screens:
 - 1. Type III, Style E (wall hung).
 - a. With integral flanges and continuous, full height wall anchor plate.
 - b. Option: Full height U-Type bracket.
 - c. Wall anchor plate drilled for 4 anchors on both sides of screen.
 - 2. Screen 600 mm (24 inches) wide and 1060 mm (42 inches high).
 - 3. Same material and finish as toilet partition.

2.3 FASTENERS

- A. Partition Fasteners: CID A-A-60003.
- B. Use expansion bolts, CID A-A-60003, for anchoring to solid masonry or concrete.

- C. Use toggle bolts, CID A-A-60003, for anchoring to hollow masonry or stud framed walls.
- D. Use steel bolts FS-B-575, for anchoring pilasters to overhead steel supports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

- 1. Install in rigid manner, straight, plumb and with all horizontal lines level.
- 2. Conceal evidence of drilling, cutting and fitting in finish work.
- 3. Use hex-bolts for through-bolting.
- 4. Adjust hardware and leave in freely working order.
- 5. Clean finished surfaces and leave free of imperfections.

B. Panels and Pilasters:

- 1. Support panels, except urinal screens, and pilaster abutting building walls near top and bottom by stirrup supports secured to partitions with through-bolts.
- 2. Secure stirrups to walls with two suitable anchoring devices for each stirrup.
- 3. Secure panels to faces of pilaster near top and bottom with stirrup supports, through-bolted to panels and machine screwed to each pilaster.
- 4. Secure edges of panels to edges of pilasters near top and bottom with "U" shaped brackets.
- 5. Where overhead braced, secure pilasters to building walls by headrails clamped on or set into top of each pilaster.
 - a. Secure clamps to pilasters with two through-bolts to each clamp.
 - b. When headrails are set into pilasters, through-bolt them to the pilasters.
 - c. Support headrails on wall flange fittings secured to building walls with minimum of two anchor bolts to each flange fitting.

C. Urinal Screens:

- 1. Anchor urinal screen flange to walls with minimum of four bolts both side of panel.
- 2. Space anchors at top and bottom and equally in between.

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**SECTION 10 21 23
CUBICLE CURTAIN TRACKS**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies cubicle curtain track.

1.2 RELATED WORK

A. Section 09 51 00, ACOUSTICAL CEILINGS: Acoustical ceiling tile and suspension systems.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. 305 mm (12 inch) long piece of cubicle curtain track with carrier access and end stop.

2. Curtain carrier for attaching curtain to track.

C. Shop Drawings: Showing layout of tracks and method of anchorage.

D. Manufacturer's Literature and Data:

1. Cubicle curtain track.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.

B. Store in dry and protected location. Store so as to not bend or warp the tracks.

C. Do not open packages until contents are needed for installation, unless verification inspection is required.

1.5 WARRANTY

A. Construction Warranty: Cubicle curtain tracks are subject to the terms of the Article "Warranty of Construction," FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

B221-14Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B456-17Electrodeposited Coatings for Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

C. Aluminum Association (AA):

DAF 45-09Designation System for Aluminum Finishes

- D. American Architectural Manufacturers Association (AAMA):
 2603-20Voluntary Specification, Performance
 Requirements and Test Procedures for Pigmented
 Organic Coatings on Aluminum Extrusions and
 Panels (with Coil Coating Appendix)
- E. The National Association of Architectural Metal Manufacturers (NAAMM):
 AMP 500-06 SeriesMetal Finishes Manual

PART 2 - PRODUCTS

2.1 CUBICLE CURTAIN TRACKS (CCT-1)

- A. Basis for Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Channel Tracks (Surface Mounted Type): Extruded aluminum,
 ASTM B221M (B221), alloy 6063, temper T5, channel shaped, with smooth
 inside raceway for curtain carriers.
- C. Curtain Carriers: Nylon carriers, with nylon wheels on nylon axles.
 - 1. Equip each carrier with either stainless steel, chromium plated
 brass or steel hooks with swivel, or nickel chromium plated brass or
 stainless steel bead chain.
 - 2. Hook for bead chain may be the same material and finish as the bead
 chain or may be chromium plated steel.
 - 3. Provide 2.2 carriers for every 305 mm (1 foot) of each section of
 each track length, plus one (1) additional carrier.
- D. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate
 from the same material with the same finish as the tracks or from
 nylon.
- E. Hangers and Fittings: Fabricate from the same material with the same
 finish as the tracks. Hangers may be round or square for channel tracks
 and round for tubular tracks. Design fittings to be compatible with
 design of tracks and to safely transmit the track load to the hangers.
- F. At end of each section of track, make provision for insertion and
 removal of carriers. Design to prevent accidental removal of carrier.
 Provide operating mechanism shall be removable with common tools.

2.2 FASTENERS

- A. Exposed Fasteners, Screws and Bolts: Stainless steel or chromium/nickel
 plated brass.
- B. Concealed Fasteners, Screws and Bolts: Hot-dip galvanized Stainless
 steel.
- C. Metal Clips: Anchor curtain tracks to exposed grid of lay-in acoustical
 tile ceilings, with flush grid clips.

1. When it is not possible to install the metal ceiling clip, the cubicle curtain track may be screwed to the ceiling grid.

2.3 FINISHES

- A. Chrome/Nickel Plating: Satin or polished finish, ASTM B546, minimum thickness of chromium plate as follows:
 1. 0.005 mm (0.2 mil) on copper alloys.
 2. 0.01 mm (0.4 mil) on steel.
- B. Stainless Steel: No. 4 in accordance with NAAMM AMP 500.
- C. Baked Enamel or Powder Coat Finish: AAMA 2603.

