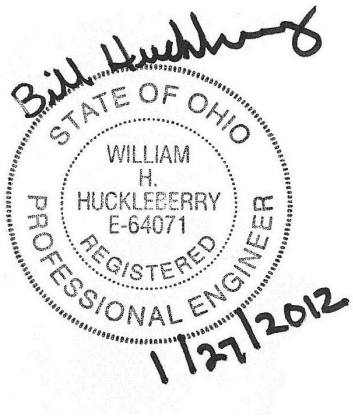
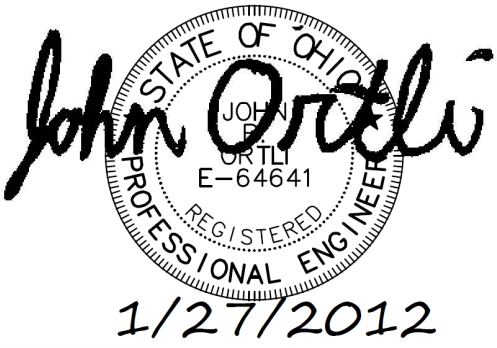
SPECIFICATIONS FOR
LOUIS A. JOHNSON VAMC
VILLAS FOR RESIDENT REHABILITATION/TREATMENT PROGRAM
PHASE 1, COMMUNITY BUILDING

VOLUME 1 OF 2





January 27, 2012
Project No. 14577400

URS Group Inc.
Architects Engineers Planners

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SECTION 00 01 01

PROJECT TITLE PAGE

Title and location of Work:

Louis A. Johnson VA Medical Center
Department of Veterans Affairs Medical Center
1 Medical Center Drive
Contracting Office (90C)
Clarksburg, WV 26301 - 4199

Name and address of Owner:

Louis A. Johnson VA Medical Center
Department of Veterans Affairs Medical Center
1 Medical Center Drive
Contracting Office (90C)
Clarksburg, WV 26301 - 4199

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- - - END - - -

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- - - END - - -

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GEOTECHNICAL DATA

PART 1 GENERAL

1.1 GEOTECHNICAL DATA AND DISCLAIMER

A. The following Geotechnical Engineering Report was prepared for the Owner by H. C. Nutting, A Terracon Consultants, Inc. Co., Charleston WV, for use in design. It is attached for informational purposes only. Such report and logs are not a part of the Contract Documents and are not to be relied upon as a complete representation of all possible soil conditions. The Geotechnical Engineer Report is not approved by nor guaranteed in any manner by the Owner or Engineer. Use of the information is totally at the risk of the Contractor. Additional soils information, if needed by any Contractor, shall be obtained by the Contractor at no cost to the Owner.

- - - E N D - - -

Geotechnical Engineering Report

Villas for Residential Rehab
Clarksburg, West Virginia
March 17, 2011
Terracon Project No. N2115002

Prepared for:
URS Group, Inc.
Columbus, Ohio

Prepared by:
H.C. Nutting
A Terracon Consultants, Inc. Company
Charleston, West Virginia

Offices Nationwide
Employee-Owned
Established in 1965
terracon.com

Terracon

Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

March 17, 2011

URS Group, Inc.
277 West Nationwide Boulevard
Columbus, OH 43215-2566

Attention: Mr. Nicholas Nash, AIA
Senior Project Manager
PHN: [614] 464 4500

Regarding: Geotechnical Engineering Report
Villas for Resident Rehabilitation
Clarksburg, West Virginia
Terracon Project No. N2115002

Dear Mr. Nash:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design of foundations for the proposed buildings.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

YOGESH S. REGE REGISTERED 16606 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Yogesh S. Rege, P.E.
Senior Associate
Geotechnical Department Manager

John R. Barclay, P.G.
Project Geologist

Enclosures
cc: 3 - Above
cc: 1 - File

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EXECUTIVE SUMMARY

A geotechnical engineering report has been completed for the proposed Villas for Resident Rehabilitation project to be located at the VA Hospital campus in Clarksburg, West Virginia. Nine (9) borings, designated B-1 through B-6 and P-1 through P-3, were performed to depths of approximately 11½ to 21½ feet below the existing ground surface within the proposed building and pavement areas.

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed structures. The following geotechnical considerations have been identified:

- Three new buildings consisting of two 2-story villas and a 1- and 2- story community center are being proposed at the site. The site is currently occupied by buildings, paved areas and a helipad. The existing buildings and paved areas will be removed to create space for the proposed new buildings.

- Assuming proper site preparation and any necessary subgrade repair, total and differential settlement should be within anticipated client/owner specifications.

- The natural soils immediately below the topsoil layer indicated soft to medium stiff consistency at some of the boring locations. These soils are anticipated to require repair during site grading operations prior to placement of new fill or aggregate base for floor slab construction.

- On-site soils appear suitable for use as compacted structural fill; however, if they do not meet the low plasticity fill criteria, they should not be placed within 24 inches of the finished grade beneath at-grade building areas.

- The east side of the community center will be located near an existing slope. Similarly, the south and east sides of Resident Villa 2 building will be located near an existing slope as well. Any future instability or movement of these slopes could create adverse effects for the proposed buildings or vice-versa the construction of the proposed buildings in this area may create slope stability problems in the future. Remediation measures could include construction of drilled pier walls on top of the slopes, between the buildings and the slopes, to reduce effects of future slope movement from affecting the proposed buildings. Additional drilling with rock coring, laboratory testing and geotechnical analyses would be required to develop recommendations for the remediation measures.

- The 2009 International Building Code (IBC), Table 1613.5.2 seismic site classification for this site is C.

- Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that the Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
VILLAS FOR RESIDENT REHABILITATION
CLARKSBURG, WEST VIRGINIA

Terracon Project No. N2115002

March 17, 2011

1.0 INTRODUCTION

A geotechnical engineering report has been completed for the proposed Villas for Resident Rehabilitation project to be located at the VA Hospital campus in Clarksburg, West Virginia. Nine (9) borings, designated B-1 through B-6 and P-1 through P-3, were performed to depths of approximately 11½ to 21½ feet below the existing ground surface within the proposed building and pavement areas. Logs of the borings along with a site location plan, and boring location plans are included in Appendix A of this report.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- pavement recommendations
- foundation design and construction
- floor slab design and construction
- seismic considerations

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	See Appendix A, Exhibits A-2 and A-3: Boring Location Plans
Proposed Structures and Associated Infrastructure	The project will include construction of three buildings: Resident Villa 1 - 2 story structure, slab on grade with no basement with a building footprint of 2,600 square feet. Resident Villa 2 - 2 story structure, slab on grade with no basement with a building footprint of 2,600 square feet. Community Center - 2 story structure for half of the building, 1 story for the other half, slab on grade with no basement with a building footprint of 10,280 square feet. In addition to the proposed buildings, we understand that new parking areas and relocated fire lane will also be constructed.

ITEM	DESCRIPTION
Building construction	Light framed wood construction with interior and exterior load bearing walls.
Finished floor elevations (FFE)	Resident Villa 1 - 1001.00 feet. Resident Villa 2 - 1000.50 feet. Community Center - 1001.50 feet.
Maximum loads	Max Wall Load = 2 to 2.5 kips/foot Max Column Loads = 20 to 25 kips
Maximum allowable settlement	Columns: 1 inch (assumed) Walls: ¾ inch over 40 feet (assumed)
Grading	Less than 2 feet of cut/fill

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	Existing Veterans Administration campus in Clarksburg, West Virginia.
Existing improvements	The site is currently occupied by three buildings and a helipad with many underground utilities.
Current ground cover	Grass,asphalt pavement and concrete walkways
Existing topography	Relatively flat in the area of the proposed buildings with ground surface elevations varying from about 998 to 1001 feet. The area immediately to the east of the community center building slopes at about 2H:1V inclination for a height of about 10 feet. The area immediately to the south and east of the Resident Villa 2 slope at about 3H:1V inclination for a height of about 10 feet.

3.0 SUBSURFACE CONDITIONS

3.1 Geology

According to the West Virginia Geological and Economic Survey Map of Harrison County, the bedrock underlying the project site belongs to the Conemaugh Group. The Conemaugh Group is subdivided into the Glenshaw and Casselman formations. The basal formation contact is conformable with the subjacent Allegheny Formation. An unconformity spanning part of the Late Pennsylvanian is present between the Mahoning and Brush Creek coals beds. The upper formation contact is conformable with the overlying Monongahela Formation. The lower part of the Conemaugh Group is assigned to the Glenshaw Formation. The Glenshaw consists of

terrestrial red beds, sandstones and coal beds with marine units. The most widespread marine units are the Brush Creek and Ames marine zones, both of which occur across West Virginia. The top of the Ames is used as the contact between the Glenshaw and the Casselman. The Casselman Formation consists of red beds, sandstones, and coal beds deposited in terrestrial settings. Mined coal beds in the Conemaugh are the Brush Creek, Bakerstown, Harlem and Elk Lick.

The West Virginia Geological and Economic Survey (WVGES) was contacted with regard to historical underground mapping in the area. According to survey personnel, they had no record of underground mining in the project site. There is evidence, however, of surface and deep mining in the Pittsburgh Coal seam within the hillside above the site to the southeast of the nearby bridge location. The elevation of the Pittsburgh seam is approximately 1140 feet at this location.

3.2 Typical Profile

Based on the results of the borings, subsurface conditions at the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Relative Density / Hardness
Surface	0.5 feet in Borings B-1 through B-6, P-1 and P-2	Topsoil	N/A
Surface	0.8 feet in Boring P-3	Asphalt pavement underlain by aggregate base	N/A
1	2.5 to 7.5 feet in Borings B-1 through B-6, P-2 and P-3 Undetermined in Boring P-1, Boring P-1 completed at 11.5 feet within this stratum	Lean clay and sandy lean clay	Medium stiff to very stiff
2	17.5 feet to 20 feet in Borings B-1 through B-6, P-2 and P-3	Silty sand and silty clayey sand	Loose to medium dense
3	Undetermined: Borings B-1 through B-6 completed within this stratum.	Claystone	Soft

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report.

3.3 Groundwater

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was observed at the following elevations in the borings:

Boring	Depth of groundwater while drilling (feet)
B-1	N/E
B-2	18
B-3	18
B-4	N/E
B-5	15
B-6	17
P-1	N/E
P-2	N/E
P-3	N/E

The groundwater level readings shown above do not necessarily mean that a stable groundwater level was observed in the borings. Due to the low permeability of some of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole. However, these borings were backfilled immediately after completion of drilling. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. In addition, perched water can develop over low permeability soil and rock strata. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Three new buildings consisting of two 2-story villas and a 1- and 2- story community center are being proposed at the site. The site is currently occupied by buildings, paved areas and a helipad. The existing buildings and paved areas will be removed to create space for the proposed new buildings.

Assuming proper site preparation and any necessary subgrade repair, total and differential settlement should be within anticipated client/owner specifications.

The natural soils immediately below the topsoil layer indicated soft to medium stiff consistency at some of the boring locations. These soils are anticipated to require repair during site grading operations prior to placement of new fill or aggregate base for floor slab construction.

On-site soils appear suitable for use as compacted structural fill; however, if they do not meet the low plasticity fill criteria, they should not be placed within 24 inches of the finished grade beneath at-grade building areas.

The east side of the community center will be located near an existing slope. Similarly, the south and east sides of Resident Villa 2 building will be located near an existing slope as well. Any future instability or movement of these slopes could create adverse effects for the proposed buildings or vice-versa the construction of the proposed buildings in this area may create slope stability problems both during and after construction. Remediation measures could include construction of drilled pier walls on top of the slopes, between the buildings and the slopes, to reduce effects of future slope movement from affecting the proposed buildings. Additional drilling with rock coring, laboratory testing and geotechnical analyses would be required to develop recommendations for the remediation measures.

Geotechnical design and construction recommendations concerning earthwork, pavements and foundations for the proposed buildings are presented in the following paragraphs.

4.2 Earthwork

4.2.1 Site Preparation

Site preparation should commence with stripping of all topsoil, asphalt, concrete, gravel base stone, and unsuitable materials (e.g. debris, desiccated soil, frozen soil, etc.) from below the proposed building and pavement areas and other areas that will receive fill or support proposed improvements. Foundations, slabs, underground utilities, etc. associated with the existing buildings should be removed from within the proposed building, pavement or other development

areas. Excavations should be backfilled with structural fill. The actual removal depths will vary and should be evaluated by a Terracon representative during construction.

Due to the soft to medium stiff consistency, the upper soils may be unstable upon initial exposure. As a result, these soils are likely to be prone to rutting, shoving, and pumping if wetted, and unstable subgrade conditions could be expected to develop during general construction operations under existing moisture conditions. Unstable subgrade conditions could be exacerbated if the soils are wetted and/or subjected to repetitive construction traffic. Because of this, bid documents should address the possibility for soil stabilization and the contractor should be prepared to handle potentially wet, soft subgrade conditions.

If required, the appropriate method of improvement, described below, would be dependent on factors such as schedule, weather, the size of area to be stabilized, and the nature of the instability. More detailed recommendations can be provided during construction as the need for subgrade stabilization occurs. Performing site grading operations during warm seasons and dry periods would help reduce the amount of subgrade stabilization required.

If the exposed subgrade is unstable during proofrolling operations, it could be stabilized using one of the methods outlined below.

- **Scarification and Recompaction** - It may be feasible to scarify, dry, and recompact the exposed soils. The success of this procedure would depend primarily upon favorable weather and sufficient time to dry the soils. Stable subgrades likely would not be achievable if the thickness of the unstable soil is greater than about 1 foot, or if construction is performed during a period of wet or cool weather when drying is difficult.

- **Crushed Stone** - The use of crushed stone or crushed gravel is the most common procedure to improve subgrade stability. Typical undercut depths would be expected to range from about 12 to 24 inches below subgrade elevation. The use of high modulus geotextiles (i.e., engineering fabric or geogrid) could also be considered after underground work, such as utility construction, is completed. Prior to placing the fabric or geogrid, we recommend that all below grade construction, such as utility line installation, be completed to avoid damaging the fabric or geogrid. Equipment should not be operated above the fabric or geogrid until one full lift of crushed stone fill is placed above it.

  The maximum particle size of granular material placed over geotextile fabric or geogrid should not exceed 1-1/2 inches. It is also our experience that a clean crushed limestone placed over a geotextile fabric performs well when wet conditions from groundwater or rainfall are anticipated.

- **Chemical Stabilization** - Improvement of subgrades with cement, quicklime, or class C fly ash could be considered for improving unstable soils. Chemical modification should be

performed by a pre-qualified contractor having experience with successfully stabilizing subgrades in the project area on similar sized projects with similar soil conditions. Results of chemical analysis of the additive materials should be provided to the geotechnical engineer prior to use. The hazards of chemicals blowing across the site or onto adjacent property should also be considered. Additional testing would be needed to develop specific recommendations to improve subgrade stability by blending chemicals with the site soils. Additional testing could include, but not be limited to, determining the most suitable stabilizing agent, the optimum amounts required, and freeze-thaw durability of the subgrade.

Further evaluation of the need and recommendations for subgrade stabilization can be provided during construction as the geotechnical conditions are exposed.

4.2.2 Material Requirements

Compacted structural fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Lean clay	CL (LL<40)	All locations and elevations
Lean to fat clay	CL/CH (40<LL<50)	> 24 inches below building finished grade
Well graded granular	GM [2]	All locations and elevations
On-site soils	CL (LL<40)	All locations and elevations

1. Compacted structural fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Terracon for evaluation.
2. Similar to crushed limestone aggregate. If frost heave is not a concern, crushed limestone aggregate, limestone screenings or granular material such as sand, gravel or crushed stone containing at least 18% low plasticity fines may also be used. Material should be approved by the geotechnical engineer.

4.2.3 Compaction Requirements

ITEM	DESCRIPTION
Fill Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Compaction Requirements [1]	98% of the material's maximum dry density value as determined by ASTM Standard Test Method D 698 (Cohesive Soil) 75% of material's maximum relative density value per ASTM Standard Test Methods D 4253 and D 4254 or 98% of the material's maximum dry density value as determined by ASTM Standard Test Method D 698 (Granular Material)

ITEM	DESCRIPTION
Moisture Content – Cohesive Soil	Within the range of 2 percent below optimum moisture content to 3% above optimum moisture content as determined by the standard Proctor test at the time of placement and compaction
Moisture Content – Granular Material	Workable moisture levels [2]

1. We recommend that compacted structural fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

4.2.4 Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. If utility trenches are backfilled with relatively clean granular material, they should be capped with at least 18 inches of low plasticity cohesive fill in non-pavement areas to reduce the infiltration and conveyance of surface water through the trench backfill.

Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building. We recommend constructing an effective clay “trench plug” that extends at least 5 feet out from the face of the building exterior. The plug material should consist of low plasticity clay compacted at a water content at or above the soil’s optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report.

4.2.5 Grading and Drainage

Final surrounding grades should be sloped away from the structures on all sides to prevent ponding of water. Gutters and downspouts that drain water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots.

4.2.6 Construction Considerations

Due to the soft to medium stiff consistency of the upper soils, it is possible that the subgrade will be unstable upon initial exposure. Unstable subgrade conditions could worsen during general construction operations, particularly if the soils are wetted and/or subjected to repetitive

construction traffic. The use of light construction equipment would aid in reducing subgrade disturbance. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance. Should unstable subgrade conditions develop, stabilization measures will need to be employed as described in section **4.2.1 Site Preparation**.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of foundations. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to foundation construction.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

4.3 Foundations

In our opinion, the proposed buildings can be supported by shallow, spread footing foundations bearing on the native stiff clay or medium dense sand or on newly placed compacted structural fill. Design recommendations for shallow foundations are presented in the following tables and paragraphs.

4.3.1 Shallow Footing Design Recommendations

DESCRIPTION	Column	Wall
Net allowable bearing pressure [1]	2,000 psf	2,000 psf
Minimum dimensions	30 inches	18 inches
Minimum embedment below finished grade for frost protection [2]	36 inches	36 inches

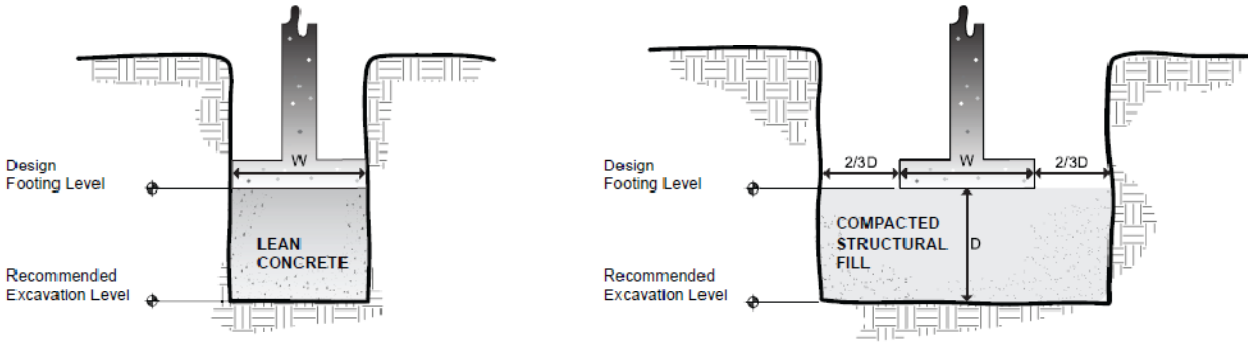
DESCRIPTION	Column	Wall
Approximate total settlement from foundation loads [3]	<1 inch	<1 inch
Estimated differential settlement from foundation loads [3]	<¾ inch between columns	<¾ inch over 40 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable material or soft/medium stiff/loose soils, if encountered, will be undercut and replaced with compacted structural fill or lean concrete backfill.
2. This will also reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas.
3. The above settlement estimates from foundation loads have assumed that the maximum footing size is 5 feet for column footings and 2 feet for continuous footings.

4.3.2 Shallow Footing Construction Considerations

The base of all foundation excavations should be free of water and loose/soft/medium stiff soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, or frozen, the affected soil should be removed prior to placing concrete. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open over night or for an extended period of time. It is recommended that the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

If unsuitable bearing soils are encountered in footing excavations, the excavation could be extended deeper to suitable soils and the footing could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. As an alternative, the footings could also bear on properly compacted structural backfill extending down to the suitable soils. Overexcavation for compacted structural fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with well graded granular material placed in lifts of 9 inches or less in loose thickness (6 inches or less if using hand-guided compaction equipment) and compacted to at least 98 percent of the material's standard effort maximum dry density (ASTM D 698). The overexcavation and backfill procedure is described in the following figure.



NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

4.4 Seismic Considerations

Code Used	Site Classification
2009 International Building Code (IBC) [1]	C [2]

1. In general accordance with the *2009 International Building Code,* Table 1613.5.2.
2. The 2009 International Building Code requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope requested does not include the required 100 foot soil profile determination. Borings for this report extended to a maximum depth of approximately 21½ feet and this seismic site class assignment considers that bedrock continues below the maximum depth of the subsurface exploration. Additional exploration to greater depths could be considered to confirm the conditions below the current depth of exploration. Alternatively, a geophysical exploration could be utilized in order to confirm the seismic site class.

4.5 Floor Slab

4.5.1 Floor Slab Design Recommendations

ITEM	DESCRIPTION
Floor slab support	Per recommendations provided in Section 4.2.1
Modulus of subgrade reaction	100 pounds per square inch per inch (psi/in) for point loading conditions
Aggregate base course/capillary break [2]	6 inches of free draining granular material

1. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movement between the slab and foundation. We recommend subgrades be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompacted. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density until construction of the building floor slabs.
2. The floor slab design should include a capillary break, comprised of free-draining, compacted,

granular material, at least 6 inches thick and can be considered as part of the low volume change zone. Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or any cracks that develop should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

4.5.2 Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the floor slab subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of free draining granular material or concrete and corrective action may be required.

We recommend that once the area underlying the floor slab has been rough graded, it be thoroughly proofrolled with a loaded tandem axle dump truck prior to final grading and placement of aggregate base. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the aggregate base and concrete.

4.6 Pavements

We understand that the proposed relocated fire access lane has been designed as a grass paver system which will be comprised of geogrid, aggregate base, and the grass paver modules. The section design is based upon a CBR value of 2. In the following paragraphs we have provided recommendations for an alternative asphalt paving section for the fire access drive in the event the VA does not want to utilize the grass paver system. We understand that the traffic on the fire access lane will be comprised of 1 fire truck per month over a 20 year

design life. We understand that the Average Daily Traffic (ADT) will be about 20 cars over a 10 year design life for the light-duty pavement areas.

4.6.1 Subgrade Preparation

On most project sites, the site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to improve trafficability temporarily. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the top 9 inches of the subgrade be evaluated and the pavement subgrades be proofrolled within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in section **4.2 Earthwork** to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

4.6.2 Design Considerations

Based on provided traffic loading information, we have developed two pavement sections. The light duty section is for areas that receive only car traffic. The other section is for the fire access lane. A design life of 10 years was assumed for the light-duty section and 20 years for the fire access lane section. A California Bearing Ratio (CBR) value of 2 has been estimated for the low plasticity cohesive natural soils at this site. Laboratory/field CBR testing should be considered to confirm this CBR value. To help obtain this CBR value in the field, the upper 12 inches of pavement subgrades should be compacted to at least 98 percent of the standard Proctor density at moisture content within -2 to +3 percent of its optimum moisture.

Climatic conditions are considered in the design subgrade support value listed above and in the paving material characteristics.

4.6.3 Design Recommendations

MATERIAL	Asphalt Thickness (inches)	
	Light Duty Section (Cars Only)	Fire Access Lane
Asphalt Surface	1½	1½
Asphalt Binder	2	3
Aggregate Base	6	8
Total Pavement Section	9½	12½
Traffic [1] (ESALs)	10,000	50,000

1. The total ESALs exceed the required ESALs based on provided traffic information; however the section thicknesses shown above are the minimum thicknesses recommended for the application under consideration.

Asphalt concrete aggregates and base course materials should conform to the West Virginia Department of Transportation (WVDOT) specifications.

For areas subject to concentrated and repetitive loading conditions such as dumpster pads, truck delivery docks and ingress/egress aprons, we recommend using a Portland cement concrete pavement with a thickness of at least 7 inches underlain by at least 4 inches of crushed stone. The concrete should be air-entrained and have a minimum compressive strength of 4,000 psi after 28 days of laboratory curing per ASTM C-31. The above section represents the minimum design thickness and, as such, periodic maintenance should be anticipated. Prior to placement of the crushed stone the areas should be thoroughly proofrolled. For dumpster pads, the concrete pavement area should be large enough to support the container and tipping axle of the refuse truck.

Long term performance of pavements constructed on the site will be dependent upon maintaining stable moisture content of the subgrade soils, and providing for a planned program of preventative maintenance. The performance of all pavements can be enhanced by minimizing excess moisture that can reach the subgrade soils. The following recommendations should be considered at minimum:

- Final grade adjacent to parking lots and drives should slope down from pavement edges at a minimum 2%;
- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage;
- Install pavement drainage surrounding areas anticipated for frequent wetting;
- Seal all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils;

- Place compacted, low permeability backfill against the exterior side of curb and gutter; and,
- Place curb, gutter and/or sidewalk directly on a lean clay subgrade soils rather than on unbound granular base course materials to minimize water infiltration.

4.6.4 Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

4.6.5 Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore preventive maintenance should be planned and provided for through an on-going pavement management program. Preventive maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

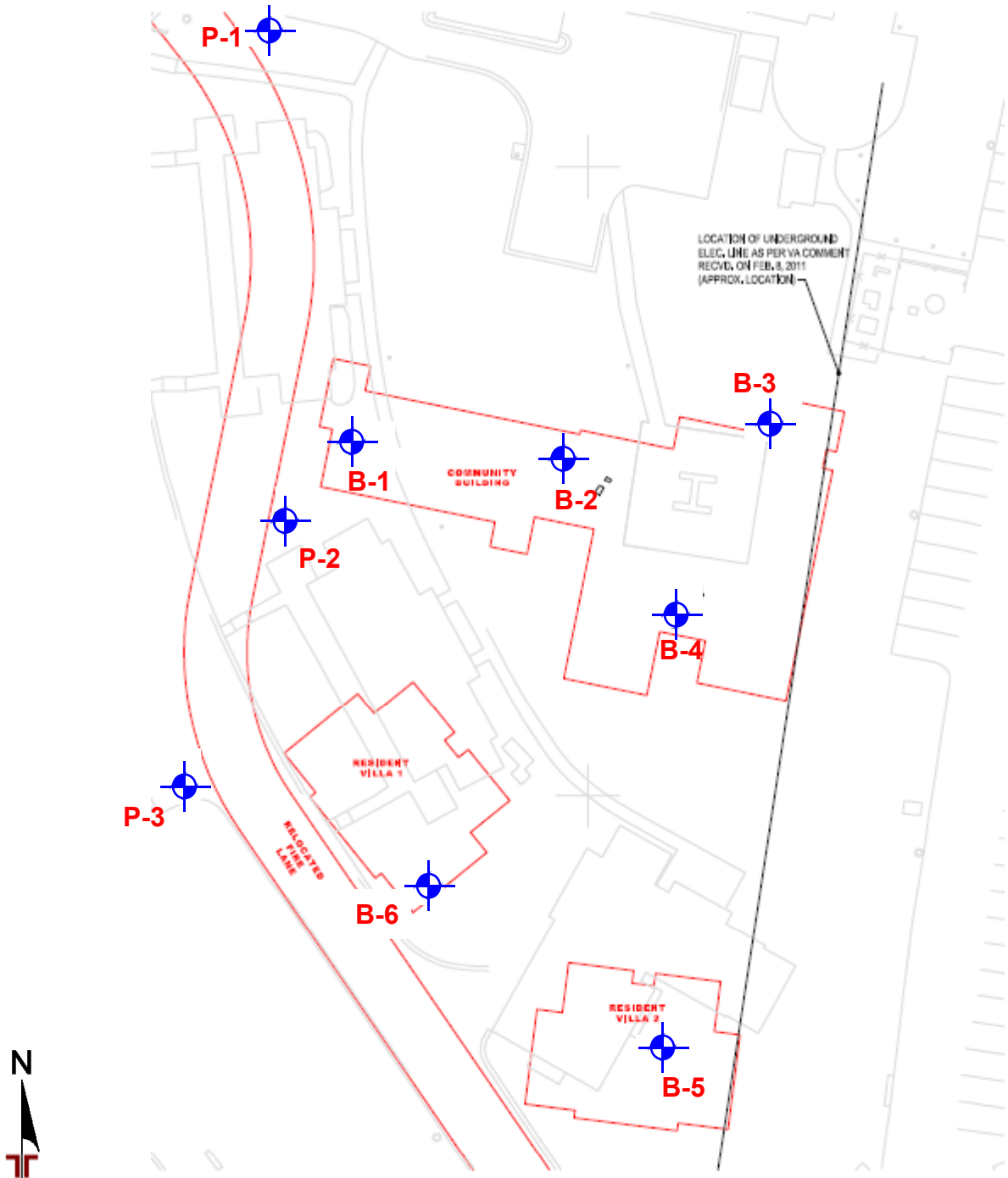
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: YSR	Project No. N2115002	Terracon Consulting Engineers & Scientists	SITE LOCATION PLAN
Drawn by: YSR	Scale: N.T.S	912 Morris Street Charleston, West Virginia 25301	VILLAS FOR RESIDENT REHAB VA MEDICAL CAMPUS CLARKSBURG, WEST VIRGINIA
Checked by: JRB	File Name: SLP-N2115002	PH. (304) 344-0821 FAX. (304) 342-4711	EXHIBIT A-1
Approved by: JRB	Date: 3/17/2011		



B-1 Approximate Boring Locations

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: YSR	Project No. N2105082	Terracon Consulting Engineers & Scientists	BORING LOCATION PLAN
Drawn by: YSR	Scale: N.T.S	912 Morris Street Charleston, West Virginia 25301	VILLAS FOR RESIDENT REHAB
Checked by: JRB	File Name: BLP-N2115002	PH. (304) 344-0821 FAX. (304) 342-4711	VA MEDICAL CAMPUS
Approved by: JRB	Date: 3/17/2011		CLARKSBURG, WEST VIRGINIA

EXHIBIT A-2

LOG OF BORING NO. B-1

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

Approx. Surface Elev.: 999.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
0.5	**TOPSOIL** 999		CL	1	SS	15	7	25		8500*
2.5	**LEAN CLAY WITH SAND**, brown, medium stiff 997									
	SILTY, CLAYEY SAND, brown, medium dense, very fine sand		SC SM	2	SS	18	15	20		
7.5	992	5	SC SM	3	SS	18	11	20		
	SILTY SAND, brown, loose, very fine sand with high silt content		SM	4	SS	18	5	20		
		10	SM	5	SS	13	5	22		
15	984.5									
	SILTY SAND WITH GRAVEL, brown and dark brown, medium dense, fine to medium sand, sandstone gravel	15	SM	6	SS	18	16	12		
20	979.5									
21.5	**CLAYSTONE**, severe weathering, dark red, soft 978	20		7	SS	18	58	11		
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ N/E	WD	▼	
▼		▼	
Exhibit A-3			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

LOG OF BORING NO. B-2

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

Approx. Surface Elev.: 1000.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	0.5 **TOPSOIL** 999.5									
	LEAN CLAY WITH SAND, brown with dark brown, stiff, very fine sand		CL	1	SS	10	10	24		6500*
	2.5 997.5									
	SANDY LEAN CLAY, brown, very stiff, very fine sand, trace friable gravel		CL	2	SS	18	18	18		5500*
		5	CL	3	SS	18	12	21		5500*
	7.5 992.5									
	SILTY, CLAYEY SAND, brown, loose, very fine sand, clay content decreases with depth		SC SM	4	SS	18	6	20		
		10	SC SM	5	SS	18	6	19		
	15 985									
	SILTY SAND WITH GRAVEL, brown and dark brown, medium dense, fine to medium sand, friable sandstone gravel ▽	15	SM	6	SS	18	19	10		
	20 980									
	20.9 **CLAYSTONE**, severe weathering, dark red, soft 979	20		7	SS	9	50/5"	11		
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ 18	WD	▼	
▼		▼	
Exhibit A-4			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

LOG OF BORING NO. B-3

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 1000.5 ft									
	0.5 **TOPSOIL** 1000		CL	1	SS	18	10	18		9000*
	LEAN CLAY, trace sand, brown, stiff									
	2.5 998									
	LEAN CLAY WITH SAND, brown with dark brown, very stiff, very fine sand		CL	2	SS	18	17	24		9000*
	5 995.5	5								
	SANDY LEAN CLAY, brown with dark brown, stiff, very fine sand		CL	3	SS	18	10	21		3000*
	7.5 993									
	SILTY, CLAYEY SAND, brown, loose, very fine sand, clay content decreases with depth		SC SM	4	SS	18	9	19		
		10	SC SM	5	SS	18	6	16		
		15	SC SM	6	SS	18	6	17		
	▽ 18.5 982									
	CLAYSTONE, severe weathering, dark red with trace gray, soft	20		7	SS	15	50/4"	17		
	21.3 979									
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ 18	WD	▼	
▼		▼	
Exhibit A-5			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

LOG OF BORING NO. B-4

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 1000.0 ft									
	0.5 **TOPSOIL** 999.5		CL	1	SS	14	7	18		7000*
	LEAN CLAY, trace sand, brown, medium stiff 2.5 997.5									
	LEAN CLAY WITH SAND, brown with dark brown, very stiff, very fine sand		CL	2	SS	18	16	20		7000*
	5 995									
	SILTY, CLAYEY SAND, brown, medium dense, very fine sand	5	SC SM	3	SS	18	10	22		
			SC SM	4	SS	18	10	18		
		10	SC SM	5	SS	18	11	16		
	15 985									
	SILTY SAND, trace gravel, brown, medium dense, very fine to fine sand	15	SM	6	SS	18	10	9		
	17.5 982.5									
	CLAYSTONE, severe weathering, dark red with brown, soft	20		7	SS	17	50/5"	10		
	21.4 978.5									
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ N/E	WD	▼	
▼		▼	
Exhibit A-6			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

LOG OF BORING NO. B-5

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 999.0 ft									
	0.5 **TOPSOIL** 998.5 **LEAN CLAY WITH SAND**, brown with dark brown, medium stiff		CL	1	SS	15	4	20		
			CL	2	SS	18	5	21		3500*
		5	CL	3	SS	18	7	11		
	7.5 991.5 **SILTY, CLAYEY SAND**, orange-brown, loose, very fine sand		SC SM	4	SS	18	8	20		3000*
		10	SC SM	5	SS	18	7	18		
	15 ▽ 984 **SILTY SAND WITH GRAVEL**, brown, medium dense, fine to medium sand	15	SM	6	SS	18	21	17		
	18 981 **CLAYSTONE**, severe weathering, dark red with gray									
	21 978	20		7	SS	12	50/6"	12		
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ 15	WD	▼	
▼		▼	
Exhibit A-7			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

LOG OF BORING NO. B-6

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 998.5 ft									
	0.5 **TOPSOIL** 998									
	SANDY LEAN CLAY, brown, stiff, very fine sand		CL	1	SS	14	6	28		
			CL	2	SS	18	11	21		5000*
	5 993.5	5								
	SILTY, CLAYEY SAND, brown with gray, medium dense, very fine sand		SC SM	3	SS	18	12	14		
			SC SM	4	SS	18	10	14		
	10 988.5	10								
	SILTY SAND, trace clay, brown, loose, very fine sand		SM	5	SS	18	6	16		
	16 982.5	15								
	SILTY SAND WITH GRAVEL, brown, medium dense, fine to medium sand, sandstone gravel ▽		SC SM	6	SS	18	17	12		
	18 980.5									
	CLAYSTONE, moderately severe weathering, dark red, soft									
	20.8 977.5	20		7	SS	9	50/4"	8		
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ 17	WD	▼	
▼		▼	
Exhibit A-8			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

LOG OF BORING NO. P-1

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 999.5 ft									
	0.5 **TOPSOIL** 999		CL	1	SS	18	4	26		2000*
	LEAN CLAY WITH SAND, brown, soft									
	2.5 997									
	SANDY LEAN CLAY, brown, stiff to medium stiff, very fine sand, high sand content		CL	2	SS	18	11	22		4500*
		5	CL	3	SS	18	9	21		3500*
			CL	4	SS	18	7	20		4500*
		10	CL	5	SS	18	6	20		3000*
	11.5 988									
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ N/E	WD	▼	
▼		▼	
Exhibit A-9			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

LOG OF BORING NO. P-2

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 999.0 ft									
	0.5 **TOPSOIL** 998.5		CL	1	SS	14	6	22		5500*
	LEAN CLAY WITH SAND, brown, medium stiff 2.5 996.5									
	SANDY LEAN CLAY, brown, stiff, very fine sand, high sand content		CL	2	SS	18	11	20		3000*
	- Sand lenses from 5' to 7.5'	5	CL	3	SS	18	11	17		
	7.5 991.5									
	SILTY, CLAYEY SAND, brown, loose, very fine sand		SC SM	4	SS	18	7	19		5000*
		10								
	11.5 987.5		SC SM	5	SS	18	6	20		
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ N/E	WD	▼	
▼		▼	
Exhibit A-10			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

LOG OF BORING NO. P-3

CLIENT
URS Group, Inc.