2.4 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form tracks and bends of lengths that will produce the minimum number of joints. Make track sections up to 4877 mm (16 feet) without joints. Form corner bend on a 305 mm (12 inch) radius.
- C. Provide steel anchor plates, supports, and anchors for securing components to building construction.
- D. Form flat surface without distortion.
- E. Shop assemble components and package complete with anchors and fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install tracks after finish painting and ceiling finishing operations are complete.
- B. Install track level and hangers plumb and securely anchor to the ceiling to form a rigid installation.
- C. Anchor surface mounted curtain tracks directly to exposed grid of lay-in acoustical tile ceilings with suitable fasteners, spaced approximately 610 mm (24 inches) on center.
- D. Fasten end stop caps to prevent them from being forced out by the striking weight of carriers.
- E. Remove damaged or defective components and replace with new components or repair to the original condition.
- F. Install track rigid, plumb, level and true, and securely anchored to the overhead construction.
- G. Verify that carrier units operate smoothly and easily over the full range of travel.

- - - E N D - - -

**SECTION 10 21 23.13
CUBICLE CURTAINS**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies cubicle curtains.

1.2 RELATED WORK

A. Cubicle curtain tracks: Section 10 21 23 CUBICLE CURTAIN TRACKS

B. Color and pattern: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. Fabric: Swatch to be a minimum 12"-square and display a full pattern repeat where applicable. Clearly label if fabric is intended to be railroaded.

2. Mesh Top: Not less than 4 inches square, demonstrating manufacturer's standard hemming around mesh perimeter with matching fabric.

C. Manufacturer's Literature and Data:

1. Cubicle curtain fabric.

2. Mesh top.

D. Maintenance Data:

1. Methods for maintaining and cleaning curtains, including instructions on laundering and precautions regarding use of cleaning solvents and methods.

1.4 DELIVERY, STORAGE AND HANDLING

A. Do not deliver or install curtains until construction within spaces are substantially complete.

B. Label curtains according to schedule.

C. Store products in manufacturer's unopened packaging until ready for installation.

1.5 WARRANTY

A. Construction Warranty: Cubicle curtains are subject to the terms of the Article "Warranty of Construction," FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 CUBICLE CURTAINS (PC-1)

A. Curtain: Consists of an upper mesh panel snapped onto a lower fabric panel.

- B. Meets NFPA 13 Sprinkler System Code.
- C. Meets requirement of NFPA Bulletin 701 (test 1, small scale).
- D. Fabric Panel:
 - 1. Material: 100% polyester/recycled polyester.
 - 2. 1" triple-folded bottom and side hems with lockstitch.
- E. Mesh header:
 - 1. Material: 100% nylon.
 - 2. 1" triple-folded header for grommet reinforcement.
 - 3. 20" finished height minimum for fire safety compliance.
- F. Grommets: #10 nickel-plated grommets, spaced 6" on center.
- G. Size: 66-inch x 66-inch snap panels; track length plus 15% (rounded to nearest foot) for fullness.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install curtains on carriers.

- - - E N D - - -

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section specifies wall guards, handrail/wall guard combinations, corner guards, end wall guards, and rigid sheet wall protection.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.
- B. Section 07 92 00, JOINT SEALANTS.
- C. Section 08 71 00, DOOR HARDWARE: Armor plates and kick plates not specified in this section.
- D. Section 09 06 00, SCHEDULE FOR FINISHES: Color and texture of stainless steel and resilient material.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer with a minimum of three (3) years' experience in providing items of type specified.
1. Obtain wall and door protection from single manufacturer.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
2. For composite wood products, submit documentation indicating product contains no added urea formaldehyde.
- C. Shop Drawings: Show design and installation details.
- D. Manufacturer's Literature and Data (including installation and maintenance):
1. Handrail/Wall Guard Combinations.
2. Wall Guards.
3. Corner Guards.
4. End Wall Guards.
5. Rigid Sheet Wall Protection.
- E. Test Report: Showing that resilient material complies with specified fire and safety code requirements.
- F. Finish Verification Samples (each type and color indicated):
1. Handrail/Wall Guard Combinations.
2. Wall Guards.

- 3. Corner Guards.
- 4. End Wall Guards.
- 5. Rigid Sheet Wall Protection.

G. Manufacturer’s warranty.

1.5 DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21 degrees C (70 degrees F) for at least 48 hours prior to installation.

1.6 WARRANTY

- A. Construction Warranty: Comply with FAR clause 52.246-21 “Warranty of Construction”.
- B. Manufacturer Warranty: Manufacturer shall warranty their wall protection for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. publications are referenced in text by basic designation only.
- B. ASTM International (ASTM):
 - A240/A240M-20Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and For General Applications
 - B221-14Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - B221M-13Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
 - D256-10(2018)Determining the Izod Pendulum Impact Resistance of Plastics
 - D635-18Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
 - D6108Standard Test Method for Compressive Properties of Plastic Lumber and Shapes
 - D6109Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastic Lumber

- D6111Standard Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by displacement
- D6177Standard Test Methods for Mechanical Fasteners in Plastic Lumber and Shapes
- E84-20Surface Burning Characteristics of Building Materials
- C. Aluminum Association (AA):
 - DAF 45-09Designation System for Aluminum Finishes
- D. American Architectural Manufacturers Association (AAMA):
 - 611-14Voluntary Specification for Anodized Architectural Aluminum
- E. Code of Federal Regulation (CFR):
 - 40 CFR 59(2020) Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings
- F. The National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500-06Metal Finishes Manual
- G. SAE International (SAE):
 - J 1545-2014-10Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim.
- H. Underwriters Laboratories Inc. (UL):
 - Annual IssueBuilding Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: A240/A240M, Type 304.
- B. Aluminum Extruded: ASTM B221M (B221), Alloy 6063, Temper T5 or T6.
- C. Resilient Material:
 - 1. Provide resilient material consisting of high impact resistant polyvinyl chloride and PETG conforming to the following:
 - a. Minimum impact resistance of 960.8 N-m/m (18 feet-pounds/square inch) when tested in accordance with ASTM D256 (Izod impact, feet-pounds per inch notched).
 - b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
 - c. Rated self-extinguishing when tested in accordance with ASTM D635.

- d. Provide material labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
- e. Provide integral color with colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
- f. Recycled High-Density Polyethylene: In accordance with ASTM D6108, ASTM D6109, ASTM D6111, and ASTM D6177.
- g. MDF Board: No added urea formaldehyde.

2.2 CORNER GUARDS (CG-1)

- A. Fabricate stainless steel corner guards of 1.52 mm (.06 inch) thick material conforming to ASTM A240/A240M, Type 304. 2" wings; 8' high, unless otherwise noted. Install corner guards from top of base.

2.3 END WALL GUARDS (EG-1)

- A. Flush mount stainless steel end wall protectors of 0.060" thick material conforming to ASTM A240/A240M, Type 304. 3" depth, width to match wall, 1/8" radius corner. Install end wall guards from floor to ceiling.

2.4 WALL GUARDS AND HANDRAILS (HR-1 AND WG-1)

- A. Resilient Wall Guards and Handrails:

1. Handrail/Wall Guard Combination (HR-1):

- a. Round handrail system with integrated wall guard; 200 mm (7-7/8-inch) overall height, 38 mm (1-1/2-inch) gripping diameter with stainless steel returns, 127 mm (5-inch) high wall guard, 82 mm (3-1/4-inch) distance from wall.
- b. Snap-on covers of resilient material, minimum 2 mm (0.078-inch) thick.
- c. Free-floating on a continuous, extruded aluminum retainer, minimum 2mm (0.078-inch) thick.
- d. Brackets shall be stainless steel Type 201SS and have a vinyl base.
- e. Anchor to wall at maximum 762 mm (30 inches) on center.

2. Wall Guards (WG-1):

- a. Recycled high-density polyethylene wall guards; 20 mm (8-inch) high, 13 mm (1/2-inch) deep.

- 3. Provide handrails and wall guards with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners to be field adjustable to assure close alignment with

handrails and wall guards. Screw or bolt closure caps to aluminum retainer in a concealed manner.

2.5 RIGID SHEET WALL PROTECTION (RWP-1)

- A. Provide sheets consisting of high impact rigid polyvinyl chloride resilient material.
- B. Sheet sizes to be 1.22 x 2.44 m (4ft x 8ft).
- C. Submit fire rating and extinguishing test results for resilient material.
- D. Submit statements attesting that the items comply with specified fire and safety code requirements.
- E. Rigid Sheet: Sheet thickness to be 1.52 mm (0.060 inch).
- F. Provide adhesive as recommended by the wall covering manufacturer. Provide adhesive with VOC content of 250 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).
- G. Accessories:
 - 1. Trim: Extruded PVC trim as required.
 - 1. Horizontal Top Cap Board: 1 mm (0.04-inch) thick polyvinyl chloride factory-bonded to MDF board; 9.5 mm (3/8-inch) thick, 50 mm (2-inch) high.

2.6 FASTENERS AND ANCHORS

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified in construction documents, submit shop drawings showing proposed installation details.

2.7 FINISH

- A. Aluminum: In accordance with AA DAF-45.
 - 1. Concealed aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.
- B. Stainless Steel: In accordance with NAAMM AMP 500 finish Number 4.
- C. Resilient Material: Embossed textures and color in accordance with SAE J1545.

PART 3 - INSTALLATION

3.1 STAINLESS STEEL CORNER GUARDS

- A. Mount guards on external corners of interior walls, partitions and columns as shown on construction documents.
- B. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent-type contact adhesive

specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow curing undisturbed for 24 hours.

3.2 STAINLESS STEEL END WALL GUARDS

- A. Clean substrate to remove dust, debris, and loose particles.
- B. Screw on: Position the end wall protectors on the wall and attach it using the supplied screws.
- C. Install in accordance with manufacturer's details and instructions. Install level and plumb.
- D. Install Height: From floor to ceiling.

3.3 WALL GUARDS AND RESILIENT WALL GUARD HANDRAIL COMBINATION

- A. Secure to walls in accordance with manufacturer's details and instructions.
- B. Install wall guard handrail combination
- C. Install wall guards six (6) inches AFF to bottom; cap fastener holes with matching color.

3.4 RIGID SHEET WALL PROTECTION

- A. Surfaces to receive protection to be clean, smooth and free of obstructions.
- B. Apply with adhesive in controlled environment according to manufacturer's recommendations.
- C. Trim between panels and at inside corners with manufacturer's pvc trim; trim any exposed edges, such as at outside corners of window jamb returns with manufacturer's top cap trim installed vertically.
- D. Trim top with horizontal top cap boards.
- E. Install Height: 48" AFF, unless otherwise noted.