SITE
Clarksburg, West Virginia

PROJECT
VA Villas for Resident Rehab

Boring Location: As Shown on Test Boring Location Plan

Approx. Surface Elev.: 996.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	0.5 **ASPHALT PAVEMENT** 995.5									
	0.8 **BASE COURSE AGGREGATE** 995									
	2.5 **SANDY LEAN CLAY**, trace gravel and organics (roots), brown, medium stiff 993.5		CL	1	SS	12	6	18		5500*
	SANDY LEAN CLAY WITH GRAVEL, gray with brown, stiff		CL	2	SS	18	15	17		
		5	CL	3	SS	18	14	13		
	7.5 988.5									
	SILTY, CLAYEY SAND, orange-brown to brown, medium dense, very fine sand		SC SM	4	SS	18	11	13		
		10	SC SM	5	SS	18	13	14		
	11.5 984.5									
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
▽ N/E	WD	▼	
▼		▼	
Exhibit A-11			

Terracon

BORING STARTED			3-2-11
BORING COMPLETED			3-2-11
RIG	CME-45C	FOREMAN	JW
APPROVED	JRB	JOB #	N2115002

REVISED BORING LOGS VA VILLAS BORING LOGS.GPJ TERRACON.GDT 3/17/11

Field Exploration Description

The boring locations were laid out on the site by the Terracon using site plans provided by the client and measuring from available site features. Right angles for the boring location measurements were estimated. Ground surface elevations indicated on the boring logs were obtained in the field by referencing the ground surface in the helipad area (approximate elevation 1001 feet based on contours shown on the topographic site plan). The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a track-mounted rotary drill rig using continuous flight hollow-stem augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split-barrel sampling procedures.

In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value.

A field log of each boring was prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling, as well as, the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

APPENDIX B
SUPPORTING INFORMATION

Laboratory Testing

Soil samples were tested in the laboratory to measure their natural water content. A calibrated hand penetrometer was used to estimate the approximate unconfined compressive strength of some samples. The calibrated hand penetrometer has been correlated with unconfined compression tests and provides a better estimate of soil consistency than visual examination alone. The test results are provided on the boring logs included in Appendix A.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report. All classification was by visual manual procedures.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]		GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
S	ands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]		SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI plots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

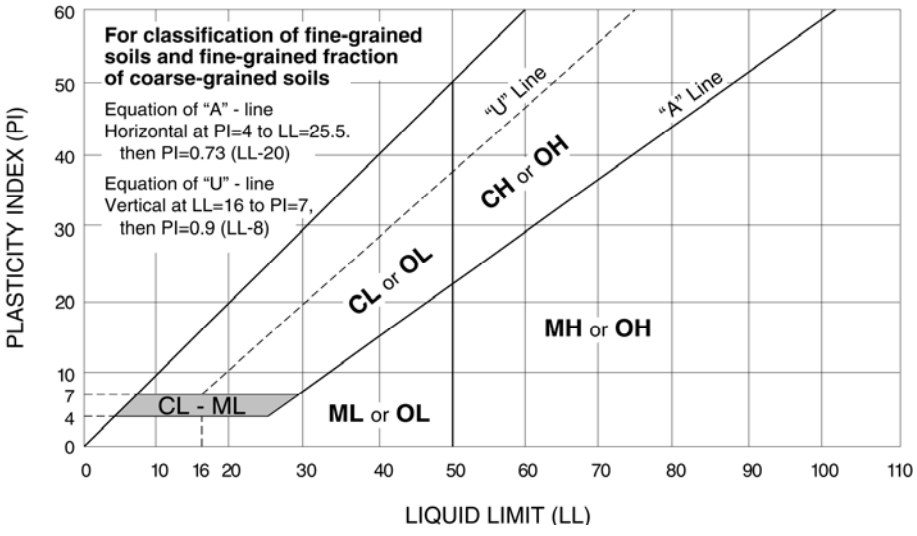
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

EXHIBIT C-2

GENERAL NOTES
Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding and Foliation Spacing in Rock[a]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

Rock Quality Designator (RQD)[b]		Joint Openness Descriptors	
RQD, as a percentage	Diagnostic description	Openness	Descriptor
Exceeding 90	Excellent	No Visible Separation	Tight
90 – 75	Good	Less than 1/32 in.	Slightly Open
75 – 50	Fair	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	1/8 to 3/8 in.	Open
Less than 25	Very poor	3/8 in. to 0.1 ft.	Moderately Wide
		Greater than 0.1 ft.	Wide

a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.
b. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976.
U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 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 the construction of the new building addition at the Clarksburg VA Medical Center, as indicated by drawings and specifications as Project 540-CSI-201, “Villas for Residents Rehab/ Treatment Program, Phase 1 Community Building”.

B. Visits to the site by Bidders may be made only by appointment with the Medical Center VA Contracting Officer Technical Representative (COTR).

C. Offices of URS, 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 VA COTR or his duly authorized representative.

D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the VA COTR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the VA COTR.

E. All employees of contractor and subcontractors shall comply with VA security management program and obtain permission of the VA security, be identified by project and employer, and restricted from unauthorized access.

F. Prior to commencing work, contractor shall provide proof that a OSHA certified “competent person” (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present.

G. Training:

1. All employees of contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
2. Submit training records of all such employees for approval before the start of work.

H. Prior to the preconstruction meeting, contractor shall provide an access plan for the intended use during construction of the existing building and site.

I. Work required in any occupied area on the First and Second Floors shall be scheduled to take place after 4:00 PM on weekdays and/or on weekends. These work hour restrictions do not apply to the Basement spaces. The contractor is required to coordinate any work in occupied areas with the VA COTR.

J. The contractor will provide URS with construction submittals as reflected in the contract documents for review/action with a copy to the VA's COTR (Contract Officer's Technical Representative).

1.2 STATEMENT OF BID ITEM(S)

A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, alterations, roads, walks, grading, drainage, mechanical and electrical work, utility systems and necessary removal of existing structures and construction and certain other items.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

A. AFTER AWARD OF CONTRACT, 1 electronic set of specifications and drawings will be furnished.

B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from reproducible prints furnished by Issuing Office. Such prints shall be returned to the Issuing Office immediately after printing is completed.

1.4 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 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. All contract employees working on VA Property – both from the Contractor and any Subcontractor – must go through the background check process with the VA Police Service. The background check includes completing VA Form 0711 for each and every worker. Workers will not be allowed to begin work until the background check is complete and they receive their temporary VA ID Badge – so the Contractor must coordinate accordingly. In addition to this

background check, each worker must also read and fill out a Station Orientation Form.

2. 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.
3. For working outside the “regular hours” as defined in the contract, The Contractor shall give 3 days notice to the Contracting Officer so that security can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
4. No photography of VA premises is allowed without written permission of the Contracting Officer.
5. VA reserves the right to close down or shut down the project site and order Contractor’s employees off the premises in the event of a national emergency. The Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The Contractor shall provide duplicate keys and lock combinations to the VA COTR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

D. Document Control:

1. Before starting any work, the Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of “sensitive information”.
2. The 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.
4. 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.
5. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
6. All paper waste or electronic media such as CD’s and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

7. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of “sensitive information”.
8. 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.

E. Motor Vehicle Restrictions
1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Parking is not permitted at the VA facility by any of the contractor’s forces. Parking must be secured, at the contractor’s expense, off site.

1.5 FIRE SAFETY

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
1. American Society for Testing and Materials (ASTM):
   E84-2008.....Surface Burning Characteristics of Building Materials
2. National Fire Protection Association (NFPA):
   10-2006.....Standard for Portable Fire Extinguishers
   30-2007.....Flammable and Combustible Liquids Code
   51B-2003.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
   70-2007.....National Electrical Code
   241-2004.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
3. Occupational Safety and Health Administration (OSHA):
   29 CFR 1926.....Safety and Health Regulations for Construction

B. Fire Safety Plan: Establish and maintain a 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 VA COTR and Facility Safety Manager for

review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the VA COTR that individuals have undergone contractor's safety briefing.

C. 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.

D. 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).

F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with VA COTR.

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspected daily by the Contractor's superintendent. Report findings and corrective actions weekly to VA COTR.

I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

L. 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 VA COTR. 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 VA COTR.

M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with VA COTR.

N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with VA COTR. Obtain permits from facility Safety Officer at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Inspect egress routes in and adjacent to construction areas daily. Coordinate with, and report findings and corrective actions to VA COTR.

P. 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.

Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

R. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

S. If required, submit documentation to the VA COTR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.6 OPERATIONS AND STORAGE AREAS

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the VA COTR. The Contractor shall hold and save the Government, its Engineers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Government Inspector, Contractor and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex

receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.

3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
7. Government Inspector Office: Within common-use field office, provide for Government Inspector’s use: Separate office, 100 SF minimum in size, with lockable door, desk, office chair, side chair, filing cabinet and bookshelf, dedicated phone line and Internet connection.

C. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.

D. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the VA COTR 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 VA COTR, the buildings and utilities may be abandoned and need not be removed.

E. The Contractor shall, under regulations prescribed by the VA COTR, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the VA COTR. 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.

(FAR 52.236-10)

F. Working space and space available for storing materials shall be as shown on the drawings.

G. Workmen are subject to rules of the Medical Center applicable to their conduct.

H. 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 VA COTR 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 two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
   3. Where access by Medical Center 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.

I. 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 suitable places where shown; or, in absence of such indication, where directed by VA COTR. All such actions shall be coordinated with the 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.

J. Building(s) No.5 will be occupied during performance of work; but immediate areas of alterations will be vacated.
   1. Within areas of alterations mentioned in preceding Subparagraph will be temporarily vacated while alterations are performed. Adjacent occupied areas not within the area, but adjacent to, alterations will not be vacated.

K. Phasing: To insure such executions, Contractor shall furnish the VA COTR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. An updated bar graph schedule shall be submitted to the VA COTR at intervals of thirty (30) calendar days. In addition, Contractor shall notify the VA COTR two weeks in advance of the proposed date of starting

work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to Medical Center VA COTR and Contractor. Work that will be required to be phased includes:

1. Relocation and demolition of subsurface utilities.
2. Construction of Community Building and Villa No. 1.
3. Demolition of existing Building No. 5 (after occupancy of Villa No. 1).
4. Construction of Villa No. 2.
5. Work to be performed on weekends in areas as predetermined and agreed to with the VA COTR.

L. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2100 mm (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 VA COTR.

M. Covered Walkway: Erect protective, covered walkway for passage of individuals through the Project site. Coordinate with entrance gates, other facilities, and obstructions.

1. Construct covered walkways using scaffold or framing as noted on the drawings.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

N. When a portion of the building is turned over to Contractor, Contractor shall accept entire responsibility 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.

O. Utilities Services: Maintain existing utility services for Medical enter 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 VA COTR.

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 VA COTR. 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 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 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.
2. Contractor shall submit a request to interrupt any such services to VA COTR, in writing, 48 hours 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.
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 VA COTR.
5. In case of a contract construction emergency, service will be interrupted on approval of VA COTR. 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.

P. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned, shall be removed.

Q. 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.
   2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the VA COTR.

R. Coordinate the work for this contract with other construction operations as directed by VA COTR. 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 VA COTR in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the VA COTR. 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 building.
   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 VA COTR.

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 VA COTR, 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 and VAAR 852.236-88).

C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and VA COTR 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 workmen in executing work of this contract.

D. Protection: Provide the following protective measures:

1. 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.
2. 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 INFECTION PREVENTION MEASURES

A. Implement the requirements of VAMC’s Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.

B. Establish and maintain a dust control program as part of the contractor’s infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to VA COTR and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

C. Medical Center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may 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.

D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold. (Communications and IT work required within the existing Hospital shall be conducted between the hours of 5:00 p.m. – 8:00 a.m.)
   1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by VA COTR.

E. 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.

1.9 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 identified by attached tags 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 VA COTR.
   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.

1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

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 workmen, 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 VA COTR.

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 VA COTR may have the necessary work performed and charge the cost to the Contractor.

(FAR 52.2236-9)

C. Protect existing vegetation, soils and the environment. Repair any damage as required.

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:

- Designating areas for equipment maintenance and repair;
- Providing waste receptacles at convenient locations and provide regular collection of wastes;
- Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
- Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and

- Providing adequately maintained sanitary facilities.

E. 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.

1.11 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 VA COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the VA COTR 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 workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and 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 VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.12 PHYSICAL DATA

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.

1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by Thrasher Engineering.

(FAR 52.236-4)

B. Subsurface conditions have been developed by core borings. Logs of subsurface exploration are shown diagrammatically on drawings in the soil report.

C. A copy of the soil report will be made available for inspection by bidders upon request to the Engineering Engineer at the VA Medical Center, 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.

1.13 PROFESSIONAL SURVEYING SERVICES

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.

1.14 LAYOUT OF WORK

A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the VA COTR. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the VA COTR until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the VA COTR may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236-17)

B. Establish and plainly mark building lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for the new addition, roads and parking lots are in accordance with lines and elevations shown on contract drawings.

C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:
   1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the VA COTR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.

D. During progress of work, and particularly as work progresses from floor to floor, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the VA COTR before any major items of concrete work are placed. In addition, Contractor shall also furnish to the VA COTR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
   1. Lines of new addition.
   2. Elevations of bottoms of footings and tops of floors of new addition.
   3. Lines and elevations of sewers and of all outside distribution systems.
   4. Lines and elevations of roads, streets and parking lots.

E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to VA COTR.

F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

1.15 HISTORIC PRESERVATION

A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the VA COTR verbally, and then with a written follow up.

1.16 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 insure compliance, as-built drawings shall be made available for the VA COTR's review, as often as requested.

C. Contractor shall deliver two approved completed sets of as-built drawings to the VA COTR within 15 calendar days after each completed phase and after the acceptance of the project by the VA COTR.

D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.17 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the VA COTR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed 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.

1.18 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 compliance with the following provisions:

1. Permission to use each unit or system must be given by VA COTR. If the equipment is not installed and maintained in accordance with the following provisions, the VA COTR 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. 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. All components and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel.

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.

1.19 TEMPORARY USE OF EXISTING ELEVATORS

A. Contractor will not be allowed the use of existing elevators. Outside type hoist shall be used by Contractor for transporting materials and equipment.

1.20 TEMPORARY TOILETS

A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by VA COTR, provide suitable dry closets where directed. Keep such places clean and free from flys, and all

connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

1.21 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 Contractor shall carefully conserve any utilities furnished without charge.

B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the VA COTR, shall install and maintain all necessary temporary connections and distribution lines. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution line, and associated paraphernalia.

C. 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.

D. Electricity (for Construction and Testing): Furnish all temporary electric services.

1. Obtain electricity by connecting to the Medical Center electrical distribution system. Electricity is available at no cost to the Contractor.

E. 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. 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 VA COTR's discretion) of use of water from Medical Center's system.

1.22 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.

1.23 TESTS

A. 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.

B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the VA COTR. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.

C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex 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 complex 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.

D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.

E. 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.

1.24 INSTRUCTIONS

A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.

B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the VA COTR 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 instructions 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 VA COTR and shall be considered concluded only when the VA COTR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the VA COTR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.25 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. 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 VA COTR 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.

1.26 CONSTRUCTION SIGN

A. Provide a Construction Sign where directed by the VA COTR. 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 VA COTR.

D. Detailed Drawing of construction sign showing required legend and other characteristics of sign as shown on the drawings.

1.27 SAFETY SIGN

A. Provide a Safety Sign where directed by VA COTR. 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 VA COTR.
D. Detail drawing of safety sign showing required legend and other characteristics of sign is shown on the drawings. Coordinate specific wording with VA COTR.
E. Post the number of accident free days on a daily basis.

1.28 CONSTRUCTION DIGITAL IMAGES

A. During the construction period through completion, furnish Department of Veterans Affairs with 200 views of digital images, including one color print of each view and one Compact Disc (CD) per visit containing those views taken on that visit. Digital views shall be taken of exterior and/or interior as selected and directed by VA COTR (RE). Each view shall be taken with a professional grade camera with minimum size of 6 megapixels (MP) and the images will be a minimum of 2272 x 1704 pixels for the 200x250mm (8x 10 inch) prints and 2592 x 1944 pixels for the 400x500 mm (16 x 20 inch) prints, as per these specifications:
   1. Normally such images will be taken at monthly intervals. However, the VA COTR may also direct the taking of special digital images at any time prior to completion and acceptance of contract. If the number of trips to the site exceeds an average of one per month of the contract performance period then an adjustment in contract price will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) of Section 00 72 00, GENERAL CONDITIONS.
   2. In event a greater or lesser number of images than specified above are required by the VA COTR, adjustment in contract price will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
B. 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.
C. Prints shall be made on 200 x 250 mm (8 by 10 inch) regular-weight matte archival grade photographic paper and produced by a process with a minimum of 300 pixels per inch (PPI). Prints must be printed using the commercial RA4 process (inkjet prints will not be acceptable). Photographs shall have 200 x 200 mm (8 by 8 inch) full picture print with no margin on three sides and a 50 mm (2 inches) margin on the bottom for pre-typed self-adhesive identity label to be added by VA

COTR. It is required that the prints are professionally processed so the quality will meet or exceed that of the same size print made with a film camera. Prints must be shipped flat to the VA COTR:

D. Images on CD-ROM shall be recorded in JPEG format with a minimum of 24 bit color and no reduction in actual picture size. Compressed size of the file shall be no less than 80% or the original with no loss of information. File names shall contain the date the image was taken, the Project number and a unique sequential identifier. The CD-ROM shall also contain an index of all the images contained therein in either a TXT or Microsoft Word format.

E. In case any set of prints are not submitted within five days of date established by VA COTR for taking thereof, the VA COTR may have such images/photographs taken and cost of same will be deducted from any money due to the Contractor.

F. Interior Final Photos: After completion of all work in an area final interior photos will be taken. The camera must allow the colors to be as close as possible to the actual colors. A minimum of eight (8) interior images shall be taken with a minimum 6 MP camera by a professional photographer. Locations to be determined by the VA COTR. View shall be taken after final completion of work. The images shall also be provided on a CD to the VA COTR.

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 VA COTR to select the image to be printed. All images are provided to the VA COTR 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 building constructed under this project (elevations as selected by the VA COTR 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 place 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 VA COTR will select one style to frame all six prints. Photographs with frames shall be delivered to the VA COTR in boxes suitable for shipping.

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SECTION 01 23 00

ALTERNATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates. The base bid shall include all labor and materials required for utility demolition and relocation, demolition of roadways and sidewalks, and construction of the Community Building.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

B. The cost for each alternate is the net deduct to the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ALTERNATE NO. 1: Deduct the basketball court and associated basketball court equipment and the four planters identified on the site plan.

B. ALTERNATE NO. 2: Deduct two operable partition walls located between C123, Dining Room, and C126, Group Room, and C126, Group Room, and C125, Group Room. The associated operable partition wall tracks, and supports shall remain in the base bid.

C. ALTERNATE NO. 3: Only partial demolition of existing Medical Center Drive.

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

1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.

1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:

A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.

1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.

1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by the Contracting Officer’s Technical Representative (COTR)on behalf of the Contracting Officer.

1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.

1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.

A. Submit samples required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.

B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.

1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or

Federal Specification Number as applicable and location(s) on project.

3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

C. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.

D. Approved samples will be kept on file by the COTR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.

E. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each drawing required, submit one legible photographic paper or vellum reproducible.
2. Reproducible shall be full size.
3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.

1-10. Samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted to Architect-Engineer, in care of COTR, for approval to:

Louis A. Johnson VA Medical Center
Department of Veterans Affairs Medical Center
1 Medical Center Drive
Contracting Office (90C)
Clarksburg, WV 26301 - 4199

1-11. At the time of transmittal, the Contractor shall also include a copy of the complete submittal for the COTR.

1-12. Samples for approval shall be sent to Architect-Engineer, in care of COTR, VA Medical Center:

Louis A. Johnson VA Medical Center

Department of Veterans Affairs Medical Center

1 Medical Center Drive

Contracting Office (90C)

Clarksburg, WV 26301 – 4199

1-13. The general contractor will provide URS with construction submittals as reflected in the contract documents for review/action with a copy to the VA's Contract Officer's Technical Representative (COTR).

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SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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)

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

DEPARMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
811 Vermont Avenue, NW - Room 462
Washington, DC 20420
Telephone Numbers: (202) 461-8217 or (202) 461-8292
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)

A. 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 http://www.aabchq.com
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
AAN	American Nursery and Landscape Association http://www.anla.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
AHAM	Association of Home Appliance Manufacturers http://www.aham.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 http://www.aitc-glulam.org
AMCA	Air Movement and Control Association, Inc. http://www.amca.org
ANLA	American Nursery & Landscape Association http://www.anla.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
ASAE	American Society of Agricultural Engineers http://www.asae.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 http://www.asse-plumbing.org
ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CI	The Chlorine Institute, Inc. http://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org

CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPMB	Concrete Plant Manufacturers Bureau http://www.cpmb.org
CRA	California Redwood Association http://www.calredwood.org
CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org
CTI	Cooling Technology Institute http://www.cti.org
DHI	Door and Hardware Institute http://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.et1.com
FAA	Federal Aviation Administration http://www.faa.gov
FCC	Federal Communications Commission http://www.fcc.gov
FPS	The Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.cssinfo.com/info/gana.html/
FM	Factory Mutual Insurance http://www.fmglobal.com
GA	Gypsum Association http://www.gypsum.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org
ICBO	International Conference of Building Officials http://www.icbo.org

ICEA	Insulated Cable Engineers Association Inc. http://www.icea.net
\ICAC	Institute of Clean Air Companies http://www.icac.com
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org\
IMSA	International Municipal Signal Association http://www.imsasafety.org
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association http://www.mbma.com
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. http://www.mss-hq.com
NAAMM	National Association of Architectural Metal Manufacturers http://www.naamm.org
NAPHCC	Plumbing-Heating-Cooling Contractors Association http://www.phccweb.org.org
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors http://www.nationboard.org
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org
NHLA	National Hardwood Lumber Association http://www.natlhardwood.org
NIH	National Institute of Health http://www.nih.gov
NIST	National Institute of Standards and Technology http://www.nist.gov
NLMA	Northeastern Lumber Manufacturers Association, Inc. http://www.nelma.org
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604

NSF	National Sanitation Foundation http://www.nsf.org
NWWDA	Window and Door Manufacturers Association http://www.nwwda.org
OSHA	Occupational Safety and Health Administration Department of Labor http://www.osha.gov
PCA	Portland Cement Association http://www.portcement.org
PCI	Precast Prestressed Concrete Institute http://www.pci.org
PPI	The Plastic Pipe Institute http://www.plasticpipe.org
PEI	Porcelain Enamel Institute, Inc. http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org
RFCI	The Resilient Floor Covering Institute http://www.rfci.com
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. http://www.rma.org
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Door Institute http://www.steeldoor.org
IGMA	Insulating Glass Manufacturers Alliance http://www.igmaonline.org
SJI	Steel Joist Institute http://www.steeljoist.org
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. http://www.smacna.org
SSPC	The Society for Protective Coatings http://www.sspc.org
STI	Steel Tank Institute http://www.steeltank.com
SWI	Steel Window Institute http://www.steelwindows.com

TCA	Tile Council of America, Inc. http://www.tileusa.com
TEMA	Tubular Exchange Manufacturers Association http://www.tema.org
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200 Madison, WI 53719 (608) 833-5900
UBC	The Uniform Building Code See ICBO
UL	Underwriters' Laboratories Incorporated http://www.ul.com
ULC	Underwriters' Laboratories of Canada http://www.ulc.ca
WCLIB	West Coast Lumber Inspection Bureau 6980 SW Varns Road, P.O. Box 23145 Portland, OR 97223 (503) 639-0651
WRCLA	Western Red Cedar Lumber Association P.O. Box 120786 New Brighton, MN 55112 (612) 633-4334
WWPA	Western Wood Products Association http://www.wwpa.org

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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 and paid for by 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):

T27-06.....Sieve Analysis of Fine and Coarse Aggregates

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

T99-01 (R2004).....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2003).....Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-01 (R2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

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

C. American Concrete Institute (ACI):

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

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

A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A370-07.....Definitions for Mechanical Testing of Steel Products

A416/A416M-06.....Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A490-06.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

C31/C31M-06.....Making and Curing Concrete Test Specimens in the Field

C33-03.....Concrete Aggregates

C39/C39M-05.....Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-05.....Compressive Strength of Hydraulic Cement Mortars
C138-07.....Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140-07.....Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-05.....Slump of Hydraulic Cement Concrete
C172-07.....Sampling Freshly Mixed Concrete
C173-07.....Air Content of freshly Mixed Concrete by the Volumetric Method
C330-05.....Lightweight Aggregates for Structural Concrete
C567-05.....Density Structural Lightweight Concrete
C780-07.....Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-08.....Sampling and Testing Grout
C1064/C1064M-05.....Freshly Mixed Portland Cement Concrete
C1077-06.....Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314-07.....Compressive Strength of Masonry Prisms
D698-07.....Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143-07.....Piles Under Static Axial Compressive Load
D1188-07.....Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556-07.....Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557-07.....Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166-06.....Unconfined Compressive Strength of Cohesive Soil
D2167-94(R2001).....Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216-05.....Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2922-05.....Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2974-07.....Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-(2002).....Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials
D3740-07.....Minimum Requirements for Agencies Engaged in the Testing and Inspecting Road and Paving Material
E94-04.....Radiographic Testing
E164-03.....Ultrasonic Contact Examination of Weldments
E329-07.....Agencies Engaged in Construction Inspection and/or Testing
E543-06.....Agencies Performing Non-Destructive Testing
E605-93(R2006).....Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
E709-(2001).....Guide for Magnetic Particle Examination
E1155-96(R2008).....Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):
D1.1-07.....Structural Welding Code-Steel

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.; E 329, C 1077, D 3666, D3740, A 880, E 543) 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 the Contractor Officer’s Technical Representative (COTR). When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COTR to such failure.

C. Written Reports: Testing laboratory shall submit test reports to COTR, Contractor, unless other arrangements are agreed to in writing by the COTR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to COTR 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 COTR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COTR 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 D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D2922 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 COTR before the tests are conducted.
   a. Building Slab Subgrade: At least one test of subgrade for every 185 m^2 (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 m^2 (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 m^2 (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. 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 COTR. 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.

C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.

D. Testing Materials: Test suitability of on-site and off-site borrow as directed by COTR.

3.2 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 COTR.

3.3 SITE WORK CONCRETE:

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

3.4 CONCRETE:

A. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COTR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COTR.
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COTR.

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 m^3 (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. After good concrete quality control has been established and maintained as determined by COTR make three cylinders for each 80 m^3 (100 cubic yards) or less of each concrete type, and at least three cylinders from any one day's pour for each concrete type. Label each cylinder with an identification number. COTR 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 m^3 (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m^3 (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 COTR 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 COTR. 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 COTR. 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/m^3 (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.

3.5 REINFORCEMENT:

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

3.6 MASONRY:

A. Mortar Tests:
   1. Laboratory compressive strength test:
      a. Comply with ASTM C780.
      b. Obtain samples during or immediately after discharge from batch mixer.
      c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
      d. Test one sample at 7 days and 2 samples at 28 days.
   2. Two tests during first week of operation; one test per week after initial test until masonry completion.
B. Grout Tests:
   1. Laboratory compressive strength test:
      a. Comply with ASTM C1019.
      b. Test one sample at 7 days and 2 samples at 28 days.
      c. Perform test for each 230 m^2 (2500 square feet) of masonry.
C. Masonry Unit Tests:
   1. Laboratory Compressive Strength Test:
      a. Comply with ASTM C140.
      b. Test 3 samples for each 460 m^2 (5000 square feet) of wall area.
D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m^2 (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.7 TYPE OF TEST:

A. Earthwork:
Laboratory Compaction Test, Soils (ASTM D698):

Testing Frequency: Obtain one composite bag sample for each type of material and one bag sample for every 1000 cubic yards of placed fill.

Field Density, Soils (AASHTO T310):

Testing Frequency: Perform two (2) tests per lift and a minimum of one (1) for every 1000 cubic yards of placed fill.

B. Subgrade:

Field Density, (AASHTO T310):

Testing Frequency: Perform a minimum of one (1) test for every 1000 square yards.

C. Aggregate Base:

Laboratory Compaction, (ASTM D698):

Testing Frequency: Obtain one composite bag sample for each type of material and one bag sample for every 1000 cubic yards of placed fill.

Field Density, (AASHTO T310):

Testing Frequency: Perform two (2) tests per lift and a minimum of one (1) for every 1000 square yards.

D. Concrete:

Make and Cure Concrete Test Cylinders based on the following:

Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

Per ASTM C 1064: one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

Compressive Strength, Test Cylinders:

Per ASTM C 31/C 31M: Cast and laboratory-cure one set of four standard cylinder specimens for each composite sample.

Per ASTM C 39: Test two laboratory-cured specimens at 7 days and two at 28 days. Revise age at testing. A compressive strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

Concrete Slump Test:

Per ASTM C 143: one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change. No concrete shall be placed that does not meet specified slump

requirements. Sump exceeding the specified maximum, when occurring in 2 consecutive tests made on different portions of the same sample, will be cause for rejection of that truckload and shall be reported to the Contracting Officer Technical Representative (COTR) immediately. The replacement of such concrete shall be done at no additional expense to the Government.

Concrete Air Content Test:

Per ASTM C 231: Pressure method, for normal-weight concrete.

ASTM C 173: Volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix. No concrete shall be placed that does not meet specified air content requirements.

Unit Weight, Lightweight Concrete:

Per ASTM C567: Fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

Flatness and Levelness Readings:

Per ASTM E1155: Once per concrete pour.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

EP-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 effect 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.

EP-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.

EP-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 328.....Definitions

EP-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 Technical Representative (COTR) 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 Project 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 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.

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.

EP-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, top soil, and land forms without permission from the COTR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.

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, land forms, 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. 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.
4. Handle discarded materials other than those included in the solid waste category as directed by the COTR.

C. 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 Ohio 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 at all times, including weekends, holidays, and hours when work is not in progress.
   2. Particulates Control: Maintain all excavations, stockpiles, permanent and temporary access roads, spoil 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 COTR. 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 COTR. 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 m (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	SAWS	75
GENERATORS	75	VIBRATORS	75
COMPRESSORS	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 COTR 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 COTR. 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

A. 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:

1. Waste Management Plan development and implementation.
2. Techniques to minimize waste generation.
3. Sorting and separating of waste materials.
4. Salvage of existing materials and items for reuse or resale.
5. Recycling of materials that cannot be reused or sold.

D. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, etc).
7. Cardboard, paper and packaging.
8. Plastics (eg, ABS, PVC).
9. Carpet and/or pad.
10. Gypsum board.
11. Insulation.
12. Paint.
13. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

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 reuse and recycle new materials 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. The Whole Building Design Guide website http://www.wbdg.org provides a Construction Waste Management Database that contains information on companies that haul. Collect, and process recyclable debris from construction projects.

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 Contracting Officer’s Technical Representative (COTR) 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.
      c. The names and locations of mixed debris reuse and recycling facilities or sites.
      d. The names and locations of trash disposal landfill facilities or sites.
      e. Documentation that the facilities or sites are approved to receive the materials.

B. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

C. 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.

1.6 APPLICABLE PUBLICATIONS

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.