3.5 CLEANING

- A. Clean surfaces after installation and before final acceptance per manufacturer's recommendations.

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**SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES**

PART 1 - GENERAL

1.1 DESCRIPTION

A. SUMMARY:

- 1. Section Includes: Toilet and bath accessories at toilets and other areas indicated on drawings.

1.2 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Society of Mechanical Engineers (ASME):

- 1. B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws inch.

C. American Welding Society (AWS):

- D10.4-86(2000)Welding Austenitic Chromium-Nickle Stainless Steel Piping and Tubing.

D. ASTM International (ASTM):

- A269/A269M-15a(2019) ...Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

- A312/A312M-19Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

- A653/A653M-20Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

- A666-15Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

- A1011/A1011M-18aSteel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

- B456-17Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

- C1036-16Flat Glass.

- C1048-18Heat-Strengthened and Fully Tempered Flat Glass.

- F446-19Grab Bars and Accessories Installed in the Bathing Area.

E. Federal Specifications (Fed. Spec.):

- A-A-3002Mirror, Glass.
- FF-S-107C(2)Screws, Tapping and Drive.

WW-P-541/8B(1)Plumbing Fixtures (Accessories, Land Use).

F. National Architectural Metal Manufacturers (NAAMM):

AMP 500-06Metal Finishes Manual.

1.3 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication, anchorage and installation details.

2. Show mounting locations and heights.

C. Manufacturer's Literature and Data:

1. Description of each product.

2. Installation instructions.

D. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel:

1. Plate or Sheet: ASTM A666, Type 304, 0.8 mm (0.031 inch) thick unless otherwise specified.

2. Tubing: ASTM A269/A269M, Grade TP 304, seamless or welded.

3. Pipe: ASTM A312/A312M; Grade TP 304.

- B. Steel Sheet: ASTM A653/A653M, zinc-coated (galvanized) coating designation G90.
- C. Chrome Plating (Service Condition Number SC 2): ASTM B456.
- D. Brass Castings: ASTM B30.
- E. Glass:
 - 1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.

2.3 GRAB BARS

- A. Fed. Spec. WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and complying with ASTM F446.
- B. Fabricate from stainless steel or nylon coated steel, use one type throughout project:
 - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Mounting:
 - 1. Floor Mounted Grab Bars: Exposed type.
 - 2. Swing Up Grab Bars: Exposed type.
 - 3. Toilet Partitions Mounted Grab Bars: Exposed type.
 - 4. Other Types and Locations: Concealed type.
- D. Bars:
 - 1. Fabricate to 38 mm (1-1/2 inch) outside diameter.
 - a. Stainless steel, minimum 1.2 mm (0.05 inch) thick.
 - 2. Fabricate in one continuous piece with ends turned toward walls.
 - a. Swing up grab bars and grab bars continuous around three sides of showers may be fabricated in two sections, with concealed slip joint between.
 - 3. Continuously weld intermediate support to grab bar.
 - 4. Swing Up Bars: Manually operated; designed to prevent bar from falling when in raised position.
- E. Flange for Concealed Mounting:
 - 1. Minimum 2.65 mm (0.1 inch) thick, maximum 79 mm (3-1/8 inch) diameter by 13 mm (1/2 inch) deep, with minimum three set screws for securing flange to back plate.
 - 2. Insert grab bar through center of flange and continuously weld perimeter of grab bar flush to back side of flange.

3. In lieu of providing flange for concealed mounting, and back plate as specified, grab bar may be welded to back plate covered with flange.

F. Flange for Exposed Mounting:

1. Minimum 5 mm (3/16 inch) thick, maximum 79 mm (3-1/8 inch) diameter.
2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
3. Where mounted on toilet partitions, provide three equally spaced, countersunk holes, sized to accommodate 5 mm (3/16 inch) diameter bolts.
4. Where mounted on floor, provide four equally spaced holes, sized to accommodate 5 mm (3/8 inch) diameter bolts, maximum 5 mm (3/8 inch) from edge of flange.

G. Back Plates:

1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, maximum 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
3. Provide spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on partitions.

2.4 CLOTHES HOOKS, ROBE OR COAT

- A. Fabricate hook units from chromium plated brass with satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to thickness of metal, or 3 mm (1/8 inch) minimum radius.
- B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to wall flange, provided with concealed fastenings.

2.5 METAL FRAMED MIRRORS

- A. Fed. Spec. A-A-3002 metal frame; stainless steel.
- B. Mirror Glass:
 1. Minimum 6 mm (1/4 inch) thick.
 2. Set mirror in a protective vinyl glazing tape.
- C. Frames:
 1. Channel or angle shaped section with face of frame minimum 9 mm (3/8 inch) wide. Fabricate with square corners.
 2. Metal Thickness 0.9 mm (0.035 inch).
 3. Filler:

- a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers contoured to conceal void between back of mirror and wall surface.
 - b. Fabricate fillers from same material and finish as mirror frame.
- D. Back Plate:
1. Fabricate backplate for concealed wall hanging from zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame.
 2. Provide set screw type theft resistant concealed fastening system for mounting mirrors.
- E. Mounting Bracket:
1. Designed to support mirror tight to wall.
 2. Designed to retain mirror with concealed set screw fastenings.
- F. ADA Accessible Mirror:
1. A high quality 1/4" polished float glass mirror with a stainless steel frame. Frame holds mirror in a tilted position for accessibility and compliance with ADA requirements. Mirror has a galvanized steel back secured to frame with concealed screws with integral horizontal hanging brackets.

2.6 DIAPER CHANGING TABLE:

- A. Wall mounted diaper changing table for use in public restrooms. Unit is a fold down system that folds upward when not in use for minimal intrusion into the room. Changing surface is contoured and has safety belt to ensure that an infant will not fall from the table. Table is designed to hold no less than 250 pounds static weight. Closed dimensions are approximately 21" H x 36" W x 5" D. Open dimensions vary according to style. One system's open dimensions are 15" high, 32" wide and 19" deep.

2.7 FABRICATION - GENERAL

- A. Welding, AWS D10.4.
- B. Grind, dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.

- G. Hot-dip galvanized steel or stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements.
- K. Round and deburr edges of sheets to remove sharp edges.

2.8 FINISH

- A. Stainless Steel: NAAMM AMP 500; No. 4 polished finish.
- B. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

2.9 ACCESSORIES

- A. Fasteners:
 - 1. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
 - 2. Concealed Fasteners:
 - a. High Moisture Areas: Stainless steel.
 - b. Other Locations: Steel, hot-dipped galvanized.
 - 3. Toggle Bolts: For use in hollow masonry or frame construction.
 - 4. Sex bolts: For through bolting on thin panels.
 - 5. Expansion Shields: Lead or plastic for solid masonry and concrete substrate as recommended by accessory manufacturer to suit application.
 - 6. Screws:
 - a. ASME B18.6.4.
 - b. Fed. Spec. FF-S-107, Stainless steel Type A.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 - 1. Verify blocking to support accessories is installed and located correctly.
- B. Verify location of accessories with Contracting Officer's Representative.
- C. Provide labor or prep as required for VA-furnished and contractor installed or VA-furnished and installed components.

3.2 INSTALLATION

- A. Install products according to manufacturer's instructions.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install grab bars according to ASTM F446.
- C. Set work accurately, in alignment and where indicated, parallel or perpendicular as required to line and plane of surface. Install accessories plumb, level, free of rack and twist.
- D. Toggle bolt to steel anchorage plates in frame partitions and hollow masonry. Expansion bolt to concrete or solid masonry.
- E. Install accessories to function as designed. Perform maintenance service without interference with performance of other devices.
- F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance.
- G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.

3.3 CLEANING

- A. After installation, clean toilet accessories according to manufacturer's instructions.

3.4 PROTECTION

- A. Protect accessories from damage until project completion.

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**SECTION 10 44 13
FIRE EXTINGUISHER CABINETS**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

A. Acrylic glazing: Section 08 80 00, GLAZING.

B. Field Painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Testing and Materials (ASTM):
D4802-15Poly (Methyl Methacrylate) Acrylic Plastic
Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

A. Recessed type with flat trim of size and design shown.

2.2 FABRICATION

A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.

B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.

1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.

2. Design doors to open 180 degrees.

3. Provide continuous hinge, pull handle, and adjustable roller catch.

4. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.

2.3 FINISH

A. Finish interior of cabinet body with baked-on semigloss white enamel.

- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

2.4 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

PART 3 - EXECUTION

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that the extinguisher height within meets the requirements of NFPA 10

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**SECTION 10 75 00
FLAGPOLES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Fixed high dimensional, ground set, uniform conical taper, seamless tube flag pole with light.

1.2 RELATED WORK

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete for Ground Set Flagpole.
- B. Division 26, ELECTRICAL: Power for light.
- C. Section 31 20 00, EARTHWORK: Excavation and Backfill.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
 - 7-16Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM):
 - A240/A240M-20Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - B209-14Aluminum and Aluminum-Alloy Sheet and Plate.
 - B209M-14Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - B241/B241M-16Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
 - C33/C33M-18Concrete Aggregates.
 - C920-18Elastomeric Joint Sealants.
- D. Master Painters Institute (MPI):
 - No. 35(2020)Bituminous Coating.
- E. National Architectural Metal Manufacturers (NAAMM):
 - AMP 500-06Metal Finishes Manual.
 - FP 1001-07Guide Specifications for Design of Metal Flagpoles.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Submittal Drawings:
 - 1. Show size and installation details for flagpole, base, and finial ball with light.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
- D. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Installer.
- E. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installed specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.
- B. Design flagpole assemblies complying with specified performance:
 - 1. Wind Loads: NAAMM FP 1001.

2.2 MATERIALS

- A. Aluminum, Extruded: ASTM B241/B241M, Alloy 6063 - T6.
- B. Aluminum, Plate and Sheet: ASTM B209, Alloy 1100.
- C. Stainless Steel: ASTM A240/A240M, Type 304.

2.3 FABRICATION

- A. Fabricate flagpole of seamless extruded aluminum tube, uniform conical taper of approximately 1 in 70 (1 inch in every 72 inches).
 - 1. Maximum Taper: 50 percent of flagpole outside base diameter.
 - 2. Sectional Flagpoles: Provide self-aligning sleeves for field joint.
 - 3. Provide one (1) 35-ft pole and two (2) 30-ft poles.