A. U.S. Green Building Council (USGBC):
LEED Green Building Rating System for New Construction

B. ASTM International (ASTM)
ASTM E 1609 Development and Implementation of a Pollution Prevention Program.

1.7 RECORDS

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. Although this Project is not registered for LEED, records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

A. List of each material and quantity to be salvaged, recycled, reused.

B. List of each material and quantity proposed to be taken to a landfill.

C. 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 11
SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

This Section describes general requirements and procedures to comply with the Guiding Principles for Leadership in High Performance and Sustainable Buildings Memorandum of Understanding incorporated in the Executive Orders 13423 and 13514; Energy Policy Act of 2005 (EPA 2005) and the Energy Independence and Security Act of 2007 (EISA 2007).

1.2 OBJECTIVES

A. To obtain acceptable Indoor Air Quality (IAQ) for the completed project and minimize the environmental impacts of the construction and operation, the Contractor during the construction phase of this project shall implement the following procedures:

1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce, and employ recycled and/or recyclable materials. It is the intent of this project to conform with EPA’s Five Guiding Principles on environmentally preferable purchasing. The five principles are:
   a. Include environmental considerations as part of the normal purchasing process.
   b. Emphasize pollution prevention early in the purchasing process.
   c. Examine multiple environmental attributes throughout a product’s or service’s life cycle.
   d. Compare relevant environmental impacts when selecting products and services.
   e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
2. Control sources for potential IAQ pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support these objectives in developing

means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.

4. Use building practices that insure construction debris and particulates do mot contaminate or enter duct work prior to system startup and turn over.

1.3 RELATED DOCUMENTS

A. Section 01 74 19 CONSTRUCTION WASTE MANANGEMENT

B. Section 01 91 00 GENERAL COMMISSIONG REQUIREMENTS

1.4 DEFINITIONS

A. Agrifiber Products: Composite panel products derived from agricultural fiber

B. Biobased Product: As defined in the 2002 Farm Bill, a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials

C. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight

D. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that is was obtained from forests certified by a specified certification program

E. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder

F. Construction and Demolition Wast.e: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 01 74 19.

G. Third Party Certification: Certification of levels of environmental achievement by nationally recognized sustainability rating system.

H. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky

I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock

J. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use

K. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 “Guidelines for the Use of Environmental Marketing Claims”: www.ftc.gov/bcp/grnrule/guides980427

L. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 250 miles (400 km) from the Project site

M. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without being manufactured

N. Sealant: Any material that fills and seals gaps between other materials

O. Type 1 Finishes: Materials and finishes which have a potential for short-term levels of off gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing.

P. Type 2 Finishes: “Fuzzy" materials and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals offgas

Q. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

1.5 SUBMITTALS

A. Sustainable Design Submittals:

1. Alternative Transportation: Provide manufacturer’s cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided. Also, provide manufacturer’s cut

sheets for any alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.

2. Heat Island Effect:
   a. Site Paving: Provide manufacturer’s cut sheets for all impervious paving materials, highlighting the Solar Reflectance Index (SRI) of the material. Also, provide cut sheets for all pervious paving materials.
3. Exterior Lighting Fixtures: Submittals must include cut sheets with manufacturer’s data on initial fixture lumens above 90° from nadir for all exterior lighting fixtures, and, for parking lot lighting, verification that the fixtures are classified by the IESNA as “full cutoff” (FCO); OR provide documentation that exterior luminaires are IDA-Approved as Dark-Sky Friendly by the International Dark Sky Association (IDA) Fixture Seal of Approval Program.
4. Water Conserving Fixtures: Submittals must include manufacturer’s cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates. Include cut sheets for any automatic faucet-control devices.
5. Process Water Use: Provide manufacturer’s cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer’s cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.
6. Elimination of CFCs AND HCFCs: Provide manufacturer’s cut sheets for all cooling equipment with manufacturer’s product data, highlighting refrigerants; provide manufacturer’s cut sheets for all fire-suppression equipment, highlighting fire-suppression agents; provide manufacturer’s cut-sheets for all polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).
7. Measurement and Verification Systems: Provide cut sheets and manufacturer’s product data for all controls systems, highlighting electrical metering and trending capability components.

8. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation:
   set of each material or product, excluding cost of labor and equipment for installation
   a. Manufacturer’s product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
   b. An electronic spreadsheet that tabulates the Project’s total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor’s Certificate and Application for Payment. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content, post-consumer recycled content, and combined recycled content value.
9. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation (excluding MEP systems equipment and components) must include the following documentation:
   a. Cost of each material or product, excluding cost of labor and equipment for installation
   b. Location of product manufacture and distance from point of manufacture to the Project Site
   c. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site
   d. Manufacturer’s product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material
   e. Manufacturer’s product data, product literature, or a letter from the manufacturer verifying the location and distance from the

Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, concrete, masonry, and GWB

f. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate on an ongoing basis, line items for each material, including cost, location of manufacture, distance from manufacturing plant to the Project Site, location of raw material extraction, and distance from extraction point to the Project Site.

10. Biobased Products:
    a. Rapidly Renewable Products: Submittals must include written documentation from the manufacturer declaring that rapidly renewable materials are made from plants harvested within a ten-year or shorter cycle and must indicate the percentage (by weight) of these rapidly renewable components contained in the candidate products, along with the costs of each of these materials, excluding labor and delivery costs.
    b. Certified Wood: Submittals for all wood-based materials must include a statement indicating the cost of each product containing FSC Certified wood, exclusive of labor and delivery costs, and third party verification of certification from one of the following:
        1) Documentation from the supplier verifying that 100% of the wood-based content originates from SFI third-party certified forest lands, identifying the company or companies that performed the SFI third-party certification for both the forest land management and the certified product content.
11. Outdoor Air Delivery Monitoring: Provide manufacturer's cut sheets highlighting the installed carbon dioxide monitoring system components and sequence of controls shop drawing documentation, including CO2 differential set-points and alarm capabilities.
12. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air,

must include manufacturer’s MSDSs or other Product Data highlighting VOC content.

a. Provide manufacturers’ documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.

13. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer’s MSDSs or other Product Data highlighting VOC content
14. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer’s MSDSs or other manufacturer’s Product Data highlighting VOC content.
15. Floorcoverings:
    a. Carpet Systems: Submittals for all carpet must include the following:
        1) A copy of an assessment from the Building for Environmental and Economic Sustainability (BEES) software model, either Version 3.0 or 4.0, with parameters of the model set as described by this specification section.
        2) Manufacturer’s product data verifying that all carpet systems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
16. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer’s product data verifying that these products contain no urea-formaldehyde resins.
17. Entryway Systems: Provide manufacturer’s cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.
18. Air Filtration: Provide manufacturer’s cut sheets and product data highlighting the following:

a. Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs) per ASHRAE HVAC Design Manual for Hospitals and Clinics.
b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction. See above for requirements

19. Mercury in Lighting: Provide manufacturer’s cut sheets or product data for all fluorescent or HID lamps highlighting mercury content.
20. Lighting Controls: Provide manufacturer’s cut sheets and shop drawing documentation highlighting all lighting controls systems components.
21. Thermal Comfort Controls: Provide manufacturer’s cut sheets and shop drawing documentation highlighting all thermal comfort-control systems components.
22. Blended Cement: It is the intent of this specification to reduce CO_2 emissions and other environmentally detrimental effects resulting from the production of portland cement by requiring that all concrete mixes, in aggregate, utilize blended cement mixes to displace 40% of the portland cement typically included in conventional construction. Provide the following submittals:
    a. Copies of concrete design mixes for all installed concrete
    b. Copies of typical regional baseline concrete design mixes for all compressive strengths used on the Project
    c. Quantities in cubic yards of each installed concrete mix
23. Gypsum Wall Board: Provide manufacturer’s cut sheets or product data verifying that all gypsum wallboard products are moisture and mold-resistant.
24. Fiberglass Insulation: Provide manufacturer’s cut sheets or product data verifying that fiberglass batt insulation contains no urea-formaldehyde.
25. Duct Acoustical Insulation: Provide manufacturer’s cut sheets or product data verifying that mechanical sound insulation materials in air distribution ducts consists of an impervious, non-porous coatings that prevent dust from accumulating in the insulating materials.

26. Green Housekeeping: Provide documentation that all cleaning products and janitorial paper products meet the VOC limits and content requirements of this specification section.

B. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:

1. Not more than 60 days after the Preconstruction Meeting, the Contractor shall provide to the Owner and Architect-Engineer a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:
   a. Identify each reused or salvaged material, its cost, and its replacement value.
   b. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product’s weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
   c. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material, the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of total materials costs.
   d. Identify each biobased material, its source, its cost, and the total value of biobased materials as a percentage of total materials costs. Also provide the total value of rapidly renewable materials (materials made from plants that are harvested in less than a 10-year cycle) as a percentage of total materials costs.
   e. Identify each wood-based material, its cost, the total wood-based materials cost, each FSC Certified wood material, its cost, and

the total value of Certified wood as a percentage of total wood-based materials costs.

2. Provide final versions of the above spreadsheets to the Owner and Architect-Engineer not more than 14 days after Substantial Completion.

C. Construction Waste Management: See Section 01 74 19 “Construction Waste Management” for submittal requirements.

D. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:

1. Not more than 30 days after the Preconstruction Meeting, prepare and submit for the Architect-Engineer and Owner’s approval, an electronic copy of the draft Construction IAQ Management Plan in an electronic file including, but not limited to, descriptions of the following:
2. Instruction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling
   a. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage
   b. Schedule of submission to Architect-Engineer of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials
   c. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille
   d. 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
3. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:

a. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.
b. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).

4. Not more than 14 days after Substantial Completion provide the following:
   a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
   b. Minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

E. Commissioning: See Section 01 91 00 “General Commissioning Requirements” for submittal requirements.

F. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:
   1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 01 74 19 ”Construction Waste Management.”
   2. Construction IAQ Management: See details below under Section 3.2 Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

1.6 QUALITY ASSURANCE

A. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner, Architect-Engineer, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan, and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the

Project’s Sustainable Design Requirements and coordination of the Contractor’s management of these requirements with the Contracting Officer and the Construction Quality Manager.

B. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

PART 2 - PRODUCTS

2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

A. Site Clearing: Topsoil shall be provided by the Contractor from on-site material which has been stockpiled for reuse. Off-site borrow should only be used when on-site sources are exhausted. Chip and/or compost on site all vegetated material identified for removal.

B. Do not burn rubbish, organic matter, etc. or any material on the site. Dispose of legally in accordance with Specifications Sections 01 74 19.

C. Site Paving: All site impervious paving must be light colored, with a Solar Reflectance Index (SRI) of at least 29.

D. Exterior Lighting Fixtures:

1. All exterior luminaires must emit 0% of the total initial designed fixture lumens at an angle above 90° from nadir and/or meet the requirements of the Dark Sky certification program.
2. Exterior lighting cannot exceed 80% of the lighting power densities defined by ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.
3. No lighting of building facades or landscape features is permitted.

E. Herbicides and Pest Control: Herbicides shall not be permitted, and pest control measures shall utilize EPA-registered biopesticides only.

F. Water-Conserving Fixtures: Plumbing fixtures and fittings shall use in aggregate at least 40% less water than the water use baseline calculated for the building after meeting the Energy Policy Act of 1992 fixture performance requirements. Flow and flush rates shall not exceed the following:

1. Toilets: no more than 1.3 gallons per flush, otherwise be dual flush 1.6/0.8 gallons per flush, and have documented bowl evacuation capability per MaP testing of at least 400 grams

2. Urinals: Water sense rated with no more than 0.125 gallons per flush or use where considered appropriate.
3. Lavatory Faucets: 0.5 gpm with automatic faucet controls
4. Kitchen Sink Lavatories: 2.2 gpm
5. Showerheads: no more than 1.5gpm

G. Elimination of CFCs AND HCFCs:
1. Ozone Protection: Base building cooling equipment shall contain no refrigerants other than the following: HCFC-123, HFC-134a, HFC-245fa, HFC-407c, or HFC 410a.
2. Fire suppression systems may not contain ozone-depleting substances.
3. Extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation shall not be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.

H. Appliances and Equipment: All Energy Star eligible equipment and appliances, including office equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), shall be qualified by EPA’s Energy Star program.

I. HVAC Distribution Efficiency:
1. All duct systems shall be constructed of galvanized sheet metal, aluminum, or stainless steel as deemed appropriate based on the application requirements. No fiberglass duct board shall be permitted.
2. All medium- and high-pressure ductwork systems shall be pressure-tested in accordance with the current SMACNA standards.
3. All ductwork shall be externally insulated. No interior duct liner shall be permitted.
4. Where possible, all air terminal connections shall be hard-connected with sheet metal ductwork. If flexible ductwork is used, no flexible duct extension shall be more than six feet in length.
5. All HVAC equipment shall be isolated from the ductwork system with flexible duct connectors to minimize the transmittance of vibration.
6. All supply and return air branch ducts shall include the appropriate style of volume damper. Air terminal devices such as grilles, registers, and diffusers shall be balanced at duct branch dampers, not at terminal face.

J. Measurement and Verification: Install controls and monitoring devices as required by MEP divisions order to comply with International Performance Measurement & Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003, Option D.
   1. The IPMVP provides guidance on situation-appropriate application of measurement and verification strategies.

K. Recycled Content of Materials:
   1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 30% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.
      a. e post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
      b. Do not include mechanical and electrical components in the calculations.
      c. Do not include labor and delivery costs in the calculations.
      d. Recycled content of materials shall be defined according to the Federal Trade Commission’s “Guide for the Use of Environmental Marketing Claims,” 16 CFR 260.7 (e).
      e. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.
      f. The materials in the following list must contain the minimum recycled content indicated:

Category	**Minimum Recycled Content**
Compost/mulch	100% post-consumer
Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer

Category	Minimum Recycled Content
Steel Reinforcing Bars	90% combined
Structural Steel Shapes	90% combined
Steel Deck	75% combined
Steel Fabrications	60% combined
Aluminum Fabrications	35% combined
Rigid Insulation	20% pre-consumer
Batt insulation	30% combined

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SECTION 01 91 00
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 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 7, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 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 7, Division 8, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 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 contact 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 Contracting Officer Technical Representative (COTR) 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 and the COTR.

B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to COTR 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 COTR 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 COTR.

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 COTR. 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 COTR 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 COTR to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or COTR will issue an official directive to this effect.
   4. All parties to the Commissioning Process shall be individually responsible for alerting the COTR 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 COTR, 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 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.
C. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
D. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
E. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.
F. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.

G. Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

H. Section 28 31 00 FIRE DETECTION, ALARM, AND MASS NOTIFICATION

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 (USGBC) LEED ™ rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.

1. Commissioning activities and documentation for the LEED™ section on “Energy and Atmosphere” and the prerequisite of “Fundamental Building Systems Commissioning.”

1.5 DEFINITIONS

A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.

B. CxA: Commissioning Agent.

C. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.

D. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.

E. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer’s installation instruction, or may not be in compliance with generally accepted industry standards.

F. Systems Functional Performance Test: a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing is the dynamic testing of systems (rather than just components)

under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.

G. System: A system is defined as the entire set of components, equipment, and subsystems 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 component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, 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 the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.

H. Pre-Functional Checklist: a list of items provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist items entail simple testing of the function of a component, a piece of equipment or

system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The term “Pre-Functional” refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with the manufacturer’s startup checklist and the Contractor’s Quality Control checklists.

I. Seasonal Functional Performance Testing: a test or tests that are deferred until the system will experience conditions closer to their design conditions.

J. VA: Includes the Contracting Officer, COTR, or other authorized representative of the Department of Veterans Affairs.

K. TAB: Testing, Adjusting, and Balancing.

1.6 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:

1. Facility exterior closure (Division 7 and Division 8)
   a. Roofs (Asphalt shingles, flashing & sheet metal, roof specialties, and roof accessories)
   b. Exterior Doors (Emergency exit, and service)
   c. Exterior Windows (Aluminum, glazing)
   d. Sealants (Caulking, mechanical seals, and wind and vapor barriers)
2. Fire Suppression (Division 21)
   a. Fire Protection System Wet-pipe fire suppression, Dry-pipe fire suppression, dry system air compressors and motors
3. Plumbing (Division 22)
   a. Domestic Hot Water systems (Domestic water heaters, hot water circulating pumps and motors, controls, combustion burners/fans/motors).
   b. Storm Sump Pumps (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).
   c. Emergency Plumbing Fixtures (Showers, eye wash stations, water tempering valves, instruments and gages).
4. HVAC (Division 23)
   a. Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).

b. Dehumidification Systems (Energy recovery devices – such as enthalpy wheels, fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).
c. Heating Hot Water Systems (Boilers, controls, instrumentation and gages, flues, heating water pumps and motors, Variable Speed Drives, mixing valves).
d. Chilled Water Systems (Chilled water pumps and motors, Variable Speed Drives, chiller motor/compressor, controls, instrumentation and safeties, isolation valves, blending valves, side stream water cleaners/scrubbers/filters).
e. Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).
f. Direct Digital Control System (BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time).
g. HVAC Water Treatment Systems (Closed circuits – including shot feeders and final water analysis).

5. Electrical (Division 26)
   a. Normal Power Distribution Systems (Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
6. Communications (Division 27)
   a. Facility Telecommunications and Data Distribution Systems.
   b. Public Address and Mass Notification Systems (Amplifiers and head-end hardware, speaker volume, and background noise – i.e. hiss or similar interference).
7. Electronic Safety and Security (Division 28)
   a. Fire Detection and Alarm (Master panel and software, addressable units – i.e. pull stations, flow detectors, hear detectors, etc., controls and alarm functions, horns/bells and other output devices, and fire command center functions –mechanical systems shutdowns).

1.7 COMMISSIONING TEAM

A. Members Appointed by Contractor:

1. Contractor: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
2. 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. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.

B. Members Appointed by VA:
1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.8 VA'S COMMISSIONING RESPONSIBILITIES

A. Appoint an individual, company or firm to act as the Commissioning Agent.
B. 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.
C. Provide the Construction Documents, prepared by Architect-Engineer 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.

1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.
B. 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.

C. 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.

1.10 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.

1.11 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 an 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.

1.12 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 COTR with copies to the Contractor and Architect-Engineer.

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.

1.13 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 90 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CM) 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 90 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) 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.

1.14 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.

1.15 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 will work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information 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 ^{o}C (1.0 ^{o}F) and a resolution of + or - 0.1 ^{o}C (0.2 ^{o}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 when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 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.
         a) The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
         b) 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, CO_2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 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 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.

3.2 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.

3.3 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.

3.4 TRENDING AND ALARMS

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 COTR 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 COTR. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the COTR, 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.

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		
RA 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		
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
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min

Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
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
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
RF-1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
RF-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
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		

Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		
CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
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		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
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

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
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		

4-Pipe 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
Cooling Coil Valve 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 ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

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

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
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		

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
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
				3 days			

Hydronic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HW Pump 2 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 1 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 1 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Flow	AI	15 Minutes	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**
Primary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Primary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Detector	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Exhaust Fan Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Emergency Shutdown	DI	COV	12 Hours	3 days	P	True	1 Min
Primary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Enable	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**
Refrigerant Exhaust Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Outside Air Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Hot Water Supply Temperature	AI	15 Minutes	12 Hours	3 days	P	±5 ^{o}F from SP	10 Min
Hot Water Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Primary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	C	±5% from SP	10 Min
Lead Boiler	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 1 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 2 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 2 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Combustion Air Heater Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Primary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Hot Water System Enable	DO	COV	12 Hours	3 days	N/A		
Combustion Air Unit Command	DO	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Primary Pump 2 Start / Stop	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 COTR 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	1000	20	10	2 sec.

Output				

3.5 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.

3.6 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.
3. 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.
4. 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.

3.7 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.

3.8 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 COTR, 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 21, Division 22, Division 23, Division 26, Division 27,

Division 28, and Division 31 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 Videotapes: Submit two copies within seven days of end of each training module.
   a. Identification: On each copy, provide an applied label with the following information:
      1) Name of Project.
      2) Name and address of photographer
      3) Name of Contractor.
      4) Date videotape was recorded.

5) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

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. 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, fire pumps, and fire suppression systems.
   b. Intrusion detection systems.
   c. Conveying systems, including elevators, wheelchair lifts, escalators, and automated materials handling systems.
   d. Medical equipment, including medical gas equipment and piping.

e. Laboratory equipment, including laboratory air and vacuum equipment and piping.
f. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
g. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
i. switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
j. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
K. Lighting equipment and controls.
l. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
m. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.

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.

- - - E N D - - -

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.

B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

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. Temporary Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL PROTECTION.

F. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.8, INFECTION PREVENTION MEASURES.

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 1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.

C. The Contracting officer Technical Representative will provide a detail to the Contractor of the temporary construction partition to be used.

D. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

E. 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.

F. 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.

G. 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.

H. 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 COTR. 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 COTR’s approval.

I. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

J. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.8 INFECTION PREVENTION MEASURES.

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 COTR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.

D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. 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. Unidentified 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.
   1. Remove light fixtures and recycle light fixture lamps where noted on Drawings, and in manner described in Environmental Protection specifications.

E. 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 COTR. When Utility lines are encountered that are not indicated on the drawings, the COTR shall be notified prior to further work in that area.

3.2 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to COTR. Clean-up shall include off the Medical Center property 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.

- - - E N D - - -

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. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Stairs and ladders: Section 05 51 00, METAL STAIRS AND LADDERS.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:

A. Testing agency retained and reimbursed by the Contractor and approved by the Contracting Officer Technical representative (COTR).

B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology. Accompany request for approval of testing agency with a copy of Report of Latest Inspection of Laboratory Facilities by CCRL.

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.

B. Shop Drawings: Reinforcing steel: Complete shop drawings

C. Mill Test Reports:

1. Reinforcing Steel.
2. Cement.

D. Manufacturer's Certificates:

1. Air-entraining admixture.
2. Chemical admixtures, including chloride ion content.
3. Waterproof paper for curing concrete.
4. Liquid membrane-forming compounds for curing concrete.
5. Non-shrinking grout.
6. Liquid hardener.
7. Waterstops.
8. Expansion joint filler.
9. Adhesive binder.

E. 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.

F. Test Report for Concrete Mix Designs: Trial mixes including water-cement fly ash ratio curves, concrete mix ingredients, and admixtures.

G. Shoring and Reshoring Sequence: Submit for approval a shoring and reshoring sequence for flat slab/flat plate portions, prepared by a registered Professional Engineer. As a minimum, include timing of form stripping, reshoring, number of floors to be re-shored and timing of re-shore removal to serve as an initial outline of procedures subject to modification as construction progresses. Submit revisions to sequence, whether initiated by COTR (see FORMWORK) or Contractor.

H. Test reports on splitting tensile strength (Fct) of lightweight concrete.

1.7 DELIVERY, STORAGE, AND HANDLING:

A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.

B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement and fly ash in separate suitable bins.

C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

1.8 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; lightweight aggregate manufacturer; admixture manufacturers; COTR; A-E; 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.

1.9 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 Concrete Institute (ACI):

117-06.....Tolerances for Concrete Construction and Materials

211.1-02.....Selecting Proportions for Normal, Heavyweight, and Mass Concrete
211.2-04.....Selecting Proportions for Structural Lightweight Concrete
214R-02.....Evaluation of Strength Test Results of Concrete
301-05.....Structural Concrete
304R-2000.....Guide for Measuring, Mixing, Transporting, and Placing Concrete
305R-06.....Hot Weather Concreting
306R-(2002).....Cold Weather Concreting
308R-(2001).....Standard Practice for Curing Concrete
309R-05.....Guide for Consolidation of Concrete
31808.....Building Code Requirements for Reinforced Concrete and Commentary
347R-04.....Guide to Formwork for Concrete
SP-66-04.....ACI Detailing Manual

C. American National Standards Institute and American Hardboard Association (ANSI/AHA):
A135.4-2004.....Basic Hardboard

D. American Society for Testing and Materials (ASTM):
A82/A82M-07.....Steel Wire, Plain, for Concrete Reinforcement
A185/185M-07.....Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A615/A615M-08.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A706/A706M-06.....Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A767/A767M-05.....Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
A775/A775M-07.....Epoxy-Coated Reinforcing Steel Bars
A820-06.....Steel Fibers for Fiber-Reinforced Concrete
A996/A996M-06.....Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
C31/C31M-08.....Making and Curing Concrete Test Specimens in the field
C33-07.....Concrete Aggregates

C39/C39M-05.....Compressive Strength of Cylindrical Concrete Specimens
C94/C94M-07.....Ready-Mixed Concrete
C143/C143M-05.....Slump of Hydraulic Cement Concrete
C150-07.....Portland Cement
C171-07.....Sheet Materials for Curing Concrete
C172-07.....Sampling Freshly Mixed Concrete
C173-07.....Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-07.....Making and Curing Concrete Test Specimens in the Laboratory
C231-08.....Air Content of Freshly Mixed Concrete by the Pressure Method
C260-06.....Air-Entraining Admixtures for Concrete
C309-07.....Liquid Membrane-Forming Compounds for Curing Concrete
C330-05.....Lightweight Aggregates for Structural Concrete
C494/C494M-08.....Chemical Admixtures for Concrete
C496-06.....Splitting Tensile Strength of Cylindrical Concrete Specimens
C567-05.....Density of Structural Lightweight Concrete
C618-08.....Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C666/C666M-03.....Resistance of Concrete to Rapid Freezing and Thawing
C881/C881M-02.....Epoxy-Resin-Base Bonding Systems for Concrete
C1107/1107M-07.....Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
C1315-08 .....Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
D6-95(R2006).....Loss on Heating of Oil and Asphaltic Compounds
D297-93(R2006).....Rubber Products-Chemical Analysis
D1751-04.....Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D4397-02.....Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
E1155-96(R2008).....Determining F_F Floor Flatness and F_L Floor Levelness Numbers

E. American Welding Society (AWS):
D1.4-05.....Structural Welding Code - Reinforcing Steel

F. Concrete Reinforcing Steel Institute (CRSI):
Handbook 2008

G. National Cooperative Highway Research Program (NCHRP):
Report On.....Concrete Sealers for the Protection of Bridge Structures

H. U. S. Department of Commerce Product Standard (PS):
PS 1.....Construction and Industrial Plywood
PS 20.....American Softwood Lumber

I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
CRD C513.....Rubber Waterstops
CRD C572.....Polyvinyl 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. 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 alkalies, and loss on ignition (LOI) not to exceed 5 percent.

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 applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
3. 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. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 µm (No. 100) sieve.

F. Mixing Water: Fresh, clean, and potable.

G. 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.
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.

H. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).

I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.

J. Welded Wire Fabric: ASTM A185.

K. Reinforcing Bars to be Welded: ASTM A706.

L. Cold Drawn Steel Wire: ASTM A82.

M. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m^2 (1.5 pounds per square yard), or square mesh at .6Kg/m^2 (1.17 pounds per square yard).

N. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.

O. Expansion Joint Filler: ASTM D1751.

P. Sheet Materials for Curing Concrete: ASTM C171.

Q. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.

R. Abrasive Aggregate: Aluminum oxide grains or emery grits.

S. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous siliconate solution concrete surface treatment applied the day of the concrete pour in lieu of other curing methods for all concrete slabs receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays .

1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% 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: 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.

T. Penetrating Sealer: For use on parking garage ramps and decks. High penetration silane sealer providing minimum 95 percent screening per National Cooperative Highway Research Program (NCHRP) No. 244 standards for chloride ion penetration resistance. Requires moist (non-membrane) curing of slab.

U. 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.

V. Adhesive Binder: ASTM C881.
1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Bentonite Water Stop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 lbs. per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).
4. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).
5. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
6. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

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. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of COTR 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. COTR 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.

C. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Fly ash may be substituted for up to 20 percent of the minimum cement factor at option of Contractor, except fly ash may not be used in concrete designated as architectural concrete.

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

Concrete Strength		Non-Air-Entrained	Air-Entrained	
25 (3000)[1,2]	300 (500)	*	310 (520)	*

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.
2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.

* Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

D 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)

* 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), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

E. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. 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	

**TABLE IV
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE**

Nominal Maximum size of Total Air Content	Coarse Aggregate, mm's (Inches) Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

F. 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.

G. 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, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

H. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III or Table IV.

I. 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, COTR 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, COTR 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, COTR 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 COTR.

J. Concrete used for elements with thickness greater than 4’-0” shall meet the requirement of Section 8 – Mass Concrete of ACI-301.

2.4 BATCHING AND MIXING:

A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by COTR. 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^{0}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.)

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the COTR for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to

produce concrete of required quality. Representative shall assist and advise COTR.

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 COTR approves their reuse.
   2. Provide forms for concrete footings unless COTR 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. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.

G. 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.

H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, 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. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
   2. 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.
   3. Do not install sleeves in beams, joists or columns except where shown or permitted by COTR. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the COTR, and require no structural changes, at no additional cost to the Government.
   4. 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.
   5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. 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 and ACI 315, 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 315. 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 COTR.
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 COTR, 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 COTR.

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.

3.4 MOISTURE VAPOR EMISSIONS & ALKALINITY CONTROL SEALER:

A. 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, carpet, epoxy coatings and overlays.

B. 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.

1. 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.
2. Spray apply Sealer at the rate of 20 m^2 (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
3. 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 COTR.

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. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.

D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade

beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

E. Install bentonite water stop, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.6 EXPANSION JOINTS:

A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

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 COTR 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.
   1. Preparing surface for applied topping:
      a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
      b. Broom clean and keep base slab wet for at least four hours before topping is applied.
      c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of COTR.

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 it's 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.

F. Concrete used for elements with thickness greater than 4’-0” shall meet the requirements of Section 8 – Mass Concrete of ACI-301.

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 COTR.

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, thiocyantes 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 COTR.

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 COTR.

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 $10m^2/L$ (400 square feet per gallon) on steel troweled surfaces and $7.5m^2/L$ (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.

C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. In addition, for flat slab/plate, reshoring is required immediately after stripping operations are complete and not later than the end of the same day. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

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.
2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by COTR, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
   a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
   b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 µm (No. 30) sieve. Work grout into

surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.

c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.

d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.

4. Textured: Finish as specified. Maximum quantity of patched area 0.2 m^2 (2 square feet) in each 93 m^2 (1000 square feet) of textured surface.

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 COTR 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 COTR 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. 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 COTR from sample panel.

11. 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:
       Slab on Grade:
       Specified overall value F_F 25/F_L 20
       Minimum local value F_F 17/F_L 15
       Level suspended slabs (shored until after testing) and topping slabs:
       Specified overall value FF 25/FL 20
       Minimum local value FF 17/FL 15
       Unshored suspended slabs:
       Specified overall value FF 25
       Minimum local value FF 17
       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:
       Slab on grade:
       Specified overall value FF 36/FL 20
       Minimum local value FF 24/FL 15
       Level suspended slabs (shored until after testing) and topping slabs
       Specified overall value FF 30/FL 20
       Minimum local value FF 24/FL 15
       Unshored suspended slabs:
       Specified overall value FF 30
       Minimum local value FF 24
       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.

12. Measurements
    a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by COTR, to verify compliance with F_F, F_L, 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 F_F and F_L 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.
13. 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.
14. 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 COTR, 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.

C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th m^2 (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.15 APPLIED TOPPING:

A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.

B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.16 RESURFACING FLOORS:

Remove existing flooring areas to receive resurfacing to expose existing structural slab and extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, and dampening. Apply specified bonding grout. Place topping while the bonding grout is still tacky.

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 PRECAST CONCRETE ITEMS:

Precast concrete items, not specified elsewhere. Cast using 25 MPa (3000 psi) air-entrained concrete to shapes and dimensions shown. Finish to match corresponding adjacent concrete surfaces. Reinforce with steel for safe handling and erection.

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SECTION 03 54 13

CEMENTITIOUS SELF-LEVELING FLOOR UNDERLAYMENT

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 cement-based, self-leveling topping for application below interior floor coverings.

B. Related Sections:

1. Division 09 Sections for patching and leveling compounds applied with floor coverings.

1.3 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.2: For priming and sealing coatings, documentation including printed statement of VOC content.

2. Laboratory Test Reports for Credit IEQ 4: For priming and sealing coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

C. Fire-Resistance Ratings: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

D. Sound Transmission Characteristics: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for STC and IIC ratings per ASTM E 90 and ASTM E 492 by a qualified testing agency.

1.6 DELIVERY, STORAGE AND HANDLING

A. General Requirements: Materials shall be delivered in their original, unopened packages, and protected from exposure to the elements. Damaged or deteriorated materials shall be removed from the premises.

1.7 SITE CONDITIONS

A. Environmental Requirements: Before, during and after installation of Level-Right, building interior shall be enclosed and maintained at a temperature above 50 degrees F (10 degrees C) and below 100 degrees F (37.7 degrees C) until structure and subfloor temperature are stabilized.

1.8 COORDINATION

A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, specified in Division 09 Sections, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cementitious Self-Leveling Poured Floor Underlayment: Floor underlayment compound shall be self-leveling.

B. Sand Aggregate: Sand shall be silica aggregate.

C. Mix Water: Potable, free from impurities.

D. Subfloor Primer: As recommended by the manufacturer.

E. Sealer: As recommended by the manufacturer.

F. Wood Subfloor Sealer: Surface Conditioner, Acrylic, Overspray or use a slip sheet.

G. Mesh Reinforcement: 2.5 or 3.4 lb/sq yd galvanized diamond metal lath Crack Suppression Mat.

2.2 MIX DESIGNS

A. General Requirements: Mix proportions and methods shall be in strict accordance with product manufacturer recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition and Cleaning of Wooden Subfloor: The wooden subfloor must be fully secured, nailed or screwed, structurally sound and broom clean. Deflection shall not exceed L/360th of the span including live and dead loads. Fill cracks and holes in the floor with crack filler or caulk.

B. Seal the Wooden Subfloor: The day before the pour, seal the wood with 1-2 coats of Surface Conditioner, acrylic or overspray diluted 1:1 with water sprayed, rolled or broomed on at 300 sq. ft./gal (7.3 m^2/L), or staple a slip sheet across the entire wood floor.

C. Prime the Wooden Subfloor: The wood subfloor must be primed. Prime the sealed subfloor with a primer per manufacturer’s recommendation. If a slip sheet is used, the subfloor does not have to be primed.

D. Mesh Reinforcement: Staple the galvanized diamond metal lath mesh or crack Suppression Mat to the subfloor, overlapping the seams where they meet. This is done across the entire floor.

E. Expansion Joints: Allow joints to continue through at the same width.

3.2 APPLICATION OF SELF-LEVELING FLOORING

A. Scheduling: Application shall not begin until the building is enclosed, including roof, windows, doors, and other fenestration. Install after drywall installation unless tenant finish requirements identify partitioning after the pour.