- B. Base: Aluminum plate, of stock design as indicated on drawings.
- C. Halyards: Two sets of 8 mm (5/16 inch) diameter, nylon braided rope with minimum two bronze swivel snaps for each halyard.
- D. Cleats: Two aluminum cleats minimum 225 mm (9 inches) long. Secure cleats to pole with two 9 mm (3/8 inch) flat head aluminum machine screws.
- E. Foundation Sleeve: Galvanized, corrugated steel, length as indicated on drawings, welded to steel base plate.
 - 1. Weld lightning ground rod of 19 mm (3/4 inch) diameter galvanized steel to base plate at bottom of sleeve.
- F. Flashing Collar: Material and finish to match flagpole.
- G. Finial Ball with Light:
 - 1. Basis of Design: Concord American Flagpole, Internal Halyard Cam Cleat Beacon, Rope Halyard - Cam Cleat System; Architect approval.
 - 2. 8" diameter ball.
 - 3. Internal halyard; accepts up to 5/16" rope halyard.
 - 4. Cam cleat.
 - 5. 359 degree rotating truck.
 - 6. 12v hardwired.
 - 7. Standard 1-1/4" NPT Spindle.
 - 8. Warm White, 3000K LED lights rated for 25,000+ hours

2.4 FINISHES

- A. Finish flagpole exposed surfaces.
- B. Stainless Steel: NAAMM AMP 500; No. 4 polished finish.
- C. Aluminum Anodized Finish: NAAMM AMP 500.
 - 1. Clear Anodized Finish: AA-C22A41 ; Class I Architectural, 0.018 mm (0.7 mil) thick.
- D. Flagpole Shaft: Clear anodized aluminum finish, then heavily waxed.
- E. Finial Ball with Light: Silver anodized aluminum, satin finish.
- F. Base and Cleats: Finish to match flagpole.

2.5 ACCESSORIES

- A. Sand: ASTM C33/C33M.
- B. Sealant: ASTM C920, elastomeric type recommended by flagpole manufacturer.
- C. Bituminous Paint: MPI No. 35.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.

- B. Excavate flagpole foundations as specified in Section 31 20 00, EARTHWORK.
- C. Provide foundation tube for installation as work of Section 03 30 00, CAST-IN-PLACE CONCRETE for installation in flagpole footing.
- D. Place concrete as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

3.2 INSTALLATION

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Coat flagpole section within foundation sleeve with bituminous paint.
- C. Install flagpoles centered in foundation sleeve.
- D. Fill space between pole and metal sleeve to within 50 mm (2 inches) of top with sand and compact.
- E. Fill remainder of space with sealant and install flashing collar as indicated on drawings.

- - E N D - -

SECTION 12 24 00
WINDOW SHADES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes cloth shades. Provide window shades complete, including brackets, fittings and hardware.

1.2 RELATED WORK:

- A. Color of shade cloth: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Lightproof Shades: Section 12 24 21, LIGHTPROOF SHADES.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualification: Has a minimum of three (3) years' experience in providing item of type specified, and that the blinds have performed satisfactorily on similar installations.
- B. Installers who are trained and approved by manufacturer for installation of units provided.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Shade cloth, each type, 610 mm (24 inch) square, including cord and ring, showing color, finish and texture.
- C. Manufacturer's literature and data; showing details of construction and hardware for:
 - Cloth and window shades
- D. Shop Drawings: Provide fabrication and installation details for cloth shades, including shade cloth materials, their orientation to rollers, and their seam and batten locations.
 - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- E. Fire Testing: Submit report of flame spread and smoke developed during product material tests by independent testing laboratory.
- F. Manufacturer's warranty.

1.5 WARRANTY:

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their window shades for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer's warranty.

1.6 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - AA-V-00200BVenetian Blinds, Shade, Roller, Window, Roller, Slat, Cord, and Accessories
- C. ASTM International (ASTM):
 - A240/A240M-14Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - B221-14Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - B221M-13Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)
 - G21-13Determining Resistance of Synthetic Polymeric Materials to Fungi
- D. National Electric Manufacturer's Association (NEMA):
 - ICS 6-93(R2006)Industrial Control and Systems Closures
- E. National Fire Protection Association (NFPA):
 - 70-14National Electrical Code (NEC)
 - 701-15Fire Tests for Flame Propagation of Textiles and Films
- F. Underwriters Laboratories Inc. (UL):
 - 325-06(R2013)Door, Drapery, Gate, Louver, and Window Operators and Systems

PART 2 - PRODUCTS

2.1 CLOTH SHADES (WT-1, WT-2, AND WT-2A):

- A. Light-Filtering Shade Cloth: Woven fabric, stain and fade resistant.
 - 1. Types:
 - a. WT-1 and WT-2: Clutch shade with bead loop.
 - b. WT-2A: Motorized.
 - 2. Weave: Basketweave.
 - 3. Thickness: 0.026 inches.
 - 4. Weight: 14.70 ounces per square yard.
 - 5. Orientation on Shadeband: Up the boltRailroaded.
 - 6. Openness Factor: 1 percent.

7. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Submit report for testing of shade cloth materials identical to products provided.
8. Rollers: Extruded aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of fabric panels indicated without deflection. Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
9. Drive-End Location: Right side of inside face of shade.
10. Shade Cloth Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi AATCC 30 Part III.
11. Fascia: Extruded aluminum; L-shaped; manufacturer's standard height required to conceal roller and fabric panel when shade is fully open, but not less than 3 inches; with endcap covers. Provide only at locations shown on drawings.
12. Motorized Operating System (WT-2A): Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated on construction documents, 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 for motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - a. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency and marked for intended location and application.
 - b. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 - 1) Electrical Characteristics: Single phase, 110 V, 60 Hz.
 - c. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for surface mounting. Provide the following for control activation of shades:
 - 1) Wall mounted controls: switches that are able to electronically set and reconfigure shade open and close limits and system groups at the control without rewiring and without access to the Electronic Drive Unit.