B. Application: Place Level-Right at 1-1/2″ minimum over the surface of the wooden subfloor. Spread and screed to a smooth surface. Except at authorized joints, place as continuously as possible until application is complete so that no slurry is placed against product that has obtained its initial set.

C. Drying: General Contractor shall provide continuous ventilation and adequate heat. Floor goods can be installed once product passes a moisture test.

3.4 PREPARATION FOR INSTALLATION OF GLUE DOWN FLOOR GOODS

A. Sealing: Seal all areas that receive glue down floor goods with overspray according to manufacturer’s specifications. Any floor areas where the surface has been damaged shall be cleaned and sealed regardless of floor covering to be used. Where floor goods manufacturers require special adhesive or installation systems, their requirements supersede these recommendations.

B. Floor Goods Procedures: Per manufacturer’s recommendations.

3.5 FIELD QUALITY CONTROL

A. Slump Test: Level-Right mix shall be tested for slump as it is being pumped using a 2 inch by 4 inch (50 mm by 101 mm) cylinder resulting in a patty size of 9 1/2 inches (241 mm) plus or minus 1 inch (25 mm) diameter.

B. Field Samples: At least one set of 3 molded cube samples shall be taken from each day's pour during the Level-Right application. Cubes shall be tested as recommended by the manufacturer in accordance with modified ASTM C 109. Test results shall be available to architect and/or contractor upon request from applicator.

3.6 PROTECTION

A. Protection from Heavy Loads: During construction, place temporary wood planking wherever it will be subject to heavy wheeled or concentrated loads.

- - -END - - -

SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Section specifies mortar materials and mixes.

1.2 RELATED WORK:

A. Mortar used in Section:
   1. Section 04 05 16, MASONRY GROUTING.
   2. Section 04 05 20, UNIT MASONRY.

B. Mortar Color: As selected from submitted samples.

1.3 TESTING LABORATORY-CONTRACTOR RETAINED

A. Engage a commercial testing laboratory approved by Contracting Officer Technical Representative (COTR) to perform tests specified below.

B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to COTR.

1.4 TESTS

A. Test mortar and materials specified.

B. Certified test reports.

C. Identify materials by type, brand name and manufacturer or by origin.

D. Do not use materials until laboratory test reports are approved by COTR.

E. After tests have been made and materials approved, do not change without additional test and approval of COTR.

F. Testing:
   1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
   2. Mortar:
      a. Test for compressive strength and water retention; ASTM C270.
      b. Mortar compressive strengths 28 days as follows:
         Type M: Minimum 17230 kPa (2500 psi) at 28 days.
         Type S: Minimum 12400 kPa (1800 psi) at 28 days.
         Type N: Minimum 5170 kPa (750 psi) at 28 days.
   3. Cement:
      a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
      b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
   4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

G. During progress of work, testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES, takes and tests samples as specified in that section. Testing procedures and test methods in ASTM C780.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Certificates:

1. Testing laboratory's facilities and qualifications of its technical personnel.
2. Indicating that following items meet specifications:
   a. Portland cement.
   b. Masonry cement.
   c. Mortar cement.
   d. Hydrated lime.
   e. Fine aggregate (sand).

C. Laboratory Test Reports:

1. Mortar, each type.
2. Admixtures.

D. Manufacturer's Literature and Data:

1. Cement, each kind.
2. Hydrated lime.
3. Admixtures.
4. Liquid acrylic resin.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.

B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.

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

C40-04.....Organic Impurities in Fine Aggregates for Concrete
C91-05.....Masonry Cement
C109-07.....Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens)
C144-04.....Aggregate for Masonry Mortar
C150-05.....Portland Cement

C207-06.....Hydrated Lime for Masonry Purposes
C270-07.....Mortar for Unit Masonry
C307-03.....Tensile Strength of Chemical - Resistant Mortar, Grouts, and Monolithic Surfacing
C321-00/R05.....Bond Strength of Chemical-Resistant Mortars
C348-02.....Flexural Strength of Hydraulic Cement Mortars
C595-08.....Blended Hydraulic Cement
C780-07.....Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C979-05.....Pigments for Integrally Colored Concrete
C1329-05.....Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

A. ASTM C144 and as follows:
   1. Light colored sand for mortar for laying unit masonry.
   2. White plastering sand meeting sieve analysis for mortar joints for pointing and laying of structural facing tile units except that 100 percent passes No. 8 sieve, and not more than 5 percent retained on No. 16 sieve.

B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

2.3 BLENDED HYDRAULIC CEMENT

A. ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT

A. ASTM C91. Type N, S, or M.

2.5 MORTAR CEMEMT

A. ASTM C1329, Type N, S or M.

2.6 PORTLAND CEMENT

A. ASTM C150, Type I.

2.7 LIQUID ACRYLIC RESIN

A. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

2.8 WATER

A. Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.9 MASONRY MORTAR

A. Conform to ASTM C270.

B. Admixtures:

1. Do not use mortar admixtures, unless approved by COTR.
2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
3. Do not use antifreeze compounds.

2.10 HIGH BOND MORTAR

A. Mixture by volume, one-part Portland cement, 1/4-part hydrated lime, three-parts sand, water, and liquid acrylic resin.

B. Mortar properties when tested in accordance with referenced specifications.

1. Compressive Strength, ASTM C109: Minimum 19,305 kPa (2800 psi), using 50 mm (2 inch) cubes.
2. Tensile Strength, ASTM C307: 3861 kPa Minimum (560 psi), using the 25mm (1 inch) briquettes.
3. Flexural Strength, ASTM C348: Minimum 6067 kPa (880 psi), using flexural bar.
4. Bond Strength, ASTM C321: Minimum 2965 kPa (430 psi), using crossed brick.

PART 3 - EXECUTION

3.1 MIXING

A. Mix in a mechanically operated mortar mixer.

1. Mix mortar for at least three minutes but not more than five minutes.

B. Measure ingredients by volume. Measure by the use of a container of known capacity.

C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.

D. Mortar that has stiffened because of loss of water through evaporations:

1. Re-tempered by adding water to restore to proper consistency and workability.
2. Discard mortar that has reached its initial set or has not been used within two hours.

E. Pointing Mortar:

1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.
2. Allow mortar to stand in dampened condition for one to 1-1/2 hours.

3. Add water to bring mortar to a workable consistency prior to application.

3.2 MORTAR USE LOCATION

A. Use Type M mortar for precast concrete panels and waterproof parging below grade.

B. Use Type S mortar for masonry below grade.

C. Use Type N mortar for other masonry work, except as otherwise specified.

- - - E N D - - -

SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Section specifies grout materials and mixes.

1.2 RELATED WORK:

A. Grout used in Section:
   1. Section 04 05 13, MASONRY MORTARING.
   1. Section 04 20 00, UNIT MASONRY.

1.3 TESTS:

A. Test grout and materials specified.
B. Certified test reports.
C. Identify materials by type, brand name and manufacturer or by origin.
D. Do not use materials until laboratory test reports are approved by the Contracting Officer Technical Representative (COTR).
E. After tests have been made and materials approved, do not change without additional test and approval of COTR.
F. Testing:
   1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
   2. Grout:
      a. Test for compressive strength; ASTM C1019.
      b. Grout compressive strength of 13790 kPa (2000 psi) at 28 days.
   3. Cement:
      a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
   4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Certificates:
   1. Indicating that following items meet specifications:
      a. Portland cement.
      b. Masonry cement.
      c. Grout.
      d. Hydrated lime.

e. Fine aggregate (sand).

f. Coarse aggregate for grout.

C. Laboratory Test Reports:

1. Grout, each type.

2. Admixtures.

D. Manufacturer's Literature and Data:

1. Cement, each kind.

2. Hydrated lime.

3. Admixtures.

4. Liquid acrylic resin.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.

B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.6 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.

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

C40-04.....Organic Impurities in Fine Aggregates for Concrete

C91-05.....Masonry Cement

C150-05.....Portland Cement

C207-06.....Hydrated Lime for Masonry Purposes

C404-07.....Aggregate for Masonry Grout

C476-07.....Grout for Masonry

C595-08.....Blended Hydraulic Cement

C979-05.....Pigments for Integrally Colored Concrete

C1019-05.....Sampling and Testing Grout

PART 2 - PRODUCTS

2.1 HYDRATED LIME:

A. ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY GROUT:

A. ASTM C404, Size 8.

2.3 BLENDED HYDRAULIC CEMENT:

A. ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT:

A. ASTM C91. Type N, S, or M.

2.5 PORTLAND CEMENT:

A. ASTM C150, Type I.

2.6 LIQUID ACRYLIC RESIN:

A. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

2.7 WATER:

A. Potable, free of substances that are detrimental to grout, masonry, and metal.

2.8 GROUT:

A. Conform to ASTM C476 except as specified.

B. Grout type proportioned by volume as follows:

1. Fine Grout:
   a. Portland cement or blended hydraulic cement: one part.
   b. Hydrated lime: 0 to 1/10 part.
   c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
2. Coarse Grout:
   a. Portland cement or blended hydraulic cement: one part.
   b. Hydrated lime: 0 to 1/10 part.
   c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
   d. Coarse aggregate: one to two times sum of volumes of cement and lime used.
3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

PART 3 - EXECUTION

3.1 MIXING:

A. Mix in a mechanically operated grout mixer.
   1. Mix grout for at least five minutes.

B. Measure ingredients by volume. Measure by the use of a container of known capacity.

C. Mix water with grout dry ingredients in sufficient amount to bring grout mixture to a pouring consistency.

3.2 GROUT USE LOCATIONS:

A. Use fine grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is 50 mm (2 inches) or less.

B. Use either fine grout or coarse grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is greater than 50 mm (2 inches).

C. Do not use grout for filling bond beam or lintel units.

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SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for construction of masonry unit walls.

1.2 RELATED WORK

A. Mortars and grouts: Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.
B. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
C. Cavity insulation: Section 07 21 13, THERMAL INSULATION.
D. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
E. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.
F. Color and texture of masonry units: 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. Face brick, sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
   2. Concrete masonry units, when exposed in finish work.
   3. Anchors, and ties, one each and joint reinforcing 1200 mm (48 inches) long.
C. Shop Drawings:
   1. Special masonry shapes.
   2. Drawings, showing reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
   3. Ceramic glazed structural facing tile or concrete masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
   4. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

D. Certificates:
   1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
   2. Indicating that the following items meet specification requirements:
      a. Face brick.
      b. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
   3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.

E. Laboratory Test Reports:
   1. Brick for pre-built masonry panels.
   2. Ceramic glazed facing brick.

F. Manufacturer's Literature and Data:
   1. Anchors, ties, and reinforcement.
   2. Shear keys.
   3. Reinforcing bars.

1.4 SAMPLE PANEL

A. Before starting masonry, lay up a sample panel in accordance with Masonry Standards Joint Committee (MSJC) and Brick Industry Association (BIA).
   1. Use masonry units from random cubes of units delivered on site.
   2. Include reinforcing, ties, and anchors.

B. Use sample panels approved by Contracting Officer Technical Representative (COTR) for standard of workmanship of new masonry work.

C. Use sample panel to test cleaning methods.

1.5 WARRANTY

Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

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. American Society for Testing and Materials (ASTM):
   A951-06.....Steel Wire for Masonry Joint Reinforcement.
   A615/A615M-07.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

A675/A675M-03.....Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical PropertiesC34-03 Structural Clay Load-Bearing Wall Tile
C55-06.....Concrete Building Brick
C56-05.....Structural Clay Non-Load-Bearing Tile
C62-05.....Building Brick (Solid Masonry Units Made From Clay or Shale)
C67-07.....Sampling and Testing Brick and Structural Clay Tile
C90-06.....Load-Bearing Concrete Masonry Units
C126-99.....Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
C216-07.....Facing Brick (Solid Masonry Units Made From Clay or Shale)
C476-02.....Standard Specification for Grout for Masonry
C612-04.....Mineral Fiber Block and Board Thermal Insulation
C744-05.....Prefaced Concrete and Calcium Silicate Masonry Units.
D1056-07.....Flexible Cellular Materials - Sponge or Expanded Rubber
D2000-06.....Rubber Products in Automotive Applications
D2240-05.....Rubber Property - Durometer Hardness
D3574-05.....Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams
F1667-05.....Fasteners: Nails, Spikes and Staples

C. Masonry Industry Council:
All Weather Masonry Construction Manual, 2000.

D. American Welding Society (AWS):
D1.4-05 Structural Welding Code – Reinforcing Steel.

E. Federal Specifications (FS):
FF-S-107C-00.....Screws, Tapping and Drive

F. Brick Industry Association - Technical Notes on Brick Construction (BIA):
11-1986.....Guide Specifications for Brick Masonry, Part I
11A–1988.....Guide Specifications for Brick Masonry, Part II
11B–1988.....Guide Specifications for Brick Masonry, Part III Execution
11C-1998.....Guide Specification for Brick Masonry Engineered Brick Masonry, Part IV

11D-1988.....Guide Specifications for Brick Masonry
Engineered Brick Masonry, Part IV continued

G. Masonry Standards Joint Committee; Specifications for Masonry Structures (ACI 530.1-05/ASCE 6-05/TMS 602-99) (MSJC).

PART 2 - PRODUCTS

2.1 BRICK

A. Face Brick:
   1. ASTM C216, Grade SW, Type FBS.
   2. Brick when tested in accordance with ASTM C67: Classified slightly efflorescent or better.
   3. Size:
      a. Modular
      b. Thin Brick: 13 mm (1/2 inch) thick with angle shapes for corners.

B. Building Brick: ASTM C62, Grade MW for backup and interior work; Grade SW where in contact with earth.

C. Ceramic Glazed Facing Brick: ASTM C126; Grade S, Type I (single-faced units) where only one face is exposed; Grade S, Type II (two-faced units) where two opposite finished faces are exposed.

2.2 CONCRETE MASONRY UNITS

A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
   1. Unit Weight: Normal weight.
   2. Fire rated units for fire rated partitions.
   3. Sizes: Modular.
   4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
   5. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (one inch) minimum radius rounded vertical exterior corners (bullnose units).

B. Concrete Brick: ASTM C55.

2.3 SHEAR KEYS

A. ASTM D2000, solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with a durometer hardness of approximately 80 when tested in accordance with ASTM D2240, and a minimum shear strength of 3.5 MPa (500 psi).

B. Shear key dimensions: Approximately 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

2.4 REINFORCEMENT:

A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60) for bars No. 10 to No. 57 (No. 3 to No. 18), except as otherwise indicated.

B. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

C. Joint Reinforcement:

1. Form from wire complying with ASTM A951.
2. Galvanized after fabrication.
3. Width of joint reinforcement 40 mm (1 5/8-inches) less than nominal width of masonry wall or partition.
4. Cross wires welded to longitudinal wires.
5. Joint reinforcing at least 3000 mm (10 feet) in length.
6. Joint reinforcing in rolls is not acceptable.
7. Joint reinforcing that is crimped to form drip is not acceptable.
8. Maximum spacing of cross wires 400 mm (16 inches) to longitudinal wires.
9. Ladder Design: See Drawings.

2.5 ANCHORS, TIES, AND REINFORCEMENT

A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.

B. Joint Reinforcement:

1. Form from wire complying with ASTM A951.
2. Galvanized after fabrication.
3. Width of joint reinforcement 40 mm (0.16 inches) less than nominal width of masonry wall or partition.
4. Cross wires welded to longitudinal wires.
5. Joint reinforcement at least 3000 mm (10 feet) in length.
6. Joint reinforcement in rolls is not acceptable.
7. Joint reinforcement that is crimped to form drip is not acceptable.
8. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
9. Ladder Design: See Drawings.

C. Adjustable Veneer Anchor for Frame Walls:

1. Two piece, adjustable anchor and tie.
2. Anchor and tie may be either type; use only one type throughout.
3. Loop Type:
   a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
   b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage the

anchor and be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer.

4. Angle Type:
   a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
   b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:
   1. Corrugated steel dovetail anchors formed of 1.5 mm (0.0598 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
   2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend at least 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
   3. Form dovetail anchor slots from 0.6 mm (0.0239 inch) thick galvanized steel (with felt or fiber filler).

E. Individual ties:
   1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to a rectangular shape not less than 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not permitted.
   2. Adjustable Cavity Wall Ties:
      a. Adjustable wall ties may be used at Contractor's option.
      b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
      c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
      d. Form one piece to a rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into the bed joint 50 mm (2 inches).
      e. Form the other piece to a 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having a 75 mm (3 inch) long bent section for engaging the 105 mm (4-1/8 inch) wide piece to form adjustable connection.

F. Wall Ties, (Mesh or Wire):
   1. Mesh wall ties formed of ASTM A82, W0.5, 2 mm, (16 gage) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
   2. Rectangular wire wall ties formed of W1.4, 3 mm, (9 gage) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

G. Corrugated Wall Tie:
   1. Form from 1.5 mm (0.0598 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths so as to extend at least 100 mm (4 inches) into joints of new masonry plus 38 mm (1-1/2 inch) turn-up.
   2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.

H. Ridge Wall Anchors:
   1. Form from galvanized steel not less than 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
   2. Other lengths as shown.

2.6 PREFORMED COMPRESSIBLE JOINT FILLER

A. Thickness and depth to fill the joint as specified.

B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.

C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

2.7 ACCESSORIES

A. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.

B. Box Board:
   1. Mineral Fiber Board: ASTM C612, Class 1.
   2. 25 mm (1 inch) thickness.
   3. Other spacing material having similar characteristics may be used subject to the COTR's approval.

C. Masonry Cleaner:
   1. Detergent type cleaner selected for each type masonry used.
   2. Acid cleaners are not acceptable.
   3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

D. Fasteners:
   1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
   2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
   3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Protection:
   1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
   2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.

B. Cold Weather Protection:
   1. Masonry may be laid in freezing weather when methods of protection are utilized.
   2. Comply with MSJC and “Hot and Cold Weather Masonry Construction Manual”.

3.2 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:

B. Maximum variation from plumb:
   1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
   2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
   3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).

C. Maximum variation from level:
   1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
   2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).

D. Maximum variation from linear building lines:
   1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
   2. In 12 000 mm (40 feet) or more - 19 mm (3/4 inch).

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
   1. Minus 6 mm (1/4 inch).
   2. Plus 13 mm (1/2 inch).

F. Maximum variation in prepared opening dimensions:
   1. Accurate to minus 0 mm (0 inch).
   2. Plus 6 mm (1/4 inch).

3.3 INSTALLATION GENERAL

A. Keep finish work free from mortar smears or spatters, and leave neat and clean.

B. Anchor masonry as specified in Paragraph, ANCHORAGE.

C. Wall Openings:
   1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.

2. If items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:
   1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
   2. Tool while mortar is soft enough to be compressed into joints and not raked out.
   3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
   4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:
   1. Extend partitions at least 100 mm (four inches) above suspended ceiling or to overhead construction where no ceiling occurs.
   2. Extend following partitions to overhead construction.
      a. Where noted smoke partitions, FHP (full height partition), and FP (fire partition) and smoke partitions (SP) on drawings.
      b. Both walls at expansion joints.
      c. Corridor walls.
      d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
      e. Walls at refrigerator space.
      g. Reinforced masonry partitions
   3. Extend finish masonry partitions at least four-inches above suspended ceiling and continue with concrete masonry units or structural clay tile to overhead construction:

F. Lintels:
   1. Lintels are not required for openings less than 1000 mm (3 feet 4 inches) wide that have hollow metal frames.
   2. Openings 1025 mm (3 feet 5 inches) wide to 1600 m (5 feet 4 inches) wide with no structural steel lintel or frames, require a lintel formed of concrete masonry lintel or bond beam units or structural facing tile lintel units filled with grout per ASTM C476 and reinforced with 1- #15m (1-#5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
   3. Precast lintels of 25 Mpa (3000 psi) concrete, of same thickness as partition, and with one Number 5 deformed bar top and bottom for each 100 mm (4 inches) of nominal thickness, may be used in lieu of reinforced CMU masonry lintels.

4. Use steel lintels, for openings over 1600 m (5 feet 4 inches) wide, brick masonry, and elevator openings unless shown otherwise.
5. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
6. Length for minimum bearing of 100 mm (4 inches) at ends.
7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.

G. Wall, Furring, and Partition Units:
1. Lay out field units to provide for running bond of walls and partitions, with vertical joints in second course centering on first course units unless specified otherwise.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Use no piece shorter than 100 mm (4 inches) long.
5. On interior partitions provide a 6 mm (1/4 inch) open joint for caulking between exterior walls, concrete work, and abutting masonry partitions.
6. Use not less than 100 mm (4 inches) nominal thick masonry for free standing furring unless shown otherwise.
7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

H. Use not less than 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless shown otherwise.

I. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

J. Chases:
1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
2. Masonry 100 mm (4 inch) nominal thick may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
3. Full recess chases after installation of conduit, with mortar and finish flush.
4. When pipes or conduits, or both occur in hollow masonry unit partitions retain at least one web of the hollow masonry units.

K. Wetting and Wetting Test:
1. Test and wet brick or clay tile in accordance with BIA 11B.

2. Do not wet concrete masonry units or glazed structural facing tile before laying.

L. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

M. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

N. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

O. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.

1. 10 days for girders and beams.
2. 7 days for slabs.
3. 7 days for reinforced masonry soffits.

3.4 ANCHORAGE

A. Veneer to Frame Walls:

1. Use adjustable veneer anchors.
2. Fasten anchor to stud through sheathing with self drilling and tapping screw, one at each end of loop type anchor.
3. Space anchors not more than 400 mm (16 inches) on center vertically at each stud.

B. Veneer to Concrete Walls:

1. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
2. Anchor new masonry facing to existing concrete with corrugated wall ties spaced at 400 mm, (16 inch) maximum vertical intervals, and at 600 mm (2 feet) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.

C. Masonry Facing to Backup and Cavity Wall Ties:

1. Use individual ties for new work.
2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 600 mm (2 feet) horizontally.
3. At openings, provide additional ties spaced not more than 900 mm (3 feet) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
4. Anchor new masonry facing to existing masonry with corrugated wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at

every second masonry unit horizontally. Fasten ties to masonry with masonry nails.

5. Option: Use joint reinforcing for multiple wythes and cavity wall ties spaced not more than 400 mm (16 inches) vertically.
6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals not to exceed 600 mm (24 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

D. Anchorage of Abutting Masonry:

1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (2 foot) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with corrugated wall ties. Extend ties at least 100 mm (4 inches) into joints of new masonry. Fastened to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

3.5 REINFORCEMENT

A. Joint Reinforcement:

1. Use as joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing may be used in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Brick veneer over frame backing walls does not require joint reinforcement.
4. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.

5. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry, except where other type anchors are required for anchorage of masonry to concrete structure.
6. Joint reinforcement is required in every other course of stack bond CMU masonry.
7. Wherever brick masonry is backed up with stacked bond masonry, joint reinforcement is required in every other course of CMU backup, and in corresponding joint of facing brick.

B. Steel Reinforcing Bars:
1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.
2. Use grade 60 bars if not specified otherwise.
3. Bond Beams:
   a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#15m (#5) reinforcing steel unless shown otherwise. Do not cut reinforcement.
   b. Brake bond beams only at expansion joints and at control joints, if shown.
4. Stack Bond:
   a. Locate additional joint reinforcement in vertical and horizontal joints as shown.
   b. Anchor vertical reinforcement into the foundation or wall or bond beam below and hold in place.
   c. Provide temporary bracing for walls over 8 ft. tall until permanent horizontal bracing is completed.
5. Grout openings:
   a. Leave cleanout holes in double wythe walls during construction by omitting units at the base of one side of the wall.
   b. Locate 75 mm x 75 mm (3 in. x 3 in.) min. clean-out holes at location of vertical reinforcement.
   c. Keep grout space clean of mortar accumulation and sand debris. Clean the grout space every day using a high pressure jet stream of water, or compressed air, or industrial vacuum, or by laying wood strips on the metal ties as the wall is built. If wood strips are used, lift strips with wires as the wall progresses and before placing each succeeding course of wall ties.

3.6 BRICK EXPANSION AND CMU CONTROL JOINTS.

A. Provide brick expansion (BEJ) and CMU control (CJ) joints where shown on drawings.

B. Keep joint free of mortar and other debris.

C. Where joints occur in masonry walls.

1. Install preformed compressible joint filler in brick wythe.
2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
3. Install filler, backer rod, and sealant on exposed faces.

D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint

E. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.

F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 BUILDING EXPANSION AND SEISMIC JOINTS

A. Keep joint free of mortar. Remove mortar and other debris.

B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.

C. Where joints are on exposed faces, provide depth for backer rod and sealant as specified in Section 07 92 00, JOINT SEALANTS, unless shown otherwise.

3.8 ISOLATION SEAL

A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.

B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.

C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.

3.9 BRICKWORK

A. Lay clay brick in accordance with BIA Technical Note 11 series.

B. Laying:

1. Lay brick in running bond with course of masonry bonded at corners unless shown otherwise.

2. Maintain bond pattern throughout.
3. Do not use brick smaller than half-brick at any angle, corner, break or jamb.
4. Where length of cut brick is greater than one half but less than a whole brick, maintain the vertical joint location of such units.
5. Lay exposed brickwork joints symmetrical about center lines of openings.
6. Do not structural bond multi wythe brick walls unless shown.
7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
8. Lay brick for sills with wash and drip.
9. Build solid brickwork as required for anchorage of items.

C. Joints:
1. Exterior and interior joint widths: Lay for three equal joints in 200 mm (eight inches) vertically, unless shown otherwise.
2. Rake joints for pointing with colored mortar when colored mortar is not full depth.
3. Arches:
   a. Flat arches (jack arches) lay with camber of 1 in 200 (1/16 inch per foot) of span.
   b. Face radial arches with radial brick with center line of joints on radial lines.
   c. Form Radial joints of equal width.
   d. Bond arches into backing with metal ties in every other joint.

D. Weep Holes:
1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in the wall.
2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.

E. Cavity Type Exterior Walls:
1. Keep air space clean of mortar accumulations and debris.
   a. Clean cavity by use of hard rubber, wood or metal channel strips having soft material on sides contacting wythes.
   b. Lift strips with wires before placing next courses of horizontal joint reinforcement or individual ties or adjustable cavity wall ties.

2. For each lift lay two courses of concrete masonry units, followed by six courses of brick facing.
3. Insulated Cavity Type Exterior Walls:
   a. Install the insulation against the cavity face of inner masonry wythe.
   b. Place insulation between rows of ties or joint reinforcing or bond to masonry surface with a bonding agent as recommended by the manufacturer of the insulation.
   c. Lay the outer masonry wythe up with an air space between insulation and masonry units.
4. Veneer Framed Walls:
   a. Build with 100 mm (4 inches) of face brick over sheathed stud wall with air space.
   b. Keep air space clean of mortar accumulations and debris.

3.10 CONCRETE MASONRY UNITS

A. Kind and Users:
1. Provide special concrete masonry shapes as required. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not use brick jambs in exposed finish work.
5. Use concrete building brick only as filler in backup material where not exposed.
6. Masonry assemblies shall meet the required fire resistance in fire rated partitions of type and construction that will provide fire rating as shown.
7. Where lead lined concrete masonry unit partitions terminate below the underside of overhead floor or roof deck, fill the remaining open space between the top of the partition and the underside of the overhead floor or roof deck, with standard concrete masonry units of same thickness as the lead lined units.

B. Laying:
1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
2. Do not wet concrete masonry units before laying.

3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Provide a 6 mm (1/4 inch) open joint for caulking between exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes shown.
12. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
13. Steel reinforcement in place before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
16. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.
17. Reinforcement shall be fully encased by grout or concrete.
18. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
19. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
20. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
21. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.

3.11 POINTING

A. Fill joints with pointing mortar using rubber float trowel to rub mortar solidly into raked joints.

B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.

C. Finish exposed joints in finish work with a jointing tool to provide a smooth concave joint unless specified otherwise.

3.12 GROUTING

A. Preparation:
   1. Clean grout space of mortar droppings before placing grout.
   2. Close cleanouts.
   3. Install vertical solid masonry dams across grout space for full height of wall at intervals of not more than 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
   4. Verify reinforcing bars are in cells of units or between wythes as shown.

B. Placing:
   1. Place grout by hand bucket, concrete hopper, or grout pump.
   2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
   3. Do not slush with mortar or use mortar with grout.
   4. Interruptions:
      a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inch) below top of last masonry course.
      b. Grout from dam to dam on high lift method.
      c. A longitudinal run of masonry may be stopped off only by raking back one-half a masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

C. Puddling Method:
   1. Double wythe masonry constructed grouted in lifts not to exceed 300 mm (12 inches) or less than 50 mm (2 inches) wide.
   2. Consolidate by puddling with a grout stick during and immediately after placing.
   3. Grout the cores of concrete masonry units containing the reinforcing bars solid as the masonry work progresses.

D. Low Lift Method:
   1. Construct masonry to a height of 1.5 m (5 ft) maximum before grouting.
   2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:
   1. Do not pour grout until masonry wall has properly cured a minimum of 4 hours.
   2. Place grout in lifts not exceeding 1.5 m (5 ft).

3. Exception:
   Where the following conditions are met, place grout in lifts not exceeding 3.86 m (12.67 ft).
   a. The masonry has cured for at least 4 hours.
   b. The grout slump is maintained between 254 and 279 mm (10 and 11 in).
   c. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into the preceding lift to close any shrinkage cracks or separation from the masonry units.

3.13 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.

C. Splice reinforcement bars where shown; do not splice at other places unless accepted by the COTR. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

D. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.

E. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.

F. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated “L” and “T” sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

G. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.

H. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

3.14 INSTALLATION OF REINFORCED BRICK MASONRY

A. Mortar Jointing and Bedding:

1. Pattern Bond: Lay exterior wythes in the pattern bond shown, or if not shown, lay in 1/2 running bond with vertical joints in each course centered on units in courses above and below. Lay inner wythes (if any) with all units in a wythe bonded by lapping not less than 50 mm (2 inches). Bond and interlock each course of each wythe at corners and intersections. Do not use units with less than 100 mm (4 inch) nominal horizontal face dimension at corners or jambs.
2. Lay exterior wythes with bed (horizontal) and head (vertical) joints between units completely filled with mortar. Top of bed joint mortar may be sloped toward center of walls. Butter ends of units with sufficient mortar to completely fill head joints and shove into place. Do not furrow bed joints or slush head joints. Remove any mortar fins which protrude into grout space.
3. Maintain joint widths shown for head and bed joints, except for minor variations required to maintain pattern bond. If not shown, lay with 10 mm (3/8 inch) head and bed joints.
4. Maintain joint widths shown for head and bed joints, but adjust thickness of bed joints, if required, to allow for not less than 6 mm (1/4 inch) thickness of mortar between reinforcement and masonry units, except 6 mm (1/4 inch) bars (if any) may be laid in 13 mm (1/2 inch) thick bed joints and 4.9 mm diameter (6 gage) or smaller wire reinforcing (if any) may be laid in 10 mm (3/8 inch) thick bed joints.

B. Limit extent of masonry construction to sections which do not exceed the maximum pour requirements specified hereafter. Provide temporary dams or barriers to control horizontal flow of grout at ends of wall sections. Build dams full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completion of grout pour.

C. Low-Lift Grouting:

1. Use Low-Lift grouting technique with “Fine Grout” per ASTM C476.
2. At Contractor’s option, low-lift grouting technique may be used for reinforced masonry construction with grout spaces wider than 50 mm (2

inches), except use “Coarse Grout” mix per ASTM C476 and place in lifts not to exceed 200 mm (8 inches) in height.

3. Construct low-lift masonry by placing reinforcement, laying masonry units and pouring grout as the work progresses.
4. Place vertical reinforcement bars and supports prior to laying of masonry units. Extend above elevation of maximum pour height as required to allow for splicing. Horizontal reinforcement bars may be placed progressively with laying of masonry units.
5. Limit grout pours as required to prevent displacement of masonry by grout pressures (blowout), but do not exceed 1220 mm (4 feet) pour height.
6. Lay masonry units prior to each grout pour, but do not construct more than 300 mm (12 inches) above maximum grout pour height in one exterior wythe and 100 mm (4 inches) above in other exterior wythe. Provide metal wall ties if required to prevent blowouts.
7. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 38 mm (1 1/2 inches) below top of highest course in pour.

D. High-Lift Grouting:

1. Walls: Omit every other masonry unit in first course of one wythe to provide cleanout holes. Tie wythes together with metal ties as shown or as required by code, but provide not less than 3.8 mm diameter (9 gage) wire ties spaced not more than 600 mm (24 inches) o.c. horizontally and 400 mm (16 inches) o.c. vertically for running pattern bond or 300 mm (12 inches) o.c. vertically for stack bond (if any).
2. Columns, Piers and Pilasters: Omit every other masonry unit around perimeter of member to provide cleanout holes. Provide reinforcing bands placed in bed joints as the masonry work progresses. Provide bands of the size and vertical spacing show, or as required by code, but not less than 3.8 mm diameter (9 gage) wire spaced 300 mm (12 inches) o.c. vertically.
3. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dirt, dust, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper positioning. Clean top surface of structural members supporting masonry to ensure bond. After cleaning

and inspection, close cleanout holes with matching masonry units and brace closures to resist grout pressures.

4. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure, but not less than 3 days curing time. Install shores and bracing, if required, before starting grouting operations.
5. Place grout by pumping into grout spaces, unless alternate methods are acceptable to COTR.
6. Use “Coarse Grout” per ASTM C476. Rod or vibrate each grout lift during placing and again after excess moisture has been absorbed, but before plasticity is lost. Do not penetrate or damage grout placed in previous lifts or pours.
7. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Limit pours so as not to exceed the capacity of masonry to resist displacement or loss of mortar bond due to grout pressures.
8. Do not exceed 3600 mm (12 foot) pour height.
9. Do not exceed 7600 mm (25 foot) horizontal pour dimension.
10. Where pour height exceeds 1220 mm (4 feet), place grout in a series of lifts not exceeding 1220 mm (4 feet) height. Place each lift as a continuous pouring operation. Allow not less than 30 minutes, nor more that one hour between lifts of a given pour.
11. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, remove temporary dams (if any), and lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence, if more pours are required.

3.15 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. Do not wet concrete masonry units (CMU).
B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 10 mm (3/8 inch) joints.
C. Where solid CMU units are shown, lay with full mortar head and bed joints.

D. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Grouting:

1. Use “Fine Grout” per ASTM C476 for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use “Coarse Grout” per ASTM C476 for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At the Contractor’s option, use either low-lift or high-lift grouting techniques subject to requirements which follow.

F. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm^2 (8 square inches) in vertical cores to be grouted.
2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 foot) height, or if bond beam occurs below 1.5 m (5 foot) height, stop pour 38 mm (1-1/2 in) below top of bond beam.
4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.

5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

3.16 CLEANING AND REPAIR

A. General:
   1. Clean exposed masonry surfaces on completion.
   2. Protect adjoining construction materials and landscaping during cleaning operations.
   3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
   4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Brickwork:
   1. First wet surfaces with clean water, then wash down with a solution of soapless detergent. Do not use muriatic acid.
   2. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.
   3. Free clean surfaces of traces of detergent, foreign streaks, or stains of any nature.

C. Concrete Masonry Units:
   1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
   2. Allow mud to dry before brushing.

3.17 WATER PENETRATION TESTING

A. Seven days before plastering or painting, in the presence of COTR, test solid exterior masonry walls for water penetration.

B. Direct water on masonry for a period of one hour at a time when wind velocity is less than five miles per hour.

C. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by COTR.

D. Correct the areas showing moisture on inside of walls, and repeat test at repaired areas, to insure that moisture penetration has been stopped.

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0SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies structural steel shown and classified by Section 2, Code of Standard Practice for Steel Buildings and Bridges.

1.2 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Painting: Section 09 91 00, PAINTING.

1.3 QUALITY ASSURANCE:

A. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the written notification required by 29 CFR 1926.752. Provide copy of this notification to the Contractor Officer Technical Representative (COTR).

1.4 TOLERANCES:

A. Fabrication tolerances for structural steel shall be held within limits established by ASTM A6, by Section 7, Code of Standard Practice for Buildings and Bridges, and by Standard Mill Practice - General Information (AISC ASD Manual, Ninth Edition, Page 1-145, except as follows:

1. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).
2. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).
3. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

1.5 DESIGN:

A. Connections: 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 the details shown on the Drawings, supplementing where necessary. The details shown on the 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 COTR 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 COTR. 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.

1.6 REGULATORY REQUIREMENTS:

A. AISC: Specification for Structural Steel Buildings - Allowable Stress Design.

B. AISC: Code of Standard Practice for Steel Buildings and Bridges.

1.7 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop and Erection Drawings: Complete

C. Certificates:

1. Structural steel.
2. Steel for all connections.
3. Welding materials.
4. Shop coat primer paint.

D. Test Reports:

1. Welders' qualifying tests.

E. Design Calculations and Drawings:

1. Connection calculations, if required.

F. Record Surveys.

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 Institute of Steel Construction (AISC):

1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Ninth Edition, 1989)
2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Second Edition, 1995)
3. Code of Standard Practice for Steel Buildings and Bridges (March 2000).

C. American National Standards Institute (ANSI):

B18.22.1-98.....Plain Washers

B18.22M-00.....Metric Plain Washers

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

A6/A6M-02.....Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

A36/A36M-01.....Standard Specification for Carbon Structural Steel

A53/A53M-01.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123/A123M-02.....Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A242/A242M-01.....Standard Specification for High-Strength Low-Alloy Structural Steel

A283/A283M-00.....Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

A307-00.....Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

A325-02.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A490-02.....Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength

A500-01.....Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

A501-01.....Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

A572/A572M-01.....Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

A992/A992M-02.....Standard Specification for Structural Steel Shapes

E. American Welding Society (AWS):

D1.1-02.....Structural Welding Code-Steel

F. Research Council on Structural Connections (RCSC) of The Engineering Foundation:

Specification for Structural Joints Using ASTM A325 or A490 Bolts

G. Military Specifications (Mil. Spec.):

MIL-P-21035.....Paint, High Zinc Dust Content, Galvanizing, Repair

H. Occupational Safety and Health Administration (OSHA):
29 CFR Part 1926-2001...Safety Standards for Steel Erection

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Structural Steel: ASTM A36, A572, A992.
B. Structural Tubing: ASTM A500, Grade B.
C. Structural Tubing: ASTM A501.
D. Steel Pipe: ASTM A53, Grade B.
E. Bolts, Nuts and Washers:
1. High-strength bolts, including nuts and washers: ASTM A325.
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: ANSI Standard B18.22.1.
F. Zinc Coating: ASTM A123.
G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.

PART 3 - EXECUTION

3.1 CONNECTIONS (SHOP AND FIELD):

A. Welding: Welding in accordance with AWS D1.1. 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.
B. High-Strength Bolts: High-strength bolts tightened to a bolt tension not less than proof load given in Specification for Structural Joints Using ASTM A325 or A490 Bolts. 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 or the turn-of-the-nut method. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

3.2 FABRICATION:

Fabrication in accordance with Chapter M, Specification for Steel Buildings - Allowable Stress Design and Plastic Design.

3.3 SHOP PAINTING:

A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.
B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.
C. Do not apply paint to following:
1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
2. Surfaces which will be encased in concrete.
3. Surfaces which will receive sprayed on fireproofing.

4. Top flange of members which will have shear connector studs applied.

D. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (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.

3.4 ERECTION:

A. General: Erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.

B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.

3.5 FIELD PAINTING:

A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.

B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

3.6 SURVEY:

Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to COTR for approval. Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS. Report shall specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

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SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies material and services required for installation of steel decking as shown and specified.

1.2 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

1.3 DESIGN REQUIREMENTS:

A. Design steel decking in accordance with AISI publication, "Specification for the Design of Cold-formed Steel Structural Members" except as otherwise shown or specified.

B. Design all elements with the latest published version of applicable codes.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and similar information necessary for completing installation as shown and specified, including supplementary framing, sump pans, ridge and valley plates, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. 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: Showing steel decking section properties and specifying structural characteristics.

D. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a “Steel Floor and Form Unit”.

E. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

1.5 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 Society for Testing and Materials (ASTM):

A36/A36M-08.....Standard Specification for Carbon Structural Steel

A611-97.....Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled

A653/A653M-08.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process

C423-08.....Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

C. American Institute of Steel Construction (AISC):

1. Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design (ninth Edition, 1989)
2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)

D. American Iron and Steel Institute (AISI):

1. Specification and Commentary for the Design of Cold-Formed Steel Structural Members

E. American Welding Society (AWS):

D1.3-08.....Structural Welding Code - Sheet Steel

F. Military Specifications (Mil. Spec.)

MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Steel Decking: ASTM A653, Structural Quality.

B. Galvanizing: ASTM A653, see Drawings.

C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.

D. Welding Electrode: E70XX minimum.

E. Sheet Metal Accessories: ASTM A653, 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. Sump Pans for Roof Drains: Fabricated from single piece of minimum 1.9 mm (14 gauge) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 75 mm (3 inches) wide. Recess pans not less than 38 mm (1 1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

2.2 REQUIREMENTS:

A. Provide steel decking of the type, depth, gauge, and section properties as shown.

B. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces utilized to act as a permanent support for all superimposed loads. Comply with the depth and minimum gage requirements as shown on the Contract Documents.

1. Wide Rib (Type B) Deck
   a. Finish: Galvanized G-90.
2. Composite Floor Deck
   a. Finish: Galvanized G-60.

C. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

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. Remove any 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. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.

D. Provide steel decking in sufficient lengths to extend over 3 or more spans, except for interstitial levels.

E. Place steel decking units at right angles to supporting members. End laps of sheets of roof deck shall be a minimum of 50 mm (2 inches) and shall occur over supports.

F. Fastening Deck Units:

1. Fasten floor deck units to steel supporting members by not less than 19 mm (3/4 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. 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. Use self-tapping No. 10 or larger machine screws at 610 mm (2 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
3. Fasten roof deck units to steel supporting members by not less than 19 mm (3/4 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. at every support, and at closer spacing where required for lateral force resistance by diaphragm action. Attach split or partial panels to the structure in every valley. In addition, secure deck to each supporting member in ribs where side laps occur. Power driven fasteners may be used in lieu of welding for roof deck if strength equivalent to the welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.
4. Mechanically fasten side laps of adjacent roof deck units at intervals not exceeding 610 mm (2 feet) o.c., using self-tapping No. 10 or larger machine screws.
5. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
6. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 1.4 kPa (30 psf).

G. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop 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 by the trade requiring the opening.

4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any 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 Technical Representative (COTR). Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

3.2 WELDING:

A. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

3.3 FIELD REPAIR:

A. General
   1. Areas scarred during erection.
   2. Welds to be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units shall be zinc rich galvanizing repair paint. Touch-up paint for shop painted units of same type used for shop painting.

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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: (12, 14A, 14C)
2. Frames: (24E)
3. Safety Nosings
4. Railings: (10)
5. Steel Counter or Bench Top Frame and Leg

1.2 RELATED WORK

A. Masonry: Section 04 20 00, UNIT MASONRY.

B. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS AND LADDERS.

C. Carpentry: Section 06 20 00, FINISH CARPENTRY.

D. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.

E. Prime and finish painting: Section 09 91 00, PAINTING.

F. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

G. Windows: Section 08 51 13, ALUMINUM WINDOWS.

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. Anodized finish as specified.
2. Live load designs as specified.

D. 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 of Mechanical Engineers (ASME):

B18.6.1-81(R1997).....Wood Screws

B18.2.2-87(R2005).....Square and Hex Nuts

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

A36/A36M-05.....Structural Steel

A47-99(R2004).....Malleable Iron Castings

A48-03.....Gray Iron Castings

A53-06.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123-02.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A269-07.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A307-07.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A312/A312M-06.....Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

A391/A391M-01.....Grade 80 Alloy Steel Chain

A653/A653M-07.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

A786/A786M-05.....Rolled Steel Floor Plate

B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
B456-03.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
B632-02.....Aluminum-Alloy Rolled Tread Plate
C1107-07.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
D3656-04.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
F436-07.....Hardened Steel Washers
F468-06.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
F593-02.....Stainless Steel Bolts, Hex Cap Screws, and Studs
F1667-05.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):
D1.1-04.....Structural Welding Code Steel
D1.2-03.....Structural Welding Code Aluminum
D1.3-98.....Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)
AMP521-01.....Pipe Railing Manual
AMP 500-505-1988.....Metal Finishes Manual
MBG 531-00.....Metal Bar Grating Manual
MBG 532-00.....Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC):
SP 1-05.....No. 1, Solvent Cleaning
SP 2-05.....No. 2, Hand Tool Cleaning
SP 3-05.....No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):
RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

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. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

A. Structural Steel: ASTM A36 or ASTM A992.

B. Stainless Steel: ASTM A167, Type 302 or 304.

C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.

D. Floor Plate:
   1. Steel ASTM A786.
   2. Aluminum: ASTM B632.
E. Steel Pipe: ASTM A53.
   1. Galvanized for exterior locations.
   2. Type S, Grade A unless specified otherwise.
   3. NPS (inside diameter) as shown.
F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
G. Malleable Iron Castings: A47.
H. Primer Paint: As specified in Section 09 91 00, PAINTING.
I. Stainless Steel Tubing: ASTM A269, type 302 or 304.
J. 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 with in 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.
K. 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.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

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 Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
   a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
   b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
   c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
   d. Painted: AA-C22R10.
3. 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.

4. Stainless Steel: NAAMM AMP-504 Finish No. 4.
5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

G. Protection:
1. Isolate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
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 Wall Mounted Items:
1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flatted for anchorage to stud.

5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

C. For Trapeze Bars:
1. Construct assembly above ceilings as shown and design to support not less than a 340 kg (750 pound) working load at any point.
2. Fabricate trapeze supports as shown, with all exposed members, including screws, nuts, bolts and washers, fabricated of stainless steel.
3. Fabricate concealed components of structural steel shapes unless shown otherwise.
4. Stainless steel ceiling plate drilled for eye bolt.
5. Continuously weld connections where welds shown.
6. Use modular channel where shown with manufacturers bolts and fittings.
a. Weld ends of steel angle braces to steel plates and secure to modular channel units as shown. Drill plates for anchor bolts.
b. Fabricate eye bolt, special clamp bolt, and plate closure full length of modular channel at ceiling line and secure to modular channel unit with manufacturers standard fittings.

D. For Cubicle 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.

E. Supports at Ceiling for Radiographic (X-ray) Equipment:
1. Fabricate hangers braces, and track of modular channel units assembly as shown.
2. Fabricate steel plates for anchor to structure above.
3. Drill bent plates for bolting at mid height at concrete beams.

F. For Ceiling Mounted Exam Light (Other ceiling mounted items):
1. Fabricate as shown to suit equipment furnished.
2. Drill leveling plate for light fixture bolts.

2.6 FRAMES

A. Channel Door Frames:
1. Fabricate of structural steel channels of size shown.
2. Miter and weld frames at corners.
3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide

steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.

4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
7. Prepare frame for installation of hardware specified in Section 08 71 00, DOOR HARDWARE.
   a. Cut a slot in the lock jamb to receive the lock bolt.
   b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 450 mm (18 inches) on center.

B. Frames for Lead Lined Doors:
1. Obtain accurate dimensions and templates from suppliers of lead lined doors, finish hardware, and hollow steel door frames.
2. Fabricate as shown for use in connection with lead lined doors.
3. Deliver assembled frames with removable shipping spreaders at top and bottom.
4. Extend angles at jambs from floor to structural slab above. At floors of interstitial spaces, terminate jamb sections and provide anchors as shown.
5. Continuously weld plates and reinforcements to frame members and head members of angle frames between jambs.
6. Weld strap anchors, not over 600 mm (24 inches) on centers, to the back of angles for embedment in masonry or concrete unless shown otherwise.

C. Type 15 and 17 Door Frames:
   a. Structural steel angle frames with plate or bar full height to heads. Extend reinforcing at hinge cutouts two inches beyond cutout.

b. Fabricate top anchorage to beam side at mid height.
c. Weld clip angles to both legs of angle at top and bottom.
d. Drill clips and plates, at top and bottom for anchoring jamb angles with two 9 mm (3/8 inch) expansion bolts at each location.
e. Cut rabbet for pivot hinges and lock strike.

2.7 GUARDS

A. Wall Corner Guards:
1. Fabricate from steel angles and furnish with anchors as shown.
2. Continuously weld anchor to angle.

2.8 SAFETY NOSINGS

A. Fed. Spec. RR-T-650, Type C.
1. Aluminum: Class 2, Style 2.
2. Cast iron: Class 4.
B. Fabricate nosings for exterior use from cast aluminum, and nosings for interior use from either cast aluminum or cast iron. Use one Class throughout.
C. Fabricate nosings approximately 100 mm (4 inches) wide with not more than 9 mm (3/8 inch) nose.
D. Provide nosings with integral type anchors spaced not more than 100 mm (4 inches) from each end and intermediate anchors spaced approximately 375 mm (15 inches) on center.
E. Fabricate nosings to extend within 100 mm (4 inches) of ends of concrete stair treads except where shown to extend full width.
F. Fabricate nosings to extend full width between stringers of metal stairs and full width of door openings.
G. On curved steps fabricate to terminate at point of curvature of steps having short radius curved ends.

2.9 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. Base plates are not required on pipe sleeves where ornamental railings occur.

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. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Removable Rails:
a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
c. Continuously weld brackets to post.
d. Provide slotted bolt holes in rail bracket.
e. Weld bolt heads flush with top of rail.
f. Weld flanged fitting to post where posts are installed in sleeves.

7. 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.
8. Gates:
   a. Fabricate from steel pipe as specified for railings.
   b. Fabricate gate fittings from either malleable iron or wrought steel.
   c. Hang each gate on suitable spring hinges of clamp on or through bolted type. Use bronze hinges for exterior gates.
   d. Provide suitable stops, so that gate will swing as shown.

2.10 STEEL COUNTER OR BENCH TOP FRAME AND LEGS

A. Fabricate channel or angle frame with mitered and welded corners as shown.
B. Drill top of frame with 6 mm (1/4inch) holes spaced 200 mm (8 inches) on center for securing countertop.
C. Fabricate legs of angle or pipe shapes and continuously weld to frame.
D. Finish frame with backed on enamel prime coat.

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. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. 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. Supports for Wall Mounted items:

1. Locate center of support at anchorage point of supported item.
2. Locate support at top and bottom of wall hung cabinets.
3. Locate support at top of floor cabinets and shelving installed against walls.
4. Locate supports where required for items shown.

C. Support at Ceiling for X-ray and Radiographic Equipment:

1. Bolt modular steel channel frames to hangers as shown, anchored to structure above.
2. Fasten frames with modular channel manufacturers fittings, bolts, and nuts. Space modular channel supports and hangers as shown and as required to suit equipment furnished.
3. Install closure plates in channels at ceiling where channel opening is visible. Coordinate and cut plates to fit tight against equipment anchors after equipment anchors are installed.

D. Ceiling Support for Exam Light (Other ceiling mounted items):

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.

E. Supports for Cubicle Curtain Track:

1. Install assembly where shown after ceiling suspension grid is installed.

2. Drill angle for bolt and weld nut to angle prior to installation of tile.

F. Support for cantilever grab bars:
1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structural slab above.
2. Anchor at top and bottom with angle clips bolted to channels or tube with two, 9 mm (3/8 inch) diameter bolts.
3. Anchor to floors and overhead construction with two 9 mm (3/8 inch) diameter bolts.
4. Fasten clips to concrete with expansion bolts, and to steel with machine bolts or welds.

G. Supports for Trapeze Bars:
1. Secure plates to overhead construction with fasteners as shown.
2. Secure angle brace assembly to overhead construction with fasteners as shown and bolt plate to braces.
3. Fit modular channel unit flush with finish ceiling, and secure to plate with modular channel unit manufacturer's standard fittings through steel shims or spreaders as shown.
a. Install closure plates in channel between eye bolts.
b. Install eyebolts in channel.

3.3 FRAMES FOR LEAD LINED DOORS

A. Secure jamb angle clips and plates, at top and bottom with two, 9 mm (3/8 inch) expansion bolts to concrete.
B. Secure 150 x 90 x 13 mm (6 x 3-1/2 x 1/2 inch) angle to steel framing for anchorage when expansion bolts to concrete is not possible.
C. Secure clips by welding to steel.
D. At interstitial spaces, anchor jamb angles as shown.

3.4 DOOR FRAMES

A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.
B. Level and plumb frame; brace in position required.
C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.
D. Set frames in formwork for frames cast into concrete.
E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.5 OTHER FRAMES

A. Set frame flush with surface unless shown otherwise.
B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.

C. Set in formwork before concrete is placed.

3.6 SAFETY NOSINGS

A. Except as specified and where preformed rubber treads are shown or specified install safety nosings at the following:
   1. Exterior concrete steps.
   2. Door sills of areaway entrances curbs.
   3. Exposed edges of curbs of door sills at transformer and service rooms.
   4. Interior concrete steps, including concrete filled treads of metal stairs of service stairs.

B. Install flush with horizontal and vertical surfaces.

C. Install nosing to within 100 mm (4 inches) of ends of concrete stair treads, except where shown to extend full width.

D. Extend nosings full width of door openings.

E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.7 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. Anchor to Walls:
   1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
      a. Anchor steel plate to concrete or solid masonry with expansion bolts.
      b. Anchor steel plate to hollow masonry with toggle bolts.

2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

C. Gates:
1. Hang gate to swing as shown.
2. Bolt gate hinges to jamb post with clamp on or through bolts.

D. 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.

3.8 STEEL COMPONENTS FOR MILLWORK ITEMS

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

3.9 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.

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SECTION 05 51 00
METAL STAIRS AND LADDERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies steel stairs with railings.

B. Types:

1. Closed riser stairs with concrete filled treads and platforms.
2. Attic Access Ladder fixed attached to wall.

1.2 RALATED WORK

A. Concrete fill for treads and platforms: Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Wall handrails and railings for other than steel stairs: Section 05 50 00, METAL FABRICATIONS.

C. Requirements for shop painting: Section 09 91 00, PAINTING.

D. Colors, finishes, and textures: 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. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

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 basic designation.

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

A36/A36M-05.....Structural Steel
A47-99 (R2004).....Ferritic Malleable Iron Castings
A48-03.....Gray Iron Castings
A53-06.....Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
A307-07.....Carbon Steel Bolts and Studs, 60000 psi Tensile Strength
A653/653M-07.....Steel Sheet, Zinc Coated (Galvanized) or Zinc Alloy Coated (Galvannealed) by the Hot-Dip Process
A563-07.....Carbon and Alloy Steel Nuts
A1008-07.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy
A786/A786M-00.....Rolled Steel Floor Plates

A1011-04.....Steel, Sheet and Strip, Strip, Hot-Rolled Carbon, Structural, High-Strength, Low-Alloy

C. American Welding Society (AWS):
D1.1-04.....Structural Welding Code-Steel
D1.3-98.....Structural Welding Code-Sheet Steel

D. The National Association of Architectural Metal Manufactures (NAAMM) Manuals:
Metal Bar Gratings (ANSI/NAAMM MBG 531-00)
AMP521-01.....Pipe Railing Manual, Including Round Tube

E. American Iron and Steel Institute (AISI):
2001.....Design of Cold-Formed Steel Structural Members

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. Design stairs to support a live load of 500 kg/m^2 (100 pounds per square foot).

B. Structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.

C. Design Grating treads in accordance with NAAMM Metal Bar Grating Manual.

D. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.

B. Sheet Steel: ASTM A1008.

C. Structural Steel: ASTM A36.

D. Steel Floor Plate: ASTM 786.

E. Steel Decking: Form from zinc coated steel conforming to ASTM A446, with properties conforming to AISI Specification for the Design of Cold-Formed Steel Structural Members.

F. Steel Plate: ASTM A1011.

2.3 FABRICATION GENERAL

A. Fasteners:
1. Conceal bolts and screws wherever possible.
2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.

B. Welding:
1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
2. Where possible, locate welds on unexposed side.
3. Grind exposed welds smooth and true to contour of welded member.
4. Remove welding splatter.

C. Remove sharp edges and burrs.
D. Fit stringers to head channel and close ends with steel plates welded in place where shown.
E. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.
F. Shop Prime Painting: Prepare surface and apply primer as specified for ferrous metals in Section 09 91 00, PAINTING.

2.4 RAILINGS

A. Fabricate railings, including handrails, from steel pipe with flush.
1. Connections may be standard fittings designed for welding, or coped or mitered pipe with full welds.
2. Wall handrails are provided under Section 05 50 00, METAL FABRICATIONS.
B. Return ends of handrail to wall and close free end.
C. Provide standard terminal castings where fastened to newel.
D. Space intermediate posts not over six feet on center.
E. Fabricate handrail brackets from cast malleable iron.
F. Provide standard terminal fittings at ends of post and rails.

2.5 CLOSED RISER STAIRS

A. Provide treads, risers, platforms, railings, stringers, headers and other supporting members.
B. Fabricate pans for treads and platforms, and risers from sheet steel Fabricate pans for platforms from steel decking where shown.
C. Form risers with sanitary cove.
D. Fabricate stringers, headers, and other supporting members from structural steel.
E. Construct posts of steel tubing having wall thickness not less than 5 mm (3/16-inch), with forged steel caps and drops.

2.6 LADDER ACCESS TO ATTIC

1. Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with the requirements of ANSI A14.3, except as otherwise indicated.
a. Unless otherwise shown, provide 1/2" x 2 1/2" continuous structural steel flat bar side rails with eased edges, spaced 18" apart. Provide 3/4" diameter solid structural steel bar rungs, spaced 12" O.C. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
2. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.

3. Support each ladder at top and bottom and at intermediate points spaced not more than 5'0" O.C. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold the ladder clear of the wall surface with a minimum of 7" clearance from wall to centerline of rungs. Extend rails 42" above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose neck the extended rails back to the structure to provide secure ladder access.
4. Provide nonslip surface on the top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of Manufacturer's rung which is filled with aluminum oxide grout.
5. Ship's Ladders: Provide sloping ladders (ship's ladders) where indicated. Fabricate of open type construction with structural steel channel or steel plate stringers, pipe handrails, and open checkered plate treads with nonslip nosings, unless otherwise indicated. Provide all necessary brackets and fittings for installation.

PART 3 - EXECUTION

3.1 STAIR INSTALLATION

A. Provide hangers and struts required to support the loads imposed.
B. Perform job site welding and bolting as specified for shop fabrication.
C. Set stairs and other members in position and secure to structure as shown.
D. Install stairs plumb, level and true to line.
E. Provide steel closure plate to fill any gap between the stringer and surrounding shaft wall. Weld and finish with prime and paint finish of adjoining steel.

3.2 RAILING INSTALLATION

A. Install standard terminal fittings at ends of posts and rails.
B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.
C. Set rails horizontal or parallel to rake of stairs to within 3 mm in 3650 mm (1/8-inch in 12 feet).
D. Set posts plumb and aligned to within 3 mm in 3650 mm (1/8-inch in 12 feet).

3.3 FIELD PRIME PAINTING

A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.
B. Touch-up abraded areas with same primer paint used for shop priming.

C. Touch up abraded galvanized areas with zinc rich paint as specified in section 09 91 00, PAINTING.

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Section specifies wood blocking, framing, sheathing, nailers, and rough hardware.

1.2 RELATED WORK:

A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.
B. Fiber cement siding: Section 07 46 60, FIBER CEMENT SIDING.
C. Roofing: Section 07 53 23, EPDM ROOFING.
D. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

1.3 SUMBITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

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 150 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 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):
National Design Specification for Wood Construction
NDS-05.....Conventional Wood Frame Construction
C. American Institute of Timber Construction (AITC):
A190.1-02.....Structural Glued Laminated Timber
D. American Society of Mechanical Engineers (ASME):
B18.2.1A-96(R2005).....Square and Hex Bolts and Screws
B18.2.2-87(R2005).....Square and Hex Nuts
B18.6.1-81 (R97).....Wood Screws

B18.6.4-98(R2005).....Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws

E. American Plywood Association (APA):

E30-03.....Engineered Wood Construction Guide

F. American Society for Testing And Materials (ASTM):

A47-99(R2004).....Ferritic Malleable Iron Castings

A48-03.....Gray Iron Castings

A653/A653M-07.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

C954-04.....Steel 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

C1002-04.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

D143-94(R2004).....Small Clear Specimens of Timber, Method of Testing

D1760-01.....Pressure Treatment of Timber Products

D2559-04.....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-03.....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

F844-07.....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-05.....Nails, Spikes, and Staples

G. Federal Specifications (Fed. Spec.):

MM-L-736C.....Lumber; Hardwood

H. Commercial Item Description (CID):

A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

I. Military Specification (Mil. Spec.):

MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

J. Truss Plate Institute (TPI):

TPI-85.....Metal Plate Connected Wood Trusses

K. U.S. Department of Commerce Product Standard (PS)

PS 1-95.....Construction and Industrial Plywood

PS 20-05.....American Softwood Lumber Standard

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
   1. Identifying marks 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. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.

C. 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. Framing lumber: Minimum extreme fiber stress in bending of 1100.
   3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.

D. Sizes:
   1. Conforming to Prod. Std., PS20.
   2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:
   1. At time of delivery and maintained at the site.
   2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
   3. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:
   1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
   2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. 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, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used 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 ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

2.2 PLYWOOD

A. Comply with Prod. Std., 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 9 mm (11/32 inch) thick with supports 400 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 600 mm (24 inches) on center unless specified otherwise.
      b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.

2.3 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:
   1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
   2. Extend at least 200 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. Use 13 mm (1/2 inch) bolt unless shown otherwise.
C. Washers
   1. ASTM F844.
   2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.
D. Screws:
   1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
   2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:
1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
a. Common: Type I, Style 10.
b. Concrete: Type I, Style 11.
c. Barbed: Type I, Style 26.
d. Underlayment: Type I, Style 25.
e. Masonry: Type I, Style 27.
f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Adhesives:
1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
2. For structural laminated Wood: ASTM D2559.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:
1. AFPA National Design Specification for Wood Construction for timber connectors.
2. AITC Timber Construction Manual for heavy timber construction.
3. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.
4. APA for installation of plywood or structural use panels.
5. ASTM F 499 for wood underlayment.
6. TPI for metal plate connected wood trusses.

B. Fasteners:
1. Nails.
a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
b. Use special nails with framing connectors.
c. For sheathing, select length of nails sufficient to extend 25 mm (1 inch) into supports.

d. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
e. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.
f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
g. Nailing Schedule; Using Common Nails:
   1) Sheathing:
      a) 150 mm (6 inch) wide or less to each joist face nail two-8d.
      b) Subflooring, more than 150 mm (6 inches) wide, to each stud or joint, face nail three-8d.
      c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 150 mm (6 inches) on center and at intermediate supports 250 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 300 mm (12 inches) at supported edges and 500 mm (20 inches) o.c. at intermediate supports.
   2) Top plate to stud, end nail two-16d.
   3) Doubled studs, face nail 16d at 600 mm (24 inches) on center.
   4) Top plates, laps, and intersections, face nail two-16d.
   5) Continuous header, two pieces 16d at 400 mm (16 inches) on center along each edge.

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 use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
   d. Use toggle bolts to hollow masonry or sheet metal.
   e. Use 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 600 mm (24 inch) intervals between end bolts. Use 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 C 954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.

6. Screws to Join Wood:
   a. Where shown or option to nails.
   b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
   c. Spaced same as nails.

C. Blocking Nailers, and Furring:
   1. Install furring, blocking, nailers, and grounds where shown.
   2. Use longest lengths practicable.
   3. Use fire retardant treated wood blocking at all interior locations and where shown or specified.
   4. Layers of Blocking or Plates:
      a. Stagger end joints between upper and lower pieces.
      b. Nail at ends and not over 600 mm (24 inches) between ends.
      c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.

D. Sheathing:
   1. Use plywood or structural-use panels for sheathing.
   2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
   3. Set nails not less than 9 mm (3/8 inch) from edges.
   4. Install 50 mm by 100 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.

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SECTION 06 16 00
SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Wall sheathing.
   2. Roof sheathing.
   3. Subflooring.

B. Related Requirements:
   1. Division 06 – W0OD PLASTICS AND COMPOSITES for plywood backing panels.
   2. Division 07 – THERMAL AND MOISTURE PROTECTION for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:
   1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
   2. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that product contains no urea formaldehyde.

3. Laboratory Test Reports for Credit IEQ 4: For adhesives, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:

1. Preservative-treated plywood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Plywood.

2. Oriented strand board.

C. Plywood: Either DOC PS 1 or DOC PS 2.

D. Oriented Strand Board: DOC PS 2.

E. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

F. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood unless otherwise indicated.

2.3 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: 1/2 **inch**.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch.

2.4 ROOF SHEATHING

A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 5/8 inch.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 5/8 inch.

2.5 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.

1. Span Rating: Not less than 48/24.
2. Nominal Thickness: Not less than 3/4 inch.
3. Edge Detail: Tongue and groove.
4. Surface Finish: Fully sanded face.

B. Oriented-Stand-Board Combination Subfloor-Underlayment: Exposure 1 single-floor panels.

1. Span Rating: 48/24.

2. Nominal Thickness: Not less than 3/4 inch.
3. Edge Detail: Tongue and groove.

C. Plywood Subflooring: Exposure 1, Structural I single-floor panels or sheathing.
1. Span Rating: Not less than 48/24.
2. Nominal Thickness: Not less than 3/4 inch.

D. Oriented-Strand-Board Subflooring: Exposure 1, Structural I sheathing, single-floor panels or sheathing.
1. Span Rating: 48/24.
2. Nominal Thickness: Not less than 3/4 inch.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01, ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or

optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subfloor-Underlayment:
   a. Glue and nail to wood framing.
   b. Space panels 1/8 inch apart at edges and ends.
2. Subflooring:
   a. Glue and nail to wood framing.
   b. Space panels 1/8 inch apart at edges and ends.
3. Wall and Roof Sheathing:
   a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.

b. Space panels 1/8 inch apart at edges and ends.

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SECTION 06 17 53
SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wood roof trusses.
2. Wood floor trusses.
3. Wood girder trusses.
4. Wood truss bracing.

B. Related Requirements:

1. Division 06 – WOOD, PLASTICS, AND COMPOSITES for roof sheathing and subflooring.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For wood-preservative-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:

1. Certificates for Credit MR 6: Chain-of-custody certificates indicating that wood trusses and permanent bracing comply with forest certification requirements. Include documentation that

fabricator is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

C. Shop Drawings: Show fabrication and installation details for trusses.
   1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
   2. Indicate sizes, stress grades, and species of lumber.
   3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
   4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
   5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
   6. Show splice details and bearing details.

D. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For metal connector-plate manufacturer, professional engineer, and fabricator.

B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.

D. Evaluation Reports: For the following, from ICC-ES:
   1. Wood-preservative-treated lumber.
   2. Metal-plate connectors.
   3. Metal truss accessories.

1.6 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
   1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to the Contracting Officer Technical Representative (COTR) and is certified for chain of custody by an FSC-accredited certification body.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.

2. Maximum Deflection Under Design Loads:
   a. Roof Trusses: Vertical deflection of 1/240 of span.
   b. Floor Trusses: Vertical deflection of 1/360 of span.

C. Comply with applicable requirements and recommendations of the following publications:
   1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
   2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
   3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

A. Certified Wood: For metal-plate-connected wood trusses and permanent bracing, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Provide dressed lumber, S4S.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

C. Minimum Specific Gravity for Top Chords: 0.50.

D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 Section "Rough Carpentry."

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all trusses unless otherwise indicated.

2.4 METAL CONNECTOR PLATES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following may be incorporated into the Work include, but are not limited to, the following:

1. Alpine Engineered Products, Inc.; an ITW company.
2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
3. CompuTrus, Inc.
4. Eagle Metal Products.
5. Jager Building Systems, Inc.; a Tembec/SGF Rexfor company.
6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
7. Robbins Engineering, Inc.
8. Truswal Systems Corporation; an ITW company.

B. Source Limitations: Obtain metal connector plates from single manufacturer.

C. General: Fabricate connector plates to comply with TPI 1.

D. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

1. Use for interior locations unless otherwise indicated.

E. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

2.6 METAL FRAMING ANCHORS AND ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or

high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Truss Tie-Downs: As indicated on the Drawings.

F. Truss Tie-Downs (Hurricane or Seismic Ties): As indicated on the Drawings.

G. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

H. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch- long seat; formed from metal strap 0.062 inch thick with tabs bent to extend over and be fastened to supporting member.

I. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.8 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.9 SOURCE QUALITY CONTROL

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

1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Division 06 Section "Rough Carpentry."

2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not meet requirements.

1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by the COTR.

3.2 REPAIRS AND PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

D. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.

1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

- - - END - - -

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies exterior and interior millwork.

B. Items specified.

- Counter Shelf Type A
- Countertops
- Built-in Bench
- Pegboard (Solid Polymer Material)
- Mounting Strips, Shelves, and Rods
- Solid Polymer Window Sills (Stools)

1.2 RELATED WORK

A. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.

B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.

C. Wood doors: Section 08 14 00, INTERIOR WOOD DOORS.

D. Color and texture of finish: Section 09 06 00, SCHEDULES FOR FINISHES.

E. Stock casework: Section 12 32 00, MANUFACTURED WOOD CASEWORK.

F. Solid polymer material over countertops: Section 12 36 00, COUNTERTOPS.

H. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Millwork items – Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
2. Show construction and installation.

C. Samples:

1. Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six by twelve inches).
2. Solid polymer material: 3 inches x 3 inches.

D. Certificates:

1. Indicating preservative treatment and fire retardant treatment of materials meet the requirements specified.
2. Indicating moisture content of materials meet the requirements specified.

E. List of acceptable sealers for fire retardant and preservative treated materials.

F. Manufacturer's literature and data:
   1. Finish hardware
   2. Sinks with fittings
   3. Electrical components

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.

B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by the Contracting officer Technical Representative (COTR). Store at a minimum temperature of 21^{0}C (70^{0}F) for not less than 10 days before installation.

C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

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 of Testing and Materials (ASTM):

A36/A36M-05.....Structural Steel

A53-06.....Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless

A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B26/B26M-05.....Aluminum-Alloy Sand Castings

B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

E84-07.....Surface Burning Characteristics of Building Materials

F436-07.....Hardened Steel Washers

C. Builders Hardware Manufacturers Association (BHMA):

A156.9-03.....Cabinet Hardware

A156.11-04.....Cabinet Locks

A156.16-02.....Auxiliary Hardware

D. Hardwood Plywood and Veneer Association (HPVA):

HP1-04.....Hardwood and Decorative Plywood

E. American Society of Mechanical Engineers (ASME):

B18.2.1-96(R2005).....Square and Hex Bolts and Screws (Inch Series)

F. American Wood-Preservers' Association (AWPA):
AWPA C1-03.....All Timber Products – Preservative Treatment by Pressure Processes

G. Architectural Woodwork Institute (AWI):
AWI-99.....Architectural Woodwork Quality Standards and Quality Certification Program

H. National Electrical Manufacturers Association (NEMA):
LD 3-05.....High-Pressure Decorative Laminates
LD 3.1-95.....Application, Fabrication and Installation of High-Pressure Decorative Laminates

I. U.S. Department of Commerce, Product Standard (PS):
PS1-95.....Construction and Industrial Plywood
PS20-05.....American Softwood Lumber Standard

J. Military Specification (Mil. Spec):
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

K. Federal Specifications (Fed. Spec.):
A-A-1922A.....Shield Expansion
A-A-1936.....Contact Adhesive
FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle
FF-S-111D(1).....Screw, Wood
MM-L-736(C).....Lumber, Hardwood

L. American National Standards Institute (ANSI):
Z124.3, Z124.6.....Wear, Cleanability and Stain Resistance for Solid Polymer Material.

PART 2 - PRODUCTS

2.1 LUMBER

A. Grading and Marking:
1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Sizes:
1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.

2. Millwork, standing and running trim, and rails: Actual size as shown or specified.

C. Hardwood: MM-L-736, species as specified for each item.

D. Softwood: PS-20, exposed to view appearance grades:

1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
2. Use Prime for painted or opaque finish.

E. Use edge grain Wood members exposed to weather.

2.2 PLYWOOD

A. Softwood Plywood:

1. Prod. Std.
2. Grading and Marking:
   a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
   b. The mark shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with PS1.
3. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.
4. Plastic Laminate Plywood Cores:
   a. Exterior Type, and species group.
   b. Veneer Grade: A-C.
5. Shelving Plywood:
   a. Interior Type, any species group.
   b. Veneer Grade: A-B or B-C.
6. Other: As specified for item.

B. Hardwood Plywood:

1. HPVA: HP.1
2. Species of face veneer shall be as shown or as specified in connection with each particular item.
3. Inside of Building:
   a. Use Type II (interior) A grade veneer for transparent finish.
   b. Use Type II (interior) Sound Grade veneer for paint finish.
4. On Outside of Building:
   a. Use Type I, (exterior) A Grade veneer for natural or stained and varnish finish.
   b. Use Type I, (exterior) Sound Grade veneer for paint finish.
5. Use rotary cut white birch unless specified otherwise.

2.3 PLASTIC LAMINATE

A. NEMA LD-3.

B. Exposed decorative surfaces including built-in bench, countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, Type HGL.

C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.

1. Plastic laminate clad plywood.

D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.

E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.

2.4 ADHESIVE

A. For Plastic Laminate: Fed. Spec. A-A-1936.

B. For Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.

2.5 STAINLESS STEEL

A. ASTM A167, Type 302 or 304.

2.6 ALUMINUM CAST

A. ASTM B26

2.7 ALUMINUM EXTRUDED

A. ASTM B221

2.8 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 electric-galvanizing process. Galvanized where specified.
2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
3. Fasteners:
   a. Bolts with Nuts: FF-N-836.
   b. Expansion Bolts: A-A-1922A.
   c. Screws: Fed. Spec. FF-S-111.

B. Finish Hardware

1. Cabinet Hardware: ANSI A156.9.
   a. Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
   b. 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.
   c. Sliding Door Tracks: B07063.

d. Adjustable Shelf Standards: B4061 with shelf rest B04083.
e. Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
f. Cabinet Door Catch: B0371 or B03172.
g. Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.

2. Cabinet Locks: ANSI A156.11.
   a. Drawers and Hinged Door: E07262.
   b. Sliding Door: E07162.
3. Auxiliary Hardware: ANSI A156.16.
   a. Shelf Bracket: B04041, japanned or enameled finish.
   b. Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
   c. Closet Bar: L03131 chrome finish of required length.
   d. Handrail Brackets: L03081 or L03101.
      1) Cast Aluminum, satin polished finish.
      2) Cast Malleable Iron, japanned or enamel finish.
4. Steel Channel Frame and Leg supports for Counter top. Fabricated under Section 05 50 00, METAL FABRICATIONS.7
5. Edge Strips Moldings:
   a. Driven type "T" shape with serrated retaining stem; vinyl plastic to match plastic laminate color, stainless steel, or 3 mm (1/8 inch) thick extruded aluminum.
   b. Stainless steel or extruded aluminum channels.
   c. Stainless steel, number 4 finish; aluminum, mechanical applied medium satin finish, clear anodized 0.1 mm (0.4 mils) thick.
6. Rubber or Vinyl molding
   a. Rubber or vinyl standard stock and in longest lengths practicable.
   b. Design for closures at joints with walls and adhesive anchorage.
   c. Adhesive as recommended by molding manufacturer.
7. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

2.9 MOISTURE CONTENT

A. Moisture content of lumber and millwork at time of delivery to site.
   1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
   2. Exterior treated or untreated finish lumber and trim 100 mm (4 inches) or less in nominal thickness: 15 percent.

3. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

2.10 FIRE RETARDANT TREATMENT

A. Where wood members and plywood are specified to be fire retardant treated, the treatment shall be in accordance with Mil. Spec. MIL-L19140.

B. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings.

C. Each piece of treated material shall bear identification of the testing agency and shall indicate performance in accordance with such rating of flame spread and smoke developed.

D. Treat wood for maximum flame spread of 25 and smoke developed of 25.

E. Fire Resistant Softwood Plywood:

1. Use Grade A, Exterior, plywood for treatment.
2. Meet the following requirements when tested in accordance with ASTM E84.
   a. Flame spread: 0 to 25.
   b. Smoke developed: 100 maximum

F. Fire Resistant Hardwood Plywood:

1. Core: Fire retardant treated softwood plywood.
2. Hardwood face and back veneers untreated,
3. Factory seal panel edges, to prevent loss of fire retardant salts.

2.11 PRESERVATIVE TREATMENT

A. Wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including wood members used for rough framing of millwork items except heart-wood Redwood and Western Red Cedar shall be preservative treated in accordance with AWPA Standards.

B. Use Grade A, exterior plywood for treatment.

2.12 ACOUSTICAL PANEL

A. Performance criteria:

1. NRC 19 mm (3/4 inch) adhesive mounting direct to substrate.
2. Composite flame spread: ASTM E84, 25 or less.
3. Smoke developed: ASTM E84, 140 or less.

B. Glass fiber panel covered with fabric.

1. Glass fiber panel one inch thick minimum, self supporting of density required for minimum NRC.
2. Fabric covering treated to resist stains and soil, bonded directly to the glass fiber panel face, flat bonded directly to the glass fiber panel face, flat wrinkle-free surface.

C. Adhesive: As recommended by panel manufacturers.

2.13 FABRICATION

A. General:

1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
2. Finish woodwork shall be free from pitch pockets.
3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
4. Plywood shall be not less than 13 mm (1/2 inch), unless otherwise shown or specified.
5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded a shown.
7. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
8. Plastic Laminate Work:
   a. Factory glued to plywood thickness as shown or specified.
   b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
   c. Provide plastic backing sheet on underside of built-in bench, countertops, vanity tops, thru-wall counter and sills including back splashes and end splashes of countertops.
   d. Use backing sheet on concealed large panel surface when decorative face does not occur.

B. Mounting Strips, Shelves and Rods:

1. Cut mounting strips from 25 mm by 100 mm (1 by 4 inches) softwood stock, with exposed edge slightly rounded.
2. Cut wood shelf from softwood 1 inch stock, of width shown, exposed edge slightly rounded. Option: Use 19 mm (3/4 inch) thick plywood with 19 mm (3/4 inch) softwood edge nosing on exposed edge, slightly rounded.
3. Plastic laminate covered, 19 mm (3/4 inch) thick plywood core with edges and ends having plastic molded edge strips. Size, finish and number as shown.
4. Rod or Closet Bar: L03131. Combination Garment and Shelf Support, intermediate support for closet bar: B04051 for rods over 1800 mm (6 feet) long.

C. Pegboard:
1. Solid polymer material sheet size as shown.
2. Spacing strip: 13 mm by 13 mm (1/2 by 1/2 inch); glued to solid polymer material sheet.
a. Locate at perimeter of sheet edge.
b. Locate material intermediate spacing strips at 800 mm (32 inches) o.c.

D. Countertops:
1. Fabrication with plastic laminate over 32 mm (1-1/4 inch) thick core unless shown otherwise.
a. Use decorative laminate for exposed edges of tops 38 mm (1-1/2 inches) wide and on back splash and end splash. Use plastic or metal edges for top edges less than 38 mm (1-1/2 inches) wide.
b. Assemble back splash and end splash to countertop.
c. Use one piece counters for straight runs.
d. Miter corners for field joints with overlapping blocking on underside of joint.
2. Fabrication with solid polymer material at all countertops with sinks, or as indicated.

E. Built-in bench:
1. Fabrication with plastic laminate over 32 mm (1-1/4 inch) thick core unless shown otherwise.
a. Use decorative laminate for exposed edges of tops 38 mm (1-1/2 inches) wide.
c. Use one piece for straight runs.
d. Miter corners for field joints with overlapping blocking on underside of joint.
e. Provide wood trim on front edge of bench fabricated from Maple or Birch.

F. Window sill
1. Solid polymer sheet size as shown.
2. Front edge eased at top and bottom.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain work areas and storage areas to a minimum temperature of 21^0C (70^0F) for not less than 10 days before and during installation of interior millwork.

B. 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.

3.2 INSTALLATION

A. General:

1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
2. Secure trim with fine finishing nails, screws, or glue as required.
3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
4. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.

B. Pegboard:

1. Install board with chromium plated steel round-head toggle bolts or other fasteners capable of supporting board when loaded at 122 kg/m^2 (25 psf) of board.
2. Install board with spacers to allow hooks and accessories to be inserted and removed.
3. Install 6 mm (1/4 inch) round trim at perimeter to finish flush with face of board and close space between wall and pegboard.

C. Shelves:

1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end and not over 600 mm (24 inch) centers between ends.
   a. Nail Shelf to mounting strip at ends and to back wall strip at not over 900 mm (36 inches) on center.
   b. Install metal bracket, ANSI A156.16, B04041, not over 1200 mm (4 feet) centers when shelves exceed 1800 mm (6 feet) in length.
   c. 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.
2. Install vertical slotted shelf standards, ANSI A156.9, B04103 to studs with toggle bolts through each fastener opening. Double slotted shelf standards may be used where adjacent shelves terminate.

a. Install brackets ANSI A156.9, B04113, providing supports for shelf not over 900 mm (36 inches) on center and within 13 mm (1/2 inch) of shelf end unless shown otherwise.
b. Install shelves on brackets so front edge is restrained by bracket.

- - - E N D - - -

SECTION 07 13 52
MODIFIED BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies modified bituminous sheet material used for exterior below grade waterproofing and split slab waterproofing.

1.2 MANUFACTURER'S QUALIFICATIONS:

A. Approval by the Contracting Officer Technical Representative (COTR)is required of products and services of proposed manufacturers, and installers, and will be based upon submission by Contractor that:

1. Manufacturer regularly and presently manufactures bituminous sheet waterproofing as one of its principal products.
2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items.
3. Manufacturer's product submitted has been in satisfactory and efficient operation on three similar installations for at least three years.
4. Submit list of installations, include name and location of project and name of owner.

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. Bituminous sheet.
2. Primer.
3. Mastic.
4. Protection material, temporary and permanent.
5. Printed installation instructions for conditions specified.

C. Certificates:

1. Indicating bituminous sheet manufacturer's approval of primer, and roof cement.
2. Indicating bituminous sheet waterproofing manufacturer's qualifications as specified.
3. Approval of installer by bituminous sheet manufacturers.
4. Water test report.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to job in manufacturer's original unopened container.

B. Do not store material in areas where temperature is lower than 10 degrees C (50 degrees F,) or where prolonged temperature is above 32 degrees C (90 degrees F).

1.5 ENVIRONMENTAL REQUIREMENTS:

A. Ambient Surface and Material Temperature: Not less than 4 degrees C (40 degrees F), during application of waterproofing.

1.6 WARRANTY:

A. Warrant bituminous sheet waterproofing installation against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period is two years.

1.7 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by basic designation only.

B. Federal Specifications (Fed. Spec.):

UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft, Water-
INT AMD 1 Proof, Water Repellent and Fire Resistant)

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

C578-07.....Rigid Cellular Polystyrene Thermal Insulation
D41-05.....Asphalt Primer Used in Roofing, Dampproofing and Waterproofing
D2822-05.....Asphalt Roof Cement
D6380-03.....Asphalt Roll Roofing (Organic Felt)

D. American Hardboard Association (AHA):

A135.4-1995.....Basic Hardboard

PART 2 - PRODUCTS

2.1 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 of Bituminous Sheet: 1.5 mm (60 mils), plus or minus 0.13 mm (5 mils), and bonded to a 0.1 mm (4 mil) thick plastic sheet.

C. Provide with a release sheet to prevent bonding of bituminous sheet to itself.

2.2 PRIMER AND ROOF CEMENT:

A. Furnished by manufacturer of bituminous sheet as required for particular application in accordance with sheet manufacturer's instructions.

B. Primer: ASTM D41.

C. Roof Cement: ASTM D4586.

2.3 PROTECTION MATERIAL:

A. Polystyrene: ASTM C578, Type I or VIII, 13 mm (1/2-inch) minimum thickness.

B. Hardboard: PS-58, Service Type, 6 mm (1/4-inch) thick.

C. Waterproofed Building Paper: Fed. Spec. UU-B-790.

D. Roll Roofing: ASTM D6380, Class S (smooth), Type III with minimum net mass per unit area of roofing, 2495 g/m² (51 lb/100 ft²).

2.4 PATCHING COMPOUND:

A. A factory prepared, non-shrinking, fast setting, cementitious adhesive compound containing no ferrous metal or oxide.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Surface Condition:

1. Before applying waterproofing materials, ensure concrete and masonry surfaces are fully cured, smooth, clean, dry, and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion.
2. Fill voids, joints, and cracks with patching compound.

B. Concrete surfaces cured a minimum of seven days, free from release agents, concrete curing agents, and other contaminates.

3.2 APPLICATION:

A. Priming:

1. Prime concrete and masonry 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 in accordance with manufacturer's instructions.

B. Bituminous Sheet Installation:

1. Remove release sheet prior to application.

2. Lay bituminous sheet from low point to high point so that 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 not less than 200 mm (8 inches) wide, centered over joint.
4. Lap seams not less than 50 mm (2 inches).
5. Lay succeeding sheet with laps, and roll or press into place.
6. Repair misaligned or inadequately lapped seams in accordance with manufacturer’s instructions.
7. Seal seams and terminations in accordance with sheet manufacturer’s instructions.

C. Corner Treatment:
1. At inside and outside corners apply double cover using an initial strip not less than 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.

D. 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.

3.3 PROTECTION:

A. Protect bituminous sheet before backfill or wearing courses are placed.
B. Install protection material and hold in place in accordance with instructions of manufacturer of waterproofing materials.
C. Permanent Protection:
1. Vertical Surfaces:
a. Install hardboard, polystyrene, 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 or hardboard.

D. Horizontal Surfaces:
   1. Install roll roofing protection under concrete wearing courses.
   2. Install roll roofing, hardboard, or polystyrene under earth backfill.
   3. Where no concrete wearing course occurs or when surfaces will bear heavy traffic and will not immediately be covered with a wearing course, use protection specified for vertical surfaces.

E. Temporary Protection:
   When waterproofing materials are subjected to damage by sunlight and can not be immediately protected as specified, protect waterproofing materials by waterproof building paper or suitable coating approved by manufacturer of waterproofing system used.

3.4 PATCHING:

A. Repair tears, punctures, air blisters, and inadequately lapped seams, in accordance with manufacturer’s instructions before protection course is applied.

3.5 TESTING:

A. Before any protection or wearing course is applied, test all horizontal applications of waterproofing with a minimum of 25 mm (1-inch) head of water above highest point and leave for 24 hours.
B. Mark leaks and repair when waterproofing is dry.
C. Certify, to COTR, that water tests have been made and that areas tested were found watertight.

3.6 INSPECTION:

A. Do not cover waterproofed surfaces by other materials or backfill until work is approved by COTR.

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SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies thermal and acoustical insulation for buildings.

B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

1.2 RELATED WORK

A. Roofing: Section 07 72 00, ROOF ACCESSORIES.

B. Safing insulation: Section 07 84 00, FIRESTOPPING.

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. Insulation, each type used
2. Adhesive, each type used.
3. Tape

C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

1.4 STORAGE AND HANDLING:

A. Store insulation materials in weathertight enclosure.

B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

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 basic designation only.

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

C270-08.....Mortar for Unit Masonry
C516-08.....Vermiculite Loose Fill Thermal Insulation
C549-06.....Perlite Loose Fill Insulation
C552-07.....Cellular Glass Thermal Insulation.
C553-08.....Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
C578-08.....Rigid, Cellular Polystyrene Thermal Insulation

C591-08.....Unfaced Preformed Rigid Cellular Polyisocynurate Thermal Insulation
C612-04.....Mineral Fiber Block and Board Thermal Insulation
C665-06.....Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
C728-05.....Perlite Thermal Insulation Board
C954-07.....Steel 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
C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
D312-00(R2006).....Asphalt Used in Roofing
E84-08.....Surface Burning Characteristics of Building Materials
F1667-05.....Driven Fasteners: Nails, Spikes and Staples.

PART 2 - PRODUCTS

2.1 INSULATION – GENERAL:

A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
D. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material

Material Type	Percent by Weight
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Phenolic rigid foam	5 percent recovered material
Rock wool material	75 percent recovered material

The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

2.2 PERIMETER INSULATION IN CONTACT WITH SOIL:

A. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.

B. Cellular Glass Block: ASTM C552, Type I or IV.

2.3 EXTERIOR FRAMING OR FURRING INSULATION:

A. Batt or Blanket: Optional.

B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.

C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.

2.4 ACOUSTICAL INSULATION:

A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).

B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.

C. Thickness as shown; of widths and lengths to fit tight against framing.

2.5 RIGID INSULATION:

A. On the inside face of exterior walls, spandrel beams, floors, bottom of slabs, and where shown. Provide foil-faced glass-fiber board Insulation on the inside face of concrete precast panels: ASTM C 612, Type IA or ASTM C 553, Types I, II, and III; faced on one side with foil-scrim-kraft vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.

B. Mineral Fiber Board: ASTM C612, Type IB or 2.

C. Perlite Board: ASTM C728.

D. Cellular Glass Block: ASTM C552, Type I.

2.6 FASTENERS:

A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.

B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.

C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

2.7 ADHESIVE:

A. As recommended by the manufacturer of the insulation.

B. Asphalt: ASTM D312, Type III or IV.

C. Mortar: ASTM C270, Type 0.

2.8 TAPE:

A. Pressure sensitive adhesive on one face.

B. Perm rating of not more than 0.50.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.

B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.

C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.

D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

3.2 PERIMETER INSULATION:

A. Vertical insulation:

1. Fill joints of insulation with same material used for bonding.
2. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
3. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.

3.3 EXTERIOR FRAMING OR FURRING BLANKET INSULATION:

A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.

B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.

C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.

3.4 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS, FLOORS, AND UNDERSIDE OF FLOORS:

A. On the interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to the face of studs for interior wall finish where shown.

B. Bond to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Fill joints with adhesive cement.

C. Use impaling pins for attachment to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.

D. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings not more than 300 mm (12 inches) apart. Stagger fasteners at joints of boards. Install at each corner.

3.5 RIGID INSULATION ON INSIDE FACE OF CONCRETE PRECAST PANELS:

A. Use impaling pins for attachment to inside face of concrete precast panels. Space fastenings as required to hold insulation in place and prevent sagging.

B. Set foil-scrim-kraft vapor retarder faced units with vapor retarder to warm side of construction.

C. Tape joints and ruptures in foil-scrim-kraft vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

3.6 ACOUSTICAL INSULATION:

A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.

B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or

partition. Hold insulation in place with pressure sensitive tape or adhesive.

C. Do not compress insulation below required thickness except where embedded items prevent required thickness.

D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.

E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.

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SECTION 07 21 23
LOOSE-FILL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section covers loose fill insulation, vapor barrier and all necessary blocking to install insulation in attic spaces and where shown.

B. Insulation shall be installed in sufficient thickness to provide aged thermal resistance "R" valves of “R" 30 in attics "R" 30 as shown.

1.2 RELATED WORK

A. Masonry: Section 04 42 00, UNIT MASONRY.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. Loose fill insulation in pint size containers
2. Blocking: 150 mm (6-inch) long strips
3. Vapor Retarder: 150 mm x 150 mm (6-inch by 6-inch) pieces

C. Manufacture's Literature:

1. Submit current copies of the insulation manufacturer's printed fact sheet literature, including descriptive data, insulation characteristics, and instructions for installation and protection of insulation.
2. Submit copy of "Bag Label".

1.4 DELIVERY

A. Deliver materials to the site in the original sealed containers or packages bearing the manufacturer's name and brand designation.

B. The containers or packages of insulation shall bear the referenced specification number, type and class as applicable, recommended method of installation (pneumatic or pouring), minimum net weight of insulation, coverage charts, "R" values, and required warning statements.

1.5 STORAGE

A. Inspect materials delivered to the site for damage and unload and store with a minimum of handling.

B. Storage spaces shall be dry locations, not subject to open flames or sparks, and permitting easy access for inspection and handling.

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 of Testing and Materials (ASTM):

C612-04.....Mineral Fiber Block and Board Thermal Insulation

C728-05.....Perlite Thermal Insulation Board

C739-08.....Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation

C764-07.....Mineral Fiber Loose Fill Thermal Insulation.

C1015-06.....Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation

D4397-08.....Polyethylene Sheeting for Construction, Industrial, and Agriculture Applications

E84-08.....Surface Burning Characteristics of Building Materials

C. Federal Regulations:

Code of Federal Regulations 29 CFR 1910, Occupational Safety and Health Act (OSHA).

D. National Fire Protection Associations (NFPA):

211-06.....Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances

PART 2 - PRODUCTS

2.1 LOOSE FILL INSULATION

A. Cellulosic or Wood Fiber Loose Fill: ASTM C739.

B. Mineral Fiber Loose Fill: ASTM C764, Type I or II.

2.2 BLOCKING

A. Wood, metal, mineral fiber or perlite boards or other materials approved by the Contracting Officer Technical Representative (COTR).

B. Mineral Fiber Board: ASTM C612, Type IB.

C. Perlite Board: ASTM C728.

2.3 VAPOR RETARDER

A. Six mil thick polyethylene sheeting conforming to ASTM D4397.

B. Self adhesive tape having a perm rating equal to the polyethylene.

2.4 RECOVERED MATERIAL

A. Insulation products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Cellulose Loose-fill and spray-on	75 percent post-consumer recovered paper
Perlite composite board	23 percent post-consumer
Rock wool material	75 percent recovered material

B. The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

PART 3 - EXECUTION

3.1 INSPECTION

A. Where possible, inspect attic(s) and ceiling(s) to receive insulation for conditions which will adversely affect the execution of the work or create a safety hazard. Report unsatisfactory conditions to the COTR.

B. Do not install insulation until unsatisfactory conditions have been corrected.

C. Follow ASTM C1015. The inspection shall include checking for the following:

1. Defects in electrical fixtures, equipment, wiring, junction boxes, receptacles, and switches that will cause hazards.
2. Openings through which the loose fill insulation material may escape.
3. Air ducts which appear to have joints that are not secure or sealed.

3.2 PREPARATION

A. Prior to the installation of insulation, provide blocking as specified herein and in accordance with ASTM C1015.

B. Install blocking around attic trap door(s), ceiling access-panel(s), and vents if the level to which the unsettled insulation will be installed exceeds their height. Cover openings into the attic with temporary blocking to prevent insulation from falling into the opening, including spaces enclosed by blockings.

C. Install blocking around heat producing devices with minimum clearances as specified herein.

1. Install blocking 50 mm (two inches) above the height of the finished insulation installation and in a manner that ensures that devices which may require maintenance or servicing remain accessible after the insulation is installed.
2. Minimum clearances for blocking around heat producing devices shall be as follows:
   a. Masonry chimneys for equipment and incinerator(s) operating at a temperature of not more than 800 degrees C (1500 degrees F): 100 mm (Four inches) from the outside face of the masonry.
   b. Vents, chimney and vent connectors, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

3.3 INSTALLATION

A. Vapor Retarder:
   1. Where space is accessible, install vapor retarder below insulation. Do not install a vapor retarder over existing insulation or where there is a vapor retarder under existing insulation.
   2. Take care to prevent tears, breaks, or ruptures of any kind which might interfere with the effectiveness of the vapor retarder, and install in a manner which will assure a continuous seal.
   3. Lap joints or breaks in vapor retarder in a manner that will assure a vapor retarder capable of effectively controlling moisture transmission. Tape laps to retain vapor barrier in place.
   4. Use self adhesive tape for laps and for sealing breaks and holes in the vapor retarder.

B. Insulation:
   1. Install insulation in accordance with ASTM C1015 and the requirements specified.
   2. Do not install insulation until the requirements specified in the INSPECTION and PREPARATION paragraphs have been carried out and any defects which were identified have been corrected and their cause eliminated.
   3. Pneumatic installation of thermal insulation shall comply with OSHA. Supply and utilize the personnel protective equipment and engineering controls necessary for a safe effective installation. Use only pneumatic equipment in accordance with the manufacturer's instructions.

4. Install the insulation allowing it to settle to its natural density. Do not tamp or rod the insulation.
5. Install insulation in sufficient depth to provide the thermal value specified after settlement of the insulation. To obtain a minimum "R" value of 30 or as shown, install insulation to a minimum thickness of 242 mm (9.6 inches) or as shown, using the number of bags per 90 m² (1000 squares feet) as shown on the manufacturer's "Bag Label".
6. For pneumatic installations, use the least air pressure meeting the manufacturer's instructions.
7. Do not blow the insulation into electrical devices and vents which open into the attic and other spaces to be insulated.
8. Fit the attic side of trap doors and access panels with perlite or mineral fiber insulation boards. Insulate the attic side of trap doors unless prevented by a retractable ladder.

C. Post Installation Procedures:
1. In accordance with ASTM C1015.
2. Remove temporary blockings over vent openings in attic(s).

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SECTION 07 31 13
ASPHALT SHINGLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies organic felt and fiberglass asphalt shingles.

1.2 RELATED WORK

A. Color of shingles: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Counterflashing and flashing of roof projections: Section 07 60 00, FLASHING AND SHEET METAL.

C. Roof scuttles, ridge and roof vents, Section 07 72 00, ROOF ACCESSORIES.

1.3 SUMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Shingles, each type, color and texture.

C. Manufacturer's Literature and Data:

1. Shingles, each type
2. Installation instructions

1.4 DELIVERY AND STORAGE

A. Deliver materials in manufacturer's unopened bundles or containers with the manufacturer's brand and name clearly marked thereon.

B. Shingle bundle wrapping shall bear the label of Underwriters Laboratories, Inc.

C. Store shingles in accordance with manufacturer's printed instructions. Store roll goods on end in an upright position.

D. Keep materials dry, covered completely and protected from the weather.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part o this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

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

D226-06.....Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

D1970-08.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

D2178-04.....Asphalt Glass Felt used in Roofing and Waterproofing
D3018-03.....Class A Asphalt Shingles Surfaced with Mineral Granules
D3462-07.....Asphalt, Shingles Made from Glass Felt and Surfaced with Mineral Granules
F1667-05.....Driven Fasteners: Nails, Spikes, and Staples

C. Underwriter's Laboratories Inc. (UL):
UL790-04.....Fire Tests of Roof Covering

PART 2 - PRODUCTS

2.1 SHINGLES

A. Class A: (Fire resistive), per UL790. ASTM D3018, Type I and ASTM 3462, square butt for a maximum exposure of 125 mm (5 inches), headlap minimum 50 mm (2 inches), wind resistant, self sealing. Minimum weight: 14.6 -16.1 Kg/sqm (300 lbs/100sft).
B. Color: See Section 09 06 00, SCHEDULE OF FINISHES.
C. Eaves Protection: ASTM D 1970 sheet barrier of self-adhering rubberized asphalt membrane shingle underlayment having internal reinforcement, and "split" back plastic release film; provide material with warranty equal in duration to that of shingles being applied

2.2 ROOFING NAILS

A. ASTM F1667; Type I, Style 20, galvanized steel, deformed shanks, with heads 9.5 mm to 11 mm (3/8-inch to 7/16-inch) diameter.
B. Use nails Standard round wire type roofing nails, corrosion resistant; hot dipped zinc coated steel, aluminum, or chromated steel; minimum 3/8 inch (9.5 mm) head diameter; minimum 11 or 12 gauge (2.5 mm) shank diameter; shank to be of sufficient length to penetrate through roof sheathing or 3/4 inch (19 mm) into solid wood, plywood, or non-veneer wood decking.
C. Asphalt Roofing Cement: ASTM D 4586

2.3 ROOFING FELT

A. Fiberglass Felt: ASTM D2178.
B. Organic Felt: ASTM D226, TYPE l.
C. Modified bitumen; ASTM D 1970.
D. Underlayment: ASTM D 6757; asphalt-impregnated fiberglass-reinforced organic felt designed for use on roof decks as a water-resistant layer beneath roofing shingles.

E. Waterproofing Underlayment: ASTM D 1970 sheet barrier of self-adhering rubberized asphalt membrane shingle underlayment having internal reinforcement, and "split" back plastic release film; Use in ‘low-slope’ areas (below 4:12, but no less than 2:12); provide material with warranty equal in duration to that of shingles being applied. 3’-0” wide roof edge perimeter, valleys rakes, and roof to wall.

2.4 FLASHING FABRICATION

A. Form flashing to profiles indicated on Drawings, and to protect roofing materials from physical damage and shed water.

B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

PART 3 EXECUTION

3.1 PREPARATION

A. Roof surfaces shall be sound, reasonably smooth and free from defects which would interfere with roofing installation.

B. Roof accessories, vent pipes and other projections through the roof must be in place and roof flashing installed or ready for installation before laying shingles.

3.2 LAYING

A. Lay felt under shingles over entire roof.

B. Install asphalt felt underlayment, lapping a minimum of 100 mm (four inches) at ends, 50 mm (2 inches) at head and 300 mm (12 inches) over ridge. Extend felt 13 mm (1/2-inch) beyond edges of roof. Nail felt 125 mm (five inches) on centers along laps.

C. At eaves, install strip of 41 Kg (90 pound) mineral surface roll roofing not less than 460 mm (18 inches) wide and starter course of roof shingles with tabs reversed. Both shall overhang lower edge of roof 13 mm (1/2-inch).

D. Lay shingles with maximum exposure of 125 mm (5 inches). Nail shingles in accordance with manufacturer's published directions.

3.3 METAL DRIP EDGES

A. At rakes, install metal drip edges made of stainless steel specified under Section 07 60 00, FLASHING AND SHEET METAL. Apply the metal drip edge directly over the underlayment along the rakes.

B. Secure metal drip edges with compatible nails spaced not more than 250 mm (10 inches) on center along the inner edges.

3.4 FLASHINGS

A. Provide metal flashings specified under Section 07 60 00, FLASHING AND SHEET METAL at the intersections of roofs, adjoining walls, or projections through the deck such as chimneys and vent stacks. Give careful attention to the installation of all flashings.

3.5 RIDGE

A. Bend each shingle lengthwise down center to provide equal exposure on each side of ridge. Beginning at one end of ridge, apply shingles with maximum 125 mm (5 inches) exposure.

B. Secure each shingle with one nail on each side, 210 mm (8-1/2 inches) back from exposed end and one inch up from edge.

3.6 VALLEY FLASHING

A. Install metal valley flashing shown and as specified under Section 07 60 00, FLASHING AND SHEET METAL.

B. Secure valley flashing in accordance with shingle manufacturer's printed instructions.

C. Expose flashing in open portion of valley a minimum of 125 mm (5 inches) and lap the shingles over the flashing a minimum of 125 mm (5 inches).

3.7 ROOF ACCESSORIES

A. Install roof scuttles, ridge and roof vents, as specified under Section 07 72 00, ROOF ACCESSORIES prior to placing shingles.

B. Lap shingles over the accessories flashing a minimum of 125 mm (5 inches).

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SECTION 07 46 60
FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Siding panels.