- 2) Provide switches that are adjustable and interlocked with motor controls and set to automatically stop the shade at fully raised and fully lowered positions. Provide low voltage switching.
 - 3) Operating Function: Stop and hold shade at any position.
 - 4) Provide the following options: Group switching with integrated switch control; single face plate for multiple switch cut-outs.
- d. Provide tension idler cable kit for motorized shades exceeding the acceptable width-to-height ratio.

2.2 MATERIALS:

- A. Stainless Steel: ASTM A240/A240M.
- B. Extruded Aluminum: ASTM B221M (B221).
- C. Cords for Cloth roller shades: Metal bead chain.

2.3 FASTENINGS:

- A. Zinc-coated or cadmium plated steel or stainless steel fastenings of length and type recommended by manufacturer. Except as otherwise specified, provide fastenings for installation with various structural materials as follows:

Type of Fastening	Structural Material
Wood screw	Wood
Tap screw	Metal
Case-hardened, self-tapping screw in pre-drilled hole	Solid masonry, concrete
Screw or bolt in expansion shields	Solid masonry, concrete
Toggle bolts	Hollow blocks, gypsum wallboard, plaster

2.4 FABRICATION:

- A. Fabricate cloth shades to fit measurements of finished openings obtained at site.
- B. Cloth Shades: Rolling type, constructed of shade cloth mounted on rollers. Provide shade cloth with plain sides, and with hem at bottom to accommodate weight bar.
 - 1. Provide separate shades for each individual sash within opening or as shown on drawings. Provide shade length that exceeds height of

window by 305 mm (12 inches) measured from head to sill, in addition to material required to make-up hem:

- a. Provide rollers with spindles, nylon bearings, tempered steel springs, and other related accessories required for positive action.
- b. Provide rollers of diameter and wall thicknesses required to accommodate operating mechanisms, weights, and widths of shadebands indicated without deflection.
- c. Provide rollers with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
- d. Secure shade cloth to rollers to prevent wrinkling or folding, and on line parallel to axis of rollers so that shade hangs plumb.
- e. Secure shade cloth with zinc-coated steel or stainless steel machine screws spaced not over 228 mm (9 inches) on centers.
- f. Do not attach shade cloth to rollers with tacks.
- g. Provide enclosed hem bar of extruded aluminum for entire width of shade band. Heat seal hem bar on all sides to prevent removal.
- h. Provide eyelets with clear openings large enough to accommodate cords, without cutting into cloth when set.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Measure openings before fabrication. Do not scale construction documents.
- B. Cloth Shades: Mount window shades on end of face brackets, set on metal gussets, or casing of windows as required. Provide extension face brackets where necessary at mullions.
 1. Locate rollers in level position as high as practicable at heads of windows.
 2. Install shades to prevent infiltration of light over rollers.
 3. Where extension brackets are necessary for alignment of shades, provide metal lugs, and rigidly anchor lugs and brackets.
 4. Place brackets and rollers so that shades do not interfere with window and screen hardware.
5. Electrical Connections: Connect motor-operated shade cloth roller shades to building electrical system.

6. Shade installation methods not specifically described, are subject to approval of Contracting Officer Representative (COR).

3.2 ADJUSTING:

- A. Adjust and shades to operate smoothly, free from binding or malfunction throughout entire operational range.

3.3 CLEANING AND PROTECTION:

- A. Clean shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions that ensure that shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged shades that cannot be repaired, in a manner approved by COR before time of Substantial Completion.

3.4 DEMONSTRATION:

- A. Furnish services of factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain motorized shade operation systems.

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**SECTION 13 47 15
BULLET-RESISTANT PRODUCTS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Bullet-resistant products of the following types:
 - 1. Aluminum windows.
 - 2. Composite panels.

1.2 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing.
- B. Section 05 50 00 - Metal Fabrications.
- C. Section 06 10 00 - Rough Carpentry.
- D. Section 08 71 00 - Door Hardware.
- E. Section 09 90 00 - Painting.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute (ANSI):
 - ANSI Z97.1Safety Glazing Materials Used in Buildings -
Safety Performance Specifications and Methods
of Test.
- C. ASTM International (ASTM):
 - ASTM C920Standard Specification for Elastomeric Joint
Sealants.
 - ASTM C1036Standard Specification for Flat Glass.
 - ASTM C1172Standard Specification for Laminated
Architectural Flat Glass.
 - ASTM C1349Standard Specification for Architectural Flat
Glass Clad Polycarbonate.
 - ASTM D2000Standard Classification System for Rubber
Products in Automotive Applications.
 - ASTM E84Test method for the Surface Burning
Characteristics of Building Materials.
 - ASTM E119Standard Test Methods for Fire Tests of
Building Construction and Materials.
- D. American Welding Society (AWS):
 - AWS D1.1Structural Welding Code - Steel.
- E. National Institute of Justice (NIJ):
 - NIJ Standard 0108.01 ...Standard for Ballistic Resistant Protective
Materials.
- F. Underwriters Laboratories (UL):

UL 752Standard for Bullet Resisting Equipment.
(September 5th, 2005)

UL 972Standard for Burglary Resisting Glazing
Material.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
 - 1. Manufacturer's data sheets on each product to be used.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Shop Drawings:
 - 1. Submit shop drawings prepared by the manufacturer showing plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes.
 - 2. Include dimensioned elevation of each type opening assembly in project; indicate sizes and locations of hardware, and lites if specified.
 - 3. Schedule: Indicate each opening assembly in project; cross-referenced to plans, elevations, and details.
- D. Design Data: Bullet resistance analysis design calculations for specific project conditions, certifying system conformance to specified performance requirements.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.
- F. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- G. Closeout submittals: Warranty documents, issued and executed by manufacturer of systems, countersigned by Contractor.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified with a minimum documented experience of five years.
- B. Installer Qualifications: Company specializing in installation of products specified with minimum three years documented experience.

- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship is approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.
 - 4. Accepted mock-ups shall be comparison standard for remaining Work
- D. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.
- E. Coordination of Work: Coordinate layout and installation of components with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.
- F. Coordination: Bullet-resistant protection shall be provided in the sizes and in the configuration indicated on the Drawings. Furnish hardware necessary for the joining of the components specified. Provide components complete with adhesives, fasteners, and other devices required for complete assembly.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's unopened, undamaged packaging, with manufacturer's labels intact.
- B. Remove wraps or covers from doors and frames upon delivery at the building site. Clean and touch-up scratches or disfigurement caused by shipping or handling promptly.
- C. Store products in manufacturer's unopened packaging until ready for installation. Store assemblies, off the ground and on end, to prevent damage to face corners and edges. Store assemblies covered to protect them from damage but permitting air circulation.

1.7 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Standard Warranty: 5 years from date of manufacture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Total Security Solutions; 935 Garden Ln., Fowlerville, MI 48836; Tel: 866-304-5070; Fax: 517-223-0805; Web: https://www.tssbulletproof.com/?utm_source=arcat&utm_medium=referral&utm_campaign=digital-outbound. Architect approval required.

2.2 BULLET-RESISTANT ALUMINUM WINDOWS

- A. Fixed Aluminum Windows: Total Security Solutions Model preassembled design.
 - 1. Frame Design: Fixed frame design.
 - 2. Window Size: See Window Types 15A and 15B.
 - 3. Overall Size and Configuration: As indicated on the Drawings.
 - 4. Adjustable Split Frame: Anodized 6063-T6 extruded aluminum with internal bullet-resistant composite as required for protection level specified. Provide with matching 1 inch by 1 inch (25 mm by 25 mm) removable glazing stop.
 - a. Frame to conform to UL 752 of the following protection level.
 - 1) Protection Level: 3. Plus .30 caliber and .44 mag.

2.3 BULLET-RESISTANT COMPOSITE PANELS

- A. Composite Panels: Total Security Solutions, Total Armor Bullet Protection Composite Panels or equal. FRP composite panel manufactured using multiple layers of starch-oil woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets.
 - 1. Composite panels shall be of the "non ricochet type" intended to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.
 - 2. Material will meet ASTM E119 one hour fire resistance when installed in a non-bearing steel stud wall with 5/8 inch firecode gypsum on the exterior and with 5/8 inch (16 mm) firecode gypsum over the FRP panel on the inside.
 - 3. Panels conforming to UL 752 Rating level as follows:
 - a. UL Level 3: Total Armor BB-3. Nominal panel thickness of 1/2".

4. Panels conforming to National Institute of Justice (N.I.J) 0108.01 Threat Level Rating as follows:

- a. N.I.J Level III-A: Total Armor BB-3. Nominal panel thickness of 1/2".

2.4 FABRICATION

- A. Welds in accordance with requirements and standard practices of the American Welding Society. Exposed welds shall be ground flush and finished smooth.
- B. Joints and connections shall be tight, providing hairline joints and true alignment of adjacent members.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until openings and installing surfaces have been properly prepared.
 - 1. Verify openings are in accordance with approved shop drawings.
 - 2. Verify that supports have been installed in accordance with the Drawings.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install products in accordance with approved submittals, manufacturer's instructions and requirements of UL 752.
 - 1. Install equipment plumb, level, rigid and in true alignment.
 - 2. Use proper anchoring devices. Exposed anchor holes shall be used for anchors.
 - 3. Install hardware as required for a complete installation.
 - 4. Where applicable, install fire-rated assemblies in accordance with NFPA 80.
 - 5. Adjust operating parts for proper operation, non-binding.
- B. Bullet-Resistant Fiberglass Panels: Install using an industrial adhesive, mastic, screws or bolts. Method of application shall maintain the bullet resistive rating at junctures with the concrete floor slab,

concrete roof slab, bullet resistive door frames, bullet resistive window frames, and required penetrations.

1. Joints shall be reinforced by a back-up layer of bullet resistive material.
2. Bullet resistance of the joint, as reinforced, shall be at least equal to that of the panel.
3. Minimum width of reinforcing layer at joint shall be 4 inches (2 inches on each panel or a 2 inch minimum overlap).

C. Installation Tolerances: Do not exceed the following installation tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm) measured on a line, 90 degrees from one jamb, at the upper corner of the frame at the other jamb.
2. Alignment: Plus or minus 1/16 inch (1.6 mm) measured on jambs on a horizontal line parallel to the plane of the wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm) measured at face corners of jambs on parallel lines perpendicular to the plane of the wall.
4. Plumb: Plus or minus 1/16 inch (1.6 mm) measured on the jamb at the floor.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

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