B. Soffit panels.

C. Accessories and trim.

1.2 RELATED SECTIONS

A. Framing and sheathing: Section 06 10 00, ROUGH CARPENTRY.

B. Flashing and sheet metal: Section 07 60 00, FLASHING AND SHEET METAL.

C. Sealants: Section 07 92 00, JOINT SEALANTS.

D. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 REFERENCES

A. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 1998.

B. ASTM C 1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards; 1999.

C. ASTM C 1186 - Standard Specification for Flat Non-Asbestos Fiber Cement Sheets; 1999.

D. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 1998.

E. ASTM E 84 -- Standard Test Method for Surface Burning Characteristics of Building Materials; 1999.

F. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials; 1995.

G. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 1999.

H. ASTM E 228 - Standard Test Method for Linear Thermal Expansion of Solid Materials With a Vitreous Silica Dilatometer; 1995.

I. ASTM G 26 - Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials; 1996.

1.4 SUBMITTALS

A. Make submittals under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods, including nailing patterns.

4. Applicable model code authority evaluation report (ICC, CCMC, etc.)

C. Samples: Provide samples of all siding, soffit and trim pieces. Minimum size of 300mm by 300mm (12 inches by 12 inches).

D. LEED Submittals: Provide documentation of how the requirements of Credit will be met:

1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.

2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

3. List of proposed materials with rapidly renewing content. Indicate rapidly renewing content percentage for each product having rapidly renewing content.

E. Siding manufacturer's requirements for vapor retarders, primer, paint, etc., to be installed by others.

F. Maintenance and periodic inspection recommendations.

G. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Provide installer with not less than three years of experience with products similar to those specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products off the ground, on a flat surface, and under a roof or separate waterproof covering.

1.7 WARRANTY

A. Provide 50 year limited siding warranty.

B. Color Finish – provide 15 year limited paint warranty

C. Stain Finish – provide 12 year limited coating warranty

D. Register manufacturer's warranty, made out in Owner's name, with copy to Owner.

PART 2 PRODUCTS

2.1 PANELS

A. Fiber Cement Board Panels - General: Fiber Cement Board Panels consist of cement, fly ash and cellulose fiber formed under high pressure into boards with integral surface texture; complying with ASTM C 1186 Type A Grade II; machined edges; for nail attachment.

1. Surface Burning Characteristics: Flame spread index of 0, smoke developed index of 5, maximum; when tested in accordance with ASTM E 84 (Class I/A).

2. Flammability: Noncombustible, when tested in accordance with ASTM E 136.

3. Flexural Strength: At least 1450 psi (10 MPa) when in equilibrium condition, and at least 1015 psi (7 MPa) when in wet condition, tested in accordance with ASTM C 1185.

4. Coefficient of Thermal Expansion: Less than 1 x 10^-5/inch/inch/degree F (0.5 x 10^-5/degree C), when tested in accordance with ASTM E 228.

5. Freeze Thaw Resistance: At least 80 percent flexural strength retained, when tested in accordance with ASTM C 1185.

6. UV Resistance: No cracking, checking, or erosion, when tested for 2000 hours in accordance with ASTM G 26.

7. Water Tightness: No water droplets on underside, when tested in accordance with ASTM C 1185.

B. Horizontal Siding: Lap Siding.

1. Thickness: 5/16 inch (7.9 mm), plus or minus .04 inch (1 mm).

2. Length: 12 feet (3657 mm), plus 0, minus 1/8 inch (3 mm).

3. Style: Cedar lap siding.

   a. Width: 8-1/4 inches (210 mm) wide.

4. Sealant/Primer: FiberTect Sealant/Primer.

5. Factory Finish: Factory applied Finishing System by Manufacturer with 100 percent acrylic solid color as follows:

   a. Selected by A-E from manufacturers full range of factory applied solid colors. Provide samples for selection to A-E from colors below:

   b. Linen.

   c. Antique White.

   d. Butter.

   e. Merino Tan.

   f. Wicker.

   g. Heritage Clay.

   h. Heather.

   i. Pewter.

C. Vertical Siding: Vertical Siding boards.

1. Thickness: 5/16 inch (7.9 mm), plus or minus .04 inch (1 mm).

2. Size: 48 by 120 inches (1220 by 3048 mm).

3. Style: Cedar panel, 3/8 inch (9.5 mm) wide grooves at 8 inches (200 mm) on center.

4. Factory Finish: Factory applied Color Finishing System by manufacturer with 100 percent acrylic solid color as follows:

   a. Selected by A-E from manufacturers full range of factory applied solid colors. Provide samples for selection to A-E from colors below:

   b. White.

   c. Linen.

   d. Antique White.

   e. Butter.

f. Merino Tan.

g. Wicker.

h. Heritage Clay.

i. Heather.

j. Pewter.

D. Soffit: Soffit boards, ventilated and non-ventilated.

1. Thickness: 1/4 inch (6.35 mm), plus or minus 1/32 inch (0.8 mm).

2. Style: Cedar texture, 16 inches (406 mm) wide.

3. Ventilated soffit.

4. Factory Finish: Factory applied Color Finishing System by manufacturer with 100 percent acrylic solid color as follows:

a. Selected by A-E from manufacturers full range of factory applied solid colors. Provide samples for selection to A-E from colors below:

b. White.

c. Linen.

d. Antique White.

e. Butter.

f. Merino Tan.

g. Wicker.

h. Heritage Clay.

i. Heather.

j. Pewter.

E. Soffit/Porch Panel: Soffit/Porch Panel.

1. Thickness: 1/4 inch (6 mm), (6.35 mm, plus or minus 0.8 mm).

2. Width: 48 inches (1220 mm).

3. Length: 8 feet (2440 mm), plus 0, minus 1/8 inch (3.17 mm).

4. Factory Finish: Factory applied Color Finishing System by manufacturer with 100 percent acrylic solid color as follows:

   a. Selected by A-E from manufacturers full range of factory applied solid colors. Provide samples for selection to A-E from colors below:

   b. White.

   c. Linen.

   d. Antique White.

   e. Butter.

   f. Merino Tan.

   g. Wicker.

   h. Heritage Clay.

   i. Heather.

   j. Pewter.

2.2 ACCESSORIES

A. Trim: Trim

1. Size:

   a. Thickness as indicated on drawings.

   b. Width:

      1) 3-1/2 inch (89 mm).

      2) 5-1/2 inch (140 mm).

      3) 7-1/4 inch (185 mm).

   c. Length: 12 feet (3.657 m) plus or minus 1/8 inch (3.17 mm).

2. Sealant/Primer: FiberTect Sealant/Primer.

B. Provide the following trim:

1. Starter strip for lap siding.

2. Outside corners, butted to siding.

3. Outside corners, overlapping siding.

4. Fascia board.

C. Sealant: Paintable, 100 percent acrylic latex caulk complying with ASTM C 920.

D. Sheet Metal Flashing: Minimum 26 gauge hot-dipped galvanized steel sheet, or coated aluminum.

E. Nails: Length as required to penetrate minimum 1-1/4 inch (32mm) into solid backing; hot-dipped galvanized or stainless steel.

F. Building Paper: Kraft or bituminous paper; not polyethylene or foil.

G. Touch Up Kit: Provide manufacturers touch-up kit for each color provided.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to commencing installation, verify governing dimensions of building and condition of substrate.

B. If substrate preparation is the responsibility of another installer, notify A-E of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Examine, clean, and repair as necessary any substrate conditions that would be detrimental to proper installation.

B. Do not begin installation until unacceptable conditions have been corrected.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and Drawing details.

1. Read warranty and comply with all terms necessary to maintain warranty coverage.

2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.

3. Use trim details indicated on drawings.

4. Touch up all field cut edges before installing.

5. Pre-drill nail holes if necessary to prevent breakage.

B. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing into studs.

C. Over Masonry Walls: Install furring strips of adequate thickness to accept full length of nails and spaced at 16 inches (406 mm) on center.

D. Allow space between both ends of siding panels that butt against trim for thermal movement; seal joint between panel and trim with exterior grade sealant.

E. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.

F. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

G. Furred Installation: Leave space at top and bottom open; top may be behind soffit; at bottom install insect screen over opening by wrapping a strip of screen over bottom ends of vertical furring strips.

H. Install sheet metal flashing above door and window casings and horizontal trim in field of siding.

I. Do not install siding less than 6 inches (150 mm) from surface of ground nor closer than 1 inch (25 mm) to roofs, patios, porches, and other surfaces where water may collect.

J. After installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.

3.4 CLEANING

A. At completion of work, remove debris caused by siding installation from project site.

B. Touch-up, repair or replace damaged products before Substantial Completion.

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SECTION 07 53 23
ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING

PART 1 GENERAL

1.1 DESCRIPTION

A. Ethylene Propylene Diene Monomer (EPDM) sheet roofing adhered to roof deck.

B. Fire rated roof system.

1.2 RELATED WORK

A. Treated wood framing, blocking, and nailers: Section 06 10 00, ROUGH CARPENTRY.

C. Metal cap flashings, copings, fascias, and expansion joints: Section 07 60 00, FLASHING AND SHEET METAL.

1.3 QUALITY ASSURANCE

A. Approved applicator by the membrane roofing system manufacturer, and certified by the manufacturer as having the necessary expertise to install the specific system.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Applicators approval certification by manufacturer.

C. Shop Drawings:

1. Sheet membrane layout.
2. Fastener pattern, layout, and spacing requirements.
3. Termination details.

D. Manufacturers installation instructions revised for project.

E. Samples:

1. Sheet membrane: One 150 mm (6 inch) square piece.
2. Sheet flashing: One 150 mm (6 inch) square piece.
3. Fasteners: Two, each type.
4. Welded seam: Two 300 mm (12 inch) square samples of welded seams to represent quality of field welded seams.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials as specified by manufacturer.

B. Store volatile materials separate from other materials with separation to prevent fire from damaging the work, or other materials.

1.6 WARRANTY

Roofing work subject to the terms of the Article “Warranty of Construction”, FAR clause 52.246-21, except extend the warranty period to five years.

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

A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

D751-06.....Coated Fabrics

D2103-05.....Polyethylene Film and Sheeting

D2240-05.....Rubber Property - Durometer Hardness

D3884-07.....Abrasive Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)

D4637-04.....EPDM Sheet Used in Single-Ply Roof Membrane

D4586-07.....Asphalt Roof Cement, Asbestos Free

E96-05.....Water Vapor Transmission of Materials

E108-07.....Fire Tests of Roof Coverings

G21-96 (R2002).....Resistance of Synthetic Polymeric Materials to Fungi

C. National Roofing Contractors Association (NRCA):

Fifth Edition - 05.....The NRCA Roofing and Waterproofing Manual.

D. Federal Specifications (Fed. Spec.)

FF-S-107C(2).....Screws, Tapping and Drive

FF-S-111D(1).....Screw, Wood

UU-B-790A.....Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant)

E. Factory Mutual Engineering and Research Corporation (FM):

Annual Issue.....Approval Guide Building Materials

F. Underwriters Laboratories, Inc (UL):

Annual Issue.....Building Materials Directory

Annual Issue.....Fire Resistance Directory

G. Warnock Hersey (WH):

Annual Issue.....Certification Listings

PART 2 - PRODUCTS

2.1 EPDM SHEET ROOFING

A. Conform to ASTM D4637, Type I, Grade 1, black color

B. Additional Properties:

PROPERTY	TEST METHOD	REQUIREMENT
Shore A Hardness	ASTM D2240	55 to 75 Durometer
Water Vapor Permeance	ASTM E96	Minimum 0.14 perms Water Method
Fungi Resistance	ASTM G21	After 21 days, no sustained growth or discoloration.
Fire Resistance	ASTM E108 Class A	No Combustion Beyond Flame/Heat Source

C. Thickness:
   1. Use 1.14 mm (0.045-inch) thick sheet for adhered system.

D. Pipe Boots:
   1. Molded EDPM designed for flashing of round penetrations, 200 mm (8 inch) minimum height.
   2. Color same as roof membrane.

2.2 EPDM FLASHING SHEET

A. Conform to ASTM D4637, Type I, Grade 1, Class U, unreinforced, color, same as roof membrane modified as specified for flashing.

B. Self curing EPDM flashing, adaptable to irregular shapes and surfaces.

C. Minimum thickness 1.5 mm (0.060-inch).

2.3 MISCELLANEOUS ROOFING MEMBRANE MATERIALS

A. Sheet roofing manufacturers specified products.

B. Splice Adhesive: For roofing and flashing sheet.

C. Lap Sealant: Liquid EPDM rubber for roofing sheet exposed lap edge.

D. Bonding Adhesives: Neoprene, compatible with roofing membrane, flashing membrane, insulation, metals, concrete, and masonry for bonding roofing and flashing sheet to substrate.

E. Fastener Sealer: One part elastomeric adhesive sealant.

F. Temporary Closure Sealers (Night Sealant): Polyurethane two part sealer.

G. Primers, Splice Tapes, Cleaners, and Butyl Rubber Seals: As specified by roof membrane manufacturer.

H. Asphalt Roof Cement: ASTM D4586.

2.4 FASTENERS

A. Fasteners and washers required for securing sheet roofing to deck:
   1. Steel stress plate washers as required by sheet roofing manufacturer:
      a. Coated against corrosion.
      b. Separate or attached to fastener.

c. Approximately 50 mm (2 inch) diameter or 40 mm x 65 mm (1-1/2 by 2-1/2 inches) rectangular plate with rounded corners, minimum thickness 0.6 mm (0.023-inch).

2. Fastening strip or batten strip for securing roof membrane to deck:
   a. Stainless steel strip: ASTM A167 type 302 or 304, minimum 0.5 mm (0.018-inch) thick.
   b. Aluminum strip: ASTM B209, minimum 2.4 mm (0.094-inch) thick.
   c. Rounded corners on strips.
   d. Form strips 38 mm (1-1/2 inches) wide, 3000 mm (10 feet) maximum length with 6 mm x 10 mm (1/4 by 3/8 inch) punched slotted holes at 100 mm (4 inch) centers; centered on width of strip. Punch holes 2 mm (1/16 inch) larger than fastener shank when shank is larger than 5 mm (3/16 inch).
3. Steel decks: Screws; Fed Spec FF-S-107, hardened nylon screw or steel screw coated to resist corrosion, self drilling, anti-backout thread design. Minimum pullout resistance of 135 Kg (300 pounds), minimum thread penetration of 13 mm (1/2 inch).
4. Gypsum, Insulating Concrete, and Structural Cement Fiber Decks: Diverging or hooking point fastener, anti-spin fitting; or specifically designed for anchorage to deck as recommended by roofing membrane manufacturer, coated to resist corrosion, minimum pullout resistance of 200 Kg (450 pounds).
5. Concrete and Masonry Wall Surfaces:
   a. Nail penetration 13 mm (1/2 inch).
6. Wood:
   a. Screws; Fed. Spec. FF-S-111, Type I, Style 2.5, coated to resist corrosion, length to provide 19 mm (3/4 inch) minimum penetration.
   b. Nails: Barbed shank, galvanized.
7. Washers: Neoprene backed metal washer 28 mm (1-1/8 inch) minimum diameter.
8. To Sheet Metal: Self tapping screw; Fed. Spec. FF-S-107, 2 mm (No. 14), sheet metal screw, minimum thread penetration of 6 mm (1/4 inch); stainless steel.

B. Pipe Compression Clamp or Drawband:
   1. Stainless steel or cadmium plated steel drawband.
   2. Worm drive clamp device.
C. Surface mounted base flashing clamp strip:
   1. Stainless steel strip, ASTM A167, type 302 or 304, dead soft temper, minimum 0.5 mm (0.018-inch) thick.

2. Aluminum strip: ASTM B209 24 mm (.094-inch) thick.
3. For exposed location, form strips with 6 mm (1/4 inch) wide top edge bent out 45 degrees (for sealant) from 40 mm (1-1/2 inch) wide material; 2400 mm (8 feet) maximum length with slotted 6 mm x 10 mm (1/4 by 3/8-inch) holes punched at 200 mm (8 inch) centers, centered between bend and bottom edges.
4. For locations covered by cap flashings, form strips 30 mm (1-1/4 inch) wide, 2400 mm (8 feet) maximum length with slotted holes 6 mm x 10 mm (1/4 by 3/8 inch) punched at 200 mm (8 inch) centers, centered on strip width.

2.5 VAPOR RETARDER OR SEPARATION SHEETS

A. Polyethylene film: ASTM D2103, 0.2 mm (6 mils) thick.

B. Building Paper: Fed. Spec. UU-B-790.
1. Water vapor resistance: Type I, Grade A, Style 4, reinforced.
2. Water vapor permeable: Type I, Grade D, Style 4, reinforced.

2.6 FLEXIBLE TUBING

A. Closed cell neoprene, butyl polyethylene, vinyl, or polyethylene tube or rod.

B. Diameter approximately 1-1/2 times joint width.

2.8 PROTECTION MAT OR SEPARATION SHEETS

A. Protection Mat:
1. Water pervious; either woven or non-woven pervious sheet of long chain polymeric filaments or yarns such as polypropylene, black polyethylene, polyester, or polyamide; or, polyvinylidene-chloride formed into a pattern with distinct and measurable openings.
2. Filter fabric equivalent opening size (EOS): Not finer than the U.S.A. Standard Sieve Number 120 and not coarser than the U.S.A. Standard Sieve Number 100. EOS is defined as the number of the U.S.A. Standard Sieve having openings closest in size to the filter cloth openings.
3. Edges of fabric selvaged or otherwise finished to prevent raveling.
4. Abrasion resistance:
   a. After being abraded in conformance with ASTM D3884 using rubber-hose abrasive wheels with one kg load per wheel and 1000 revolutions, perform tensile strength test as specified in ASTM D1682, paragraph.
   b. Result; 25 kg (55 pounds) minimum in any principle direction.

5. Puncture strength:
   a. ASTM D751 - tension testing machine with ring clamp; steel ball replaced with a 8 mm (5/16 inch) diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.
   b. Result; 57 kg (125 pounds) minimum.
6. Non-degrading under a wet or humid condition within minimum 4°C (40°F) to maximum 66°C (150°F) when exposed to ultraviolet light.
7. Minimum sheet width: 2400 mm (8 feet).

PART 3 - EXECUTION

3.1 GENERAL

A. Do not apply if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless protection provided to distribute loads less than one-half compression resistance of roofing system materials.
   1. Curbs, blocking, edge strips, and other components to which roofing and base flashing is attached in place ready to receive insulation and, roofing.
   2. Coordinate roof operation with sheet metal work and roof insulation work so that insulation and flashing are installed concurrently to permit continuous roofing operations.
   3. Complete installation of flashing, insulation, and roofing in the same day except for the area where temporary protection is required when work is stopped.

B. Phased construction is not permitted. The complete installation of roofing system is required in the same day except for area where temporary protection is required when work is stopped. Complete installation includes pavers and ballast for ballasted systems.

C. Dry out surfaces, including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed.

D. Apply materials only to dry substrates.

E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, fog, ice, or frost) is present in any amount in or on the materials.
   1. Do not apply materials to substrate having temperature of 4°C (40 degrees F) or less, or when materials applied with the roof require higher application temperature.

2. Do not apply materials when the temperature is below 4°C (40 degrees F).

3.2 PREPARATION

B. Remove dirt, debris, and surface moisture. Cover or fill voids greater than 6 mm (1/4 inch) wide to provide solid support for roof membrane.

C. Install separation sheet over bituminous material on deck surface lapping edges and ends 150 mm (6 inches) or as recommended by roof membrane manufacturer.

1. Do not install of separation sheet beyond what can be covered by roofing membrane each day.
2. Use polyethylene, or building paper, that will be compatible with seaming method.
3. Insure separation sheet completely isolates bituminous materials from EPDM roofing membrane.
4. Turn up at penetrations, or other surfaces where bituminous materials occur, to cover bituminous product.
5. Turn down over edges of blocking at perimeters to cover blocking.

3.3 INSTALLATION OF ROOFING AND FLASHING

A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with EPDM roofing membrane.

B. If possible, install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.

C. If possible, start at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet.

D. Position the membrane so it is free of buckles and wrinkles.

E. Roll sheet out on deck; inspect for defects as sheet is being rolled out and remove defective areas:

1. Allow 30 minutes for relaxing before proceeding.
2. Lap edges and ends of sheets 75 mm (3 inches) or more as recommended by the manufacturer. Clean lap surfaces as specified by manufacturer.
3. Adhesively splice laps. Apply pressure as required. Seam strength of laps as required by ASTM D4637.
4. Check seams to ensure continuous adhesion and correct defects.
5. Finish edges of laps with a continuous beveled bead of lap sealant to sheet edges to provide smooth transition as specified by manufacturer.
6. Finish seams as the membrane is being installed (same day).

7. Anchor perimeter to deck or wall as specified.

F. Membrane Perimeter Anchorage:
   1. Install batten strip or steel stress plate with fasteners at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated in accordance with membrane manufacturer's instructions on top of roof membrane to wall or deck.
   2. Mechanically fastened as follows:
      a. Top of mechanical fastener set flush with top surface of the nailing strip or stress plate.
      b. Space mechanical fasteners a maximum 300 mm (12 inches) on center.
      c. Start 25 mm (1 inch) from the end of the nailing strip when used.
      d. When strip is cut round edge and corners before installing.
      e. Set fasteners in lap sealant and cover fastener head with fastener sealer including batten strip or stress plate.
      f. Stop fastening strip where the use of the nailing strip interferes with the flow of the surface water, separate by a 150 mm (6 inch) space, then start again.
      g. After mechanically fastening cover and seal with a 225 mm (9 inch) wide strip of flashing sheet. Use splice adhesive on all laps and finish edge with sealant as specified.
      h. At facia-cants turn the membrane down over the front edge of the blocking, cant, or the nailer to below blocking. Secure the membrane to the vertical portion of the nailer; with fasteners spaced not over 150 mm (6 inches) on centers.
      i. At parapet walls intersecting building walls and curbs, secure the membrane to the structural deck with fasteners 150 mm (6 inches) on center or as shown in NRCA manual (Fifth Edition).

G. 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 the deck with adhesive. Do not coat the lap joint area.
   3. After adhesive has set according to adhesive manufacturer's application instruction, roll the membrane into the adhesive in manner that minimizes voids and wrinkles.
   4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.

H. Install flashings as the membrane is being installed (same day). If the flashing cannot be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.

2. Turn down the metal drain flashing and EPDM roof membrane into the drain body/ gutter.

I. Installing EPDM Base Flashing and Pipe Flashing:

1. Install EPDM flashing membranes to pipes, walls or curbs to a height not less than 200 mm (8 inches) above roof surfaces and 100 mm (4 inches) on roof membranes. Install in accordance with NRCA manual:
   a. Adhere flashing to pipe, wall or curb with bonding adhesive.
   b. Form inside and outside corners of EPDM flashing membrane in accordance with NRCA manual (Fifth Edition). Form pipe flashing in accordance with NRCA manual (Fifth Edition).
   c. Lap ends not less than 100 mm (4 inches).
   d. Adhesively splice flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
2. Anchor top of flashing to walls or curbs with fasteners spaced not over 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.

J. Repairs to membrane and flashings:

1. Remove sections of EPDM sheet roofing or flashing that is 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. Adhesively splice to roof membrane or flashing. Finish edge of lap with sealant as specified.

3.6 FIELD QUALITY CONTROL

A. Examine and probe seams in the membrane and flashing in the presence of the Contracting Officer Technical Representative (COTR) and Membrane Manufacturer's Inspector.

B. Probe the edges of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal bonds, voids, skips, and fishmouths.

C. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through the seams where directed by the COTR.
   1. Cut one sample for every 450 m (1500 linear feet) of seams.
   2. Cut the samples perpendicular to the longitudinal direction of the seams.
   3. Failure of the samples to maintain the standard of quality within a reasonable tolerance of the approved samples will be cause for rejection of the work.

D. Repair areas of welded seams where samples have been taken or marginal bond voids or skips occur.

E. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (4 inches) beyond cut.

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SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for flashing is specified in this section.

1.2 RELATED WORK

A. Masonry: Section 04 20 00, UNIT MASONRY.

B. Shingles: Section 07 31 13, ASPHALT SHINGLES.

C. Waterproofing: Section 07 13 52, MODIFIED BITUMINOUS SHEET WATERPROOFING.

D. Siding: Section 07 46 60, FIBER CEMENT SIDING.

E. Roofing: Section 07 53 23, EPDM ROOFING.

F. Sealant compound and installation: Section 07 92 00, JOINT SEALANTS.

G. Integral flashing component of manufactured roof specialties and accessories or equipment: Section 07 72 00, ROOF ACCESSORIES, and Division 22 - PLUMBING.

H. Paint materials and application: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

Flashings

Copings

Expansion joints

C. Manufacturer's Literature and Data:

Two-piece counterflashing

Thru wall flashing

Expansion joint cover, each type

Nonreinforced, elastomeric sheeting

D. Certificates: Stating that aluminum has been given - specified finish thickness of anodizing. Coating formulators approvals as specified.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below for 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):

A167-99(R 2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A653/A653M-07.....Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-04.....Solder Metal

B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

B370-03.....Copper Sheet and Strip for Building Construction

D173-03.....Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-06.....Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187-97 (R2002).....Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-07.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

D4586-07.....Asphalt Roof Cement, Asbestos Free

C. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI):

ES-1-2003.....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual (2003 Edition).

E. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-505-88.....Metal Finishes Manual

F. American Architectural Manufacturers Association (AAMA):

605-98.....Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions Panels

G. Federal Specification (Fed. Spec):

A-A-1925A.....Shield, Expansion; (Nail Anchors)

UU-B-790A.....Building Paper, Vegetable Fiber

H. International Building Code (IBC) - 2009 Edition

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Stainless Steel: ASTM A167, Type 302B, dead soft temper.

C. Copper ASTM B370, cold-rolled temper.

D. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.

E. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated creped paper. Grooves running along the width of sheet.

F. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.

G. Aluminum Sheet: ASTM B209, alloy 3003-H14.

H. Galvanized Sheet: ASTM, A653.

I. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

J. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 lbs/100 sf).

K. Bituminous Paint: ASTM D1187, Type I.

L. Fasteners:

1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for

stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.

2. Nails:
   a. Minimum diameter for copper nails: 3 mm (0.109 inch).
   b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
   c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
   d. 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.

M. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

N. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

O. Roof Cement: ASTM D4586.

2.2 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. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
2. Stainless steel: 0.25 mm (0.010 inch) thick.
3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
4. Galvanized steel: 0.5 mm (0.021 inch) thick.

C. Exposed Locations:
1. Copper: 0.4 Kg (16 oz).
2. Stainless steel: 0.4 mm (0.015 inch).
3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

2.3 FABRICATION, GENERAL

A. Jointing:
1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. 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. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.

3. Flat and lap joints shall be made in direction of flow.

4. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.

5. Soldering:

a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.

b. Wire brush to produce a bright surface before soldering lead coated copper.

c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.

d. Completely remove acid and flux after soldering is completed.

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 copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).

4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.

5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.

6. 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 0.6 mm (0.024 inch) thick stainless steel.
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 0.8 mm (0.031 inch) thick stainless steel.

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. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge

strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.

3. All metal roof edges shall meet requirements of IBC 2003.

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.

2.4 FINISH

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, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:

1. Copper: Mill finish.
2. Stainless Steel: Finish No. 2B or 2D.
3. Aluminum:
   a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
   b. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.
   c. Fluorocarbon Finish: AAMA 605, high performance organic coating.
   d. Mill finish.
4. Steel and Galvanized Steel:
   a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
   b. Manufacturer's finish:
      1) Baked on prime coat over a phosphate coating.
      2) Baked-on prime and finish coat over a phosphate coating.
      3) Fluorocarbon Finish: AAMA 605, high performance organic coating.

2.5 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch),

or ribbed diagonal pattern, or having other deformation unless specified otherwise.

1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
2. Fabricate so keying nests at overlaps.

B. For Masonry Work When Concealed Except for Drip:

1. Either copper, stainless steel, or copper clad stainless steel.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:

1. Use same metal and thickness as counter flashing.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. For Flashing at Architectural Precast Concrete Panels.

1. Use plan flat sheet of stainless steel.
2. Form exposed portions with drip as specified or receiver.

E. Window Sill Flashing and Lintel Flashing:

1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.
4. Form exposed portion with drip as specified or receiver.

F. Door Sill Flashing:

1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.6 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
   1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
   2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
   3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
   4. Use either copper, or stainless steel at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing: (Other than engine exhaust or flue stack)
   1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
   2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
   3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
      a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
      b. Allow for loose fit around and into the pipe.
   4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
      a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
      b. Allow for loose fit around pipe.

2.7 COUNTERFLASHING (CAP FLASHINGS)

A. Either copper or 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 can not 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.

F. Pipe Counterflashing:
   1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
   2. Fabricate 100 mm (4 inch) over lap at end.
   3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
   4. Use stainless steel bolt on draw band tightening assembly.
   5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.8 REGLETS

A. Fabricate reglets of one of the following materials:
   1. 0.4 Kg (16 ounce) copper.
   2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
   3. 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.
   4. Plastic, ASTM D1784, Type II, not less than 2 mm (0.075 inch) thick.

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.

2.9 INSULATED EXPANSION JOINT COVERS

A. Either type optional, use only one type throughout.

B. Types: Constructed of a 2 mm (1/16 inch) thick vinyl sheet, flanged at both sides with stainless steel strips not less than 0.4 mm (0.015 inch) thick. Vinyl sheet locked and encased by the stainless steel strip and prepunched for nailing. A 10 mm (3/8 inch) thick closed cell polyvinyl chloride foam insulating strip shall be heat laminated to the underside of the vinyl sheet between the stainless steel strips.

C. Expansion joint covers shall have factory fabricated mitered corners, crossings, tees nd other necessary accessories. Furnish in the longest available lengths.

D. Metal flange of sufficient width to extend over the top of the curb and down curb sides 50 mm (2 inches) with hemmed edge for lock to edge strip.

2.10 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 not less than 100 mm (4 inch) wide flange to lap behind gravel stop fascia.

E. Fabricate exterior wall flange for through wall scupper not less than 25 mm (one inch) wide on top and sides with edges hemmed.

F. Fabricate gravel stop bar of 25 mm x 25 mm (one by one inch) angle strip soldered to bottom of scupper.

G. Fabricate scupper not less than 200 mm (8 inch) wide and not less than 125 mm (5 inch) high for through wall scupper.

H. Solder 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. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. 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.
7. 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.
8. 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.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.

14. 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 prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
    a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches)and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.

8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).

D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.

E. Flashing at Veneer Walls:
    1. Install near line of finish floors over shelf angles or where shown.
    2. Turn up against sheathing.

3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
4. At concrete backing, extend flashing into reglet as specified.
5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

F. Lintel Flashing when not part of shelf angle flashing:
1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Window Sill Flashing:
1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
2. Turn back edge up to terminate under window frame.
3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:
1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.
1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.

2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 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 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
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.
4. Where flashing or hood is mounted on pipe.
   a. Secure with draw band tight against pipe.
   b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
   c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
   a. Secure to face construction in accordance, with manufacturers instructions.
   b. Completely fill space at the top edge of receiver with sealant.
3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

A. Install reglets in a manner to provide a watertight installation.

B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.

C. Butt and align end joints or 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.
2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 COPINGS

A. General:

1. On walls topped with a wood nailer, install a continuous edge strip on the front and rear edges of the nailer. 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. Secure counter-flashing to lock strip in coping at continuous cleat.
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.

3.8 EXPANSION JOINT COVERS, INSULATED

A. Install insulated expansion joint covers at locations shown on curbs not less than 200 mm (8 inch) high above roof surface.

B. Install continuous edge strips of same metal as expansion joint flange, nailed at not less than 75 mm (3 inch) centers.

C. Install insulated expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies copings, fascias, ridge vents, scuppers and roof hatches for access into the attic.

1.2 RELATED WORK

A. General insulation: Section 07 21 13, THERMAL INSULATION
B. Shingles: Section 07 31 13, ASPHALT SHINGLES.
C. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
D. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.

1.3 QUALITY CONTROL

A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
B. Each accessory type shall be the same and be made by the same manufacturer.
C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Samples: Representative sample panel of color anodized aluminum not less than 100 mm X 100 mm (four by four inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
D. Manufacturer's Literature and Data: Each item specified.
E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
B. American Society for Testing and Material (ASTM):
B209/209M-07.....Aluminum and Aluminum Alloy-Sheet and Plate
B221/221M-07.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

C612-04.....Mineral Fiber Block and Board Thermal Insulation
D1187-97 (R2002).....Asphalt-Base Emulsions for Use as Protective Coatings for Metal

C. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-505-88.....Metal Finishes Manual

D. American Architectural Manufacturers Association (AAMA):
605-98.....High Performance Organic Coatings on Architectural Extrusions and Panels.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221/B221M.

B. Aluminum Sheet: ASTM B209/B209M.

C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.

D. Insulation: ASTM C612, Class 1 or 2.

E. Asphalt Coating: ASTM D 1187, Type I, quick setting.

2.2 COPINGS

A. Fabricate of aluminum not less than 2 mm (0.08) inch thick.

B. Turn outer edges down each face of wall as shown.

C. Maximum lengths of 3000 mm (10 feet).

D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.

E. Copings shall be Category 5 FM rated.

F. Provide 100 mm (four inch) wide 0.8 mm (0.032 inch) thick watertight joint covers.

G. Provide anchor gutter bar of 0.8 mm (0.032 inch) thick with anchor holes formed for underside of joint.

H. Provide concealed guttered splice plate of 0.8 mm (0.032 inch) thick with butyl or other resilient seal strips anchored to splice plate for underside of joint. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.

I. Finish: Fluorocarbon as specified.

2.3 EXTRUDED ALUMINUM FASCIAS

A. Fabricate of aluminum not less than 2 mm (0.078 inch) thick.

B. Turn fascia down face of wall and up above roof as shown.

C. Maximum lengths of 3000 mm (10-feet).

D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.

E. Provide 100 mm (four inch) wide 2 mm (0.078 inch) thick watertight joint covers with 150 mm (six inch) wide 0.8 mm (0.030 inch) thick underside joint flashing.

F. Factory fabricated scupper assemblies:
   1. Fabricate scupper assembly with extended plates to match fascia-cant in 500 mm (20 inch) minimum lengths.
   2. Extend outlet opening not less than 50 mm (two inches) with drip edge.
   3. Fabricate with stainless steel cores or sleeve to drain water from toe of cant and flash in to built-up roofing with 100 mm (4 inch) wide flange.

G. Finish on aluminum: fluorocarbon as specified.

2.4 ALUMINUM 1-HOUR RATED PERSONNEL ATTIC ACCESS ROOF HATCH

A. Cover and liner: 11 gauge (0.090-inch) aluminum cover with 1 inch rigid fiberboard insulation and 18 gauge (0.040-inch) aluminum cover liner.

B. Curb: 11 gauge (0.090-inch) aluminum curb with 1 inch rigid fiberboard insulation.

C. Hinges: Type 316 stainless steel tamper-proof hinge contained within hatch as part of spring assembly.

D. Latch: Optional Type 304 stainless steel slam latch with turn handle and inside/outside padlock hasps.

E. Springs: Greased heavy-duty compression springs in telescoping tubes.

F. Hardware: 316 stainless steel hold open arm(s) with red vinyl grip handle that automatically locks door when opened. Furnish hatches with interior padlock hasp and EPDM draft seal.

G. Mounting Flanges:
   1. Single Wall Curb with 3.5″ horizontal mounting flange
   2. Double Wall Curb with 3.5″ horizontal mounting flange
   3. Curb Mount with 3″ vertical mounting flange

H. Acceptable Product: See Drawings.

I. Finish
   1. In accordance with NAAMM Amp 500-505.
   2. Aluminum, Mill Finish: AA-MIX, as fabricated.
   3. Aluminum, Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1, Architectural, 0.7 mils thick.
   4. Aluminum Colored Finish: AA-C22A42 (anodized or AA0C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1, Architectural, 0.7 mils thick. Dyes will not be accepted.
   5. Fluorocarbon Finish: AAMA 605.2 high performance organic coating.

2.5 SHINGLE OVER RIDGE VENTS

A. Provide vents compatible with roof shingle warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof accessories where shown.

B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.

C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.

D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.

E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

F. Fascias:

1. Install fascia with butt joints with approximately 6 mm (1/4 inch) space for expansion.
2. Over each joint provide cover plates of sheet aluminum, complete with concealed sheet aluminum flashing, centered under each joint.
3. Lap cover plates and concealed flashing over the gravel stop and fascia not less than four inches.
4. Extend concealed flashing over built-up roofing, embed in roof cement and turn down over face of blocking at roof edge.

G. Aluminum Coping:

1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
2. Center joint gutter bar and covers at joints and securely lock in place.
3. When snap-on system is used insure front and back edges are locked in place.

H. Expansion Joint Covers:

1. Install to terminate base flashing 200 mm (8 inches) above roof.
2. Install moisture seals to drain water to outlets that do not permit water to enter buildings construction.
3. Use stainless steel screws when exposed.
4. Three piece assembly:
   a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
   b. Install cant to wood blocking by nailing along horizontal flange every 150 mm (6 inches), with galvanized roofing nails 25 mm (one inch) long.

c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 450 mm (18 inches) on center.
d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than four inches.

5. Two piece assembly:
a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.4 PROTECTION

Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.1 DESCRIPTION

A. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.

B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

A. Insulation: Section 07 21 13, THERMAL INSULATION.

A. Sealants and application: Section 07 92 00, JOINT SEALANTS.

B. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS, Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.

C. List of FM, UL, or WH classification number of systems installed.

D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

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 WARRANTY

A. Firestopping work subject to the terms of the Article “Warranty of Construction”, FAR clause 52.246-21, except extend the warranty period to five years.

1.6 QUALITY ASSURANCE

A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

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

E84-07.....Surface Burning Characteristics of Building Materials

E814-06.....Fire Tests of Through-Penetration Fire Stops

C. Factory Mutual Engineering and Research Corporation (FM):

Annual Issue Approval Guide Building Materials

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

Annual Issue Fire Resistance Directory

1479-03.....Fire Tests of Through-Penetration Firestops

E. Warnock Hersey (WH):

Annual Issue Certification Listings

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Use 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.

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 100 mm (4 in) nominal pipe or 0.01 m^2 (16 sq. in.) in overall cross sectional area.

C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

D. Firestop sealants used for firestopping or smoke sealing shall have following properties:

1. Contain no flammable or toxic solvents.
2. Have 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 used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall 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.
3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.

F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.

G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

H. Materials to be asbestos free.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.

B. Use mineral fiber filler and bond breaker behind sealant.

C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with 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.

3.2 PREPARATION

A. Remove dirt, grease, oil, 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 (six inches) on either 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.

3.3 INSTALLATION

A. Do not begin 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.

C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP AND ACCEPTANCE OF WORK

A. As work on each floor is completed, remove materials, litter, and debris.

B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the COTR.

C. Clean up spills of liquid type materials.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK:

A. Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

B. Masonry: Section 04 20 00, UNIT MASONRY.

C. Siding: Section 07 46 60, FIBER CEMENT SIDING.

D. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.

E. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.

F. Glazing: Section 08 80 00, GLAZING.

G. Aluminum framed entrances and storefronts: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

H. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.

I. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 QUALITY CONTROL:

A. Installer Qualifications: An experienced installer 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.

B. Source Limitations: Obtain each type of joint sealant through one 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. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer’s recommendations:
1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.
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 the Contracting Officer’s Technical Representative (COTR) seven days in advance of dates and times when test joints will be erected.

E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:
1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this section.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's installation instructions for each product used.

C. Cured samples of exposed sealants for each color where required to match adjacent material.

D. Manufacturer's Literature and Data:
1. Caulking compound
2. Primers
3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 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 °C (40 °F).

b. When joint substrates are wet.

B. Joint-Width Conditions: 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: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 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 5° C (40° F) or less than 32° C (90° F).

1.7 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Back-up 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.

1.8 WARRANTY:

A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.

B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

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 Society for Testing and Materials (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material.

C612-04.....Mineral Fiber Block and Board Thermal Insulation.

C717-07.....Standard Terminology of Building Seals and Sealants.

C834-05.....Latex Sealants.

C919-02.....Use of Sealants in Acoustical Applications.

C920-05.....Elastomeric Joint Sealants.

C1021-08.....Laboratories Engaged in Testing of Building Sealants.

C1193-05.....Standard Guide for Use of Joint Sealants.

C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

D1056-07.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.

E84-08.....Surface Burning Characteristics of Building Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

A. S-1:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40

B. S-2:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.

4. Grade P.
5. Shore A hardness of 25-40.

C. S-3:
1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.

D. S-4:
1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

E. S-5:
1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

F. S-6:
1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.

G. S-7:
1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:
1. ASTM C920, silicone, acetoxy cure.

2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:
1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

J. S-10:
1. ASTMC C920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 15-20.

K. S-11:
1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

L. S-12:
1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.

2.2 CAULKING COMPOUND:

A. C-1: ASTM C834, acrylic latex.

B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR:

A. Sealants used with precast concrete panels shall match color of precast concrete.

B. Sealants used with unpainted concrete shall match color of adjacent concrete.

C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.

D. Caulking shall be light gray or aluminum, unless specified otherwise.

2.4 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, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° 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.

2.5 FILLER:

A. Mineral fiber board: 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 POUROUS SURFACES:

A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, 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.

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 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.
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply 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.
   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.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION:

A. Install back-up 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 back-up rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

D. Install back-up 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 back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

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° C and 38° C (40° and 100° F).
   2. Do not use 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 use 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 joints to concave surface unless shown or specified otherwise.
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.

B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

C. 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 cut-outs 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 as recommended by sealant manufacturer:
1. Extent of Testing: Test completed elastomeric sealant joints as follows:

a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
b. Perform one test for each 300 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 the caulking or sealant manufacturer.

B. After filling and finishing joints, remove masking tape.

C. Leave adjacent surfaces in a clean and unstained condition.

3.8 LOCATIONS:

A. Exterior Building Joints, Horizontal and Vertical:
   1. Metal to Metal: Type S-1, S-2
   2. Metal to Masonry or Stone: Type S-1
   3. Masonry to Masonry or Stone: Type S-1
   4. Precast Concrete to Precast Concrete: Type S-1
   5. Precast Concrete to Masonry: Type S-1
   6. Threshold Setting Bed: Type S-1, S-3, S-4

B. Metal Reglets and Flashings:
   1. Flashings to Wall: Type S-6
   2. Metal to Metal: Type S-6

C. Sanitary Joints:
   1. Walls to Plumbing Fixtures: Type S-9
   2. Counter Tops to Walls: Type S-9
   3. Pipe Penetrations: Type S-9

D. Horizontal Traffic Joints:
   1. Concrete Paving: Type S-11 or S-12

E. High Temperature Joints over 204 degrees C (400 degrees F):
   1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8

F. Interior Caulking:
   1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.
   2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.
   3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.
   4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1, C-2 and C-3.
   5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
   6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
   7. Concealed Acoustic and Smoke Sealant Type S-4, C-1, C-2 and C-3.

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies steel doors, steel frames and related components.

B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

1.2 RELATED WORK

A. Frames fabricated of structural steel: Section 05 50 00, METAL FABRICATIONS.

B. Security Doors: Section 08 34 53, SECURITY DOORS AND FRAMES.

C. Aluminum frames entrance work: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

D. Door Hardware: Section 08 71 00, DOOR HARDWARE.

E. Glazing: Section 08 80 00, GLAZING.

F. Card readers and biometric devices: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEM.

G. Intrusion Alarm: Section 28 16 11, INTRUSION DETECTION SYSTEM.

H. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 TESTING

A. An independent testing laboratory shall perform testing.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers Literature and Data:

1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements and temperature rise rating for stairwell doors.
2. Sound rated doors, including test report from Testing Laboratory.

1.5 SHIPMENT

A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.

B. Fasten temporary steel spreaders across the bottom of each door frame.

1.6 STORAGE AND HANDLING

A. Store doors and frames at the site under cover.

B. Protect from rust and damage during storage and erection until completion.

1.7 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.):

L-S-125B.....Screening, Insect, Nonmetallic

C. Door and Hardware Institute (DHI):

A115 Series.....Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)

D. Steel Door Institute (SDI):

113-01.....Thermal Transmittance of Steel Door and Frame Assemblies

128-1997.....Acoustical Performance for Steel Door and Frame Assemblies

A250.8-03.....Standard Steel Doors and Frames

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

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A568/568-M-07.....Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled

A1008-08.....Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability

B209/209M-07.....Aluminum and Aluminum-Alloy Sheet and Plate

B221/221M-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes

D1621-04.....Compressive Properties of Rigid Cellular Plastics

D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns

E90-04.....Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

F. The National Association Architectural Metal Manufactures (NAAMM):
Metal Finishes Manual (1988 Edition)

G. National Fire Protection Association (NFPA):
80-09.....Fire Doors and Fire Windows

H. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory

I. Intertek Testing Services (ITS):
Certifications Listings…Latest Edition

J. Factory Mutual System (FM):
Approval Guide

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A167, Type 302 or 304; finish, NAAMM Number 4.

B. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.

C. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.

D. Aluminum Sheet: ASTM B209/209M.

E. Aluminum, Extruded: ASTM B221/221M.

F. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

2.2 FABRICATION GENERAL

A. General:

1. Follow SDI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
2. Close top edge of exterior doors flush and seal to prevent water intrusion.
3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.

B. Standard Duty Doors: SDI A250.8, Level 1, Model 2 of size and design shown. Use for interior locations only. Do not use for stairwell doors, security doors and detention doors.

C. Heavy Duty Doors: SDI A250.8, Level 2, Model 2 of size and design shown. Core construction types a, d, or f, for interior doors, and, types b, c, e, or f, for exterior doors.

D. Smoke Doors:

1. Close top and vertical edges flush.

2. Provide seamless vertical edges.
3. Apply Steel astragal to the meeting style at the active leaf of pair of doors or double egress doors.
4. Provide clearance at head, jamb and sill as specified in NFPA 80.

E. Fire Rated Doors (Labeled):

1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
2. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.
4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230 °C (450 °F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.

2.3 METAL FRAMES

A. General:

1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
3. Frames for labeled fire rated doors and windows.
   a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
   b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements. Provide labels of metal or engraved stamp, with raised or incised markings.
5. Frames for doors specified to have automatic door operators; Security doors (Type 36); service window: minimum 1.7 mm (0.067 inch) thick.

6. Frames, when not prohibited by rating and radiation protection requirements, to be provided with hospital stops: cut at a 45 degree angle 6″ above the floor.
7. Provide fully welded frames only. Knocked-down frames are not acceptable.

B. Reinforcement and Covers:
1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.

C. Terminated Stops: SDI A250.8.

D. Glazed Openings:
a. Integral stop on exterior, corridor, or secure side of door.
b. Design rabbet width and depth to receive glazing material or panel shown or specified.

E. Frame Anchors:
1. Floor anchors:
a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.
b. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts. Use 50 mm x 50 mm (2 inch by 2 inch) 9 mm by (3/8 inch) clip angle for lead lined frames, drilled for 9 mm (3/8 inch) floor bolts.
c. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.
d. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 50 mm (24 inches) on center.
2. Jamb anchors:
a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.

b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.

c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
   1) Wire loop type of 5 mm (3/16 inch) diameter wire.
   2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.

d. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.

e. Anchors for frames set in prepared openings:
   1) Steel pipe spacers with 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.
   2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
   3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.

f. Anchors for observation windows and other continuous frames set in stud partitions.
   1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
   2) Anchors spaced 600 mm (24 inches) on centers maximum.

g. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

2.4 TRANSOM PANELS

A. Fabricate panels as specified for flush doors.

B. Fabricate bottom edge with rabbet stop to fit top of door where no transom bar occurs.

2.5 SHOP PAINTING

A. SDI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Plumb, align and brace frames securely 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 if the shipping spreader is removed.
3. Protect frame from accidental abuse.
4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:
1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:
1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

D. Install anchors for labeled fire rated doors to provide rating as required.

E. Frames for Sound Rated Doors: Coordinate to line frames for sound rated doors with insulation.

F. Overhead Bracing (Lead Lined Frames): Where jamb extensions extend to structure above, anchor clip angles with not less than two, 9 mm (3/8 inch) expansion bolts or power actuated drive pins to concrete slab. Weld to steel overhead members.

3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

A. Install doors and hardware as specified in Sections 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, WOOD DOORS, Section 08 71 00, DOOR HARDWARE.

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SECTION 08 14 00
INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior flush doors with prefinish, prefit option.

B. Section includes fire rated doors and smoke doors.

1.2 RELATED WORK

A. Carpentry: Section 06 20 00, FINISH CARPENTRY.

B. Metal door frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.

C. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.

D. Installation of doors and hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, WOOD DOORS, or Section 08 71 00, DOOR HARDWARE.

E. Security Doors: Section 08 34 53, SECURITY DOORS AND FRAMES.

D. Glazing: Section 08 80 00, GLAZING.

E. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES

F. Card readers and biometric devices: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEM.

G. Intrusion alarm: Section 28 16 11, INTRUSION DETECTION SYSTEM.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

2. Veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.

C. Shop Drawings:

1. Show every door in project and schedule location in building.
2. Indicate type, grade, finish and size; include detail of glazing sound gasketing and pertinent details.
3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.

D. Manufacturer's Literature and Data:

1. Labeled fire rated doors showing conformance with NFPA 80.

E. Laboratory Test Reports:

1. Screw holding capacity test report in accordance with WDMA T.M.10.
2. Split resistance test report in accordance with WDMA T.M.5.
3. Cycle/Slam test report in accordance with WDMA T.M.7.
4. Hinge-Loading test report in accordance with WDMA T.M.8.

1.4 WARRANTY

A. Doors are subject to terms of Article titled “Warranty of Construction”, FAR clause 52.246-21, except that warranty shall be as follows:

1. For interior doors, manufacturer’s warranty for lifetime of original installation.

1.5 DELIVERY AND STORAGE

A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.

B. Store in accordance with WDMA I.S.1-A, J-1 Job Site Information.

C. Label package for door opening where used.

1.6 APPLICABLE PUBLICATIONS

Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. Window and Door Manufacturers Association (WDMA):

I.S.1-A-04.....Architectural Wood Flush Doors
I.S.4-07A.....Water-Repellent Preservative Non-Pressure Treatment for Millwork
I.S.6A-01.....Architectural Wood Stile and Rail Doors
T.M.5-90.....Split Resistance Test Method
T.M.6-08.....Adhesive (Glue Bond) Durability Test Method
T.M.7-08.....Cycle-Slam Test Method
T.M.8-08.....Hinge Loading Test Method
T.M.10-08.....Screwholding Test Method

C. National Fire Protection Association (NFPA):

80-07.....Protection of Buildings from Exterior Fire
252-08.....Fire Tests of Door Assemblies

D. ASTM International (ASTM):

E90-04.....Laboratory Measurements of Airborne Sound Transmission Loss

PART 2 - PRODUCTS

2.1 FLUSH DOORS

A. General:

1. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
2. Adhesive: Type II
3. Solid core.
4. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.
5. Basis-of-design: Algoma Novodor, or Equal.

B. Face Veneer:

1. In accordance with WDMA I.S.1-A.
2. One species throughout the project unless scheduled or otherwise shown.
3. For transparent finishes: Rotary cut “RA100”, white birch.
   a. A grade face veneer.
   b. Match face veneers for doors for uniform effect of color and grain at joints.
   c. Door edges shall be same species as door face veneer except maple may be used for stile face veneer on birch doors.
4. Factory sand doors for finishing.

C. Steel for stops and frames of windows in doors required to have factory primed finish:

1. Glazing:
   a. On all doors use steel frames with steel stops on room side and attached with flathead, countersunk stainless steel screws, spaced approximately 125 mm (5 inches) on centers.

D. Stiles and Rails:

1. Option for wood stiles and rails:
   a. Composite material having screw withdrawal force greater than minimum performance level value when tested in accordance with WDMA T.M.10.
2. Provide adequate blocking for bottom of doors having mechanically operated door bottom seal meeting or exceeding the performance duty level per T.M.10 for horizontal door edge screw holding.

E. Fire rated wood doors:
   1. Fire Performance Rating:
      a. “B” label, 1-1/2 hours.
      b. “C” label, 3/4 hour.
   2. Labels:
      a. Doors shall conform to the requirements of ASTM E2074, or NFPA 252, and, carry an identifying label from a qualified testing and inspection agency for class of door or opening shown designating fire performance rating.
      b. Metal labels with raised or incised markings.
   3. Performance Criteria for Stiles of doors utilizing standard mortise leaf hinges:
      a. Hinge Loading: WDMA T.M.8. Average of 10 test samples for Extra Heavy Duty doors.
      b. Direct screw withdrawal: WDMA T.M.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 in accordance with WDMA T.M.7.
   4. Additional Hardware Reinforcement:
      a. Provide fire rated doors with hardware reinforcement blocking.
      b. Size of lock blocks as required to secure hardware specified.
      c. Top, bottom and intermediate rail blocks shall measure not less than 125 mm (five inches) minimum by full core width.
      d. Reinforcement blocking in compliance with manufacturer's labeling requirements.
      e. Mineral material similar to core is not acceptable.
   5. Other Core Components: Manufacturer's standard as allowed by the labeling requirements.
   6. Provide steel frame approved for use in labeled doors for vision panels.
   7. Provide steel astragal on pair of doors.

F. Smoke Barrier Doors:
   1. For glazed openings use steel frames approved for use in labeled doors.

2. Provide a steel astragal on one leaf of pairs of doors, including double egress doors.

2.2 PREFINISH, PREFIT OPTION

A. Flush doors may be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.

B. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.

C. Flush doors to receive transparent finish (in addition to being prefit) shall be factory finished as follows:

1. WDMA I.S.1-A Section F-3 specification for System TR-4, Conversion Varnish or System TR-5, Catalyzed Vinyl.
2. Use stain when required to produce the finish specified in Section 09 06 00 SHEDULE FOR FINISHES.

2.3 IDENTIFICATION MARK:

A. On top edge of door.

B. Either a stamp, brand or other indelible mark, giving manufacturer’s name, door’s trade name, construction of door, code date of manufacture and quality.

C. Accompanied by either of the following additional requirements:

1. An identification mark or a separate certification including name of inspection organization.
2. Identification of standards for door, including glue type.
3. Identification of veneer and quality certification.
4. Identification of preservative treatment for stile and rail doors.

2.4 SEALING:

A. Give top and bottom edge of doors two coats of catalyzed polyurethane or water resistant sealer before sealing in shipping containers.

PART 3 - EXECUTION

3.1 DOOR PREPARATION

A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.

B. Clearances between Doors and Frames and Floors:

1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 13 mm (1/2 inch) clearance at bottom, except as otherwise specified.

2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 10 mm (3/8 inch).

C. Provide cutouts for special details required and specified.

D. Rout doors for hardware using templates and location heights specified in Section, 08 71 00 DOOR HARDWARE.

E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (two inches) of door thickness.

F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.

G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.

H. Apply a steel astragal on the opposite side of active door on pairs of fire rated doors.

I. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE

A. Install doors and hardware as specified in Section, INSTALLATION OF DOORS AND HARDWARE.

3.3 DOOR PROTECTION

A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.

B. Provide protective covering over knobs and handles in addition to covering door.

C. Maintain covering in good condition until removal is approved by COTR.

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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Section specifies access doors or panels.

1.2 RELATED WORK:

A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.

B. Access doors in acoustical ceilings: Section 09 51 00, ACOUSTICAL CEILINGS.

C. Locations of access doors for duct work cleanouts: Section 23 31 00, HVAC DUCTS AND CASINGS and Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Access doors, each type, showing construction, location and installation details.

C. Manufacturer's Literature and Data: Access doors, each type.

1.4 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 Society for Testing and Materials (ASTM):

A167-99(R-2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A1008-07.....Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy

C. American Welding Society (AWS):

D1.3-98.....Structural Welding Code Sheet Steel

D. National Fire Protection Association (NFPA):

80-06.....Fire Doors and Windows

E. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series.....Metal Finishes Manual

F. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

A. Fabricate components to be straight, square, flat and in same plane where required.
   1. Slightly round exposed edges and without burrs, snags and sharp edges.
   2. Exposed welds continuous and ground smooth.
   3. Weld in accordance with AWS D1.3.

B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire rated doors, use hinges and locks as required by fire test.

C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. Provide anchors as required by fire test.

2.2 ACCESS DOORS, FIRE RATED:

A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 120 degree C (250 degrees F).

B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.

C. Door Panel: Form of 0.9 mm (0.0359 inch) thick steel sheet type construction.

D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
   1. Weld exposed joints in flange and grind smooth.
   2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.

E. Automatic Closing Device: Provide automatic closing device for door.

F. Hinge: Continuous steel hinge with stainless steel pin.

G. Lock:
   1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder comparable and keyed the same as those specified in Section 08 71 00, DOOR HARDWARE.
   2. Provide latch release device operable from inside of door. Mortise case in door.

2.3 ACCESS DOORS, FLUSH PANEL:

A. Door Panel:

1. Form of 1.5 mm (0.0598 inch) thick steel sheet.
2. Reinforce to maintain flat surface.

B. Frame:

1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed.
2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
3. Weld exposed joints in flange and grind smooth.

C. Hinge:

1. Concealed spring hinge to allow panel to open 175 degrees.
2. Provide removable hinge pin to allow removal of panel from frame.

D. Lock:

1. Flush, screwdriver operated cam lock.

2.4 FINISH:

A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.

B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

2.5 SIZE:

A. Minimum 600 mm (24 inches) square door unless otherwise shown.

PART 3 - EXECUTION

3.1 LOCATION:

A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.

B. Use fire rated doors in fire rated partitions and ceilings.

C. Use flush panels in partitions and gypsum board or plaster ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

D. Use recessed panel access doors in the following rooms: A2026.

3.2 INSTALLATION, GENERAL:

A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.

B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.

C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.

D. Set recessed panel access doors recessed so that face of surrounding materials will finish on the same plane, when finish in door is installed.

3.3 ANCHORAGE:

A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.

B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.

C. Anchors for fire rated access doors shall meet requirements of applicable fire test.

3.4 ADJUSTMENT:

A. Adjust hardware so that door panel will open freely.

B. Adjust door when closed so door panel is centered in the frame.

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SECTION 08 34 53
SECURITY DOORS AND FRAMES

PART I - GENERAL

1.1 DESCRIPTION

A. The extent of forced-entry resistant (FE) and ballistic resistant (BR) door assemblies required for the Project is indicated on Contract Drawings, and in Door/Frame/Hardware schedules, including construction, profiles, swing, sizes, hardware, accessories, devices, and locations.

1.2 RELATED WORK

A. Refer to Division 3, CONCRETE.

B. Refer to Division 4, MASONRY.

C. Refer to Division 5, METALS for steel supports.

D. Doors and frames not designated for special security performances:
Section 08 11 13, HOLLOW METAL DOORS AND FRAMES
Section 08 14 00, WOOD DOORS.

E. Windows and frames of a forced entry/ballistic resistant rated: Section 08 56 59, SERVICE AND TELLER WINDOW UNITS.

F. Door Hardware: Section 08 71 00, DOOR HARDWARE.

G. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.

H. Deal trays of a Forced Entry/Ballistic Resistant rating: Section 08 56, 59, SERVICE AND TELLER WINDOW UNITS.

I. Card readers and biometric devices: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS

J. Intrusion alarm: Section 28 16 11, INTRUSION DETECTION SYSTEM

1.3 PERFORMANCE REQUIREMENTS

A. General: Fabricate and install FE/BR door assemblies to achieve indicated levels of resistance. Extend resistance to include anchorages, interfaces with adjoining substrates, and hardware. Security attacks shall be unable to penetrate through closed/locked security door assemblies in manner described; it is recognized that such attacks may damage units beyond repair and reuse, requiring replacement of work by Government:

1. Fire-rated assemblies: Where indicated for fire resistance, provide flush steel doors-and-frame units; comply with NFPA 80, Standard for Fire Doors and Windows. Provide units that have been tested by recognized testing agency in accordance with NFPA No. 252 and ASTM E2074:

2. Ballistic Resistant (BR) assemblies: Where door assembly is shown or scheduled as BR, provide door manufacturer's materials and fabrication for panel, inserts, and framing of unit. Provide rated units where shown or scheduled.
   a. UL 752 Level 3.

1.4 SUBMITTALS

A. General: For each security door assembly, submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1. Product data for each element of work, whether purchased from other manufacturers or provided as door Fabricator's standard production. Include data substantiating that products comply with requirements of these specifications.
2. Manufacturer's standard color chart.
3. Certificates: Letter from manufacturer indicating the products have been certified to meet the specified ratings.
4. Shop drawings showing each dimensioned details of each door assembly, including performance rating, swing, hardware set, and adjacent construction. Provide drawings on B-size 11 in x 17 inch (300 mm x 430 mm) sheets. Show typical door exterior elevations at not less than ¼ inch = 1 foot (1:50) scale. After final modifications and corrections have been incorporated into the drawings, submit drawings as AutoCAD files with DWG extension. Show the following:
   a. Unit information:
      1) Model Number.
      2) Ballistic resistant rating.
      3) Marks (window no.).
      4) Door/frame finish.
      5) Door type.
   b. Elevation Drawings:
      1) Rough opening.
      2) Door opening.
      3) Frame opening.
      4) Vision opening.
      5) Finished floor.
      6) Sill condition.

7) Undercut for carpet.
8) Weather-stripping.
9) Reference numbers for primer and finish paint, including number of coats applies.
10) Door class rating: rated or non-rated.
11) Door and frame gauge thickness.

c. Plan drawings:
1) Relate to elevation on drawing.
2) Identify “Attack” and “Protected” sides.
3) Identify door swing (i.e., RH, LH, RHRB, LHRB).
4) Provide key on drawings.
5) Indicate room space numbers taken from Contract Drawings.

d. Details: Show section at not less than ¾ inch = 1 ft (1:20) scale of members indicating construction, size, and thickness of components, frame profile, location of conduit entry, threshold configuration, vision panel together with connections, fastenings, and means of separating dissimilar metals.

e. Breakdown of Product Line Items:
1) If Manufacturer produces one contract line item as several parts (door with transom and sidelights), they shall breakout items on drawings. Each item shall be a subdivision of that product line item number.
2) Installation instructions shall cite all anchorage components, including complete description of expansion anchor as well as installation criteria such as torque requirements, minimum embedment, and minimum edge distance, and shall include alert to installers to avoid cutting of rebar during concrete anchor installation.

1.5 QUALITY ASSURANCE

A. Testing Laboratory Qualifications: For compliance with non-security performance requirements (such as fire ratings, resistance to deterioration from moisture, accessibility to persons with disabilities, or sound attenuation) on security door assemblies of this Section, use only those testing laboratories which have successfully demonstrated to the Contracting Officer’s Technical Representative (COTR) that they have experience and capabilities needed to satisfactorily conduct required tests.

B. Provide products that have been certified by Bureau of Diplomatic Security (DS) in accordance with DS/PSD SD-STD-01.01.

1.6 IDENTIFICATION SYSTEMS

A. Identify each assembly to provide VA with ready reference to original manufacturer to facilitate reorders, replacement parts, service, resolution of complaints, and inventory. The label shall be typically embossed/printed metal plate or metallic foil with adhesive backing for permanent identification. Locate label so that it is readily visible and convenient for identification by COTR after installation of assembly. The label shall be approximately 1½ inch x 3 inch (40 x 75 mm) and shall cite:

1. Manufacturer's name/city/state.
2. Contract number.
3. Month/Year of manufacture.
4. Mark number and Ballistic resistant rating.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver each assembly project site with fabrication, finishing, and assembly of primary panels, inserts, and frames completed and prepared for installation and connection with security systems. Disassemble hardware for shipping only to extent hardware interferes with shipping.

B. Refer to Division One for shipping requirements.

C. Provide removable spreader bar between jambs during fabrication, delivery, and installation and to include mullions of each frame assembly, except where integral threshold is required and serves same purpose. Do not mar finishes of assembly with installation or removal of spreader bars.

D. Provide protection of pre-finished units, such as pre-finished with baked enamel or stainless steel, using self-adhesive paper.

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. American National Standards Institute (ANSI):

A250.8-2003.....	Recommended Specifications for Standard Steel Doors and Frames (formerly SDI-100)
A250.11-2001.....	Recommended Erection Instructions for Steel Frames (formerly SDI-105)

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

A153/A153M-09.....	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A167-99(2009).....	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A653/A653M-09.....	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A1008/A1008M-09.....	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
A1011/A1011M-09a.....	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
D1044-08.....	Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion
E2074-00.....	Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies

D. National Fire Protection Association (NFPA):

NFPA 80 - 2010.....	Standard for Fire Doors and Other Opening Protectives

E. Society for Protective Coatings (SSPC):

SSPC-SP 2 - 2004.....	Hand Tool Cleaning
SSPC-SP 3 - 2004.....	Power Tool Cleaning

F. Underwriters Laboratories, Inc. (UL):

UL752-2006.....	Bullet Resisting Equipment

G. United States Department of State Bureau of Diplomatic Security (DS):

SD-STD-01.01-1993..... Certification Standard for Forced Entry and Ballistic Resistance of Structural Systems

H. United States General Services Administration (GSA):

UFAS-1998..... Uniform Federal Accessibility Standards

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Certified units: provide units, including frames and sub-frames which are produced by manufacturer who has previously produced, within last 10 years, units of similar security attack resistance of equivalent size and resistance ratings.

2.2 MATERIALS, GENERAL

A. Hot-Rolled Steel Sheets and Strips: ASTM A1011, commercial quality, pickled and oiled, except as otherwise indicated.

B. Cold-Rolled Steel Sheets: ASTM A1008, commercial quality, except as otherwise indicated.

C. Galvanized Steel Sheets: ASTM A653 with G90 zinc coating, mill phosphatized; commercial quality, except as otherwise indicated.

D. Stainless Steel Sheets: AISI Type 302/304, complying with ASTM A 167; commercial quality, No. 4 directional polish.

E. Supports and Anchors: Fabricate to endure required performances, but of not less than 1/16 inch (1.5 mm) sheet steel. For exterior wall assemblies, hot-dip zinc coat support/anchor units after fabrication in compliance with ASTM A 153, Class B.

F. Inserts, Bolts, Fasteners: Standard units of strengths required to endure performances; hot-dip zinc coated where used in exterior wall assemblies in compliance with ASTM A 153, Class C/D.

G. Vision Lights General: Fabricate vision lights of sizes shown and scheduled with same performance capabilities as specified/shown for door assembly where installed. Where applicable, achieve performances and combined performances through lamination of transparent sheets, films, and screens of standard manufactured/tested products. Comply with applicable provisions of Division 8, Section 08 80 00, GLAZING.

1. Forced-Entry (FE) Resistance: Where assembly is indicated for forced-entry resistance rating (FE), provide light of size shown or scheduled in accordance with certification.

2. Ballistic Resistance (BR): Where assembly is indicated for ballistic-resistance rating (BR), provide light of size shown or scheduled in accordance with certification.
3. Vision light faces general: Except as otherwise shown, where forced-entry or ballistic resistance is required, provide face of light exposed on exterior (to the “attack”) as glass surface, and where unit is of laminated construction, provide face exposed on interior (“safe”) as polycarbonate surface. Provide exposed polycarbonate surfaces to include an abrasion-resistant coating for 3 percent maximum haze increase for 100 revolutions on 500g Taber abraser, ASTM D 1044.

2.3 HARDWARE

A. General: Provide special units of door hardware to achieve performances, and as shown and scheduled. Standard units for each security door assembly are specified to be furnished as work of Section 08 71 00, DOOR HARDWARE; see Project “Finish Hardware Schedule” and “Data Sheets,” and provisions of this Section, as well as notes on door-and-frame schedule.

2.4 FABRICATION AND ASSEMBLY

A. General: Fabricate, test, and preassemble security door assemblies with hardware at factory; disassemble hardware only to extent necessary for handling, packaging, shipment, and installation at Project. Fabricate metal work to comply with performance requirements. Fabrications shall be rigid, neat, and free from warp/buckle/similar defects, with eased edges and continuously-welded joints, ground where exposed, to produce smooth, flush, invisible joints. Weld in accordance with AWS D1.1, Structural Welding Code for Steel:

1. Prepare panels and frames of each assembly to receive hardware, devices, and accessory units as shown and scheduled. Reinforce work for hardware and devices, and cut work for mortised or concealed units; comply with ANSI A115 series specifications, working from templates supplied by unit manufacturers and suppliers:
   a. Locate hardware, devices, and accessories as required by Section Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, WOOD DOORS, and Section 08 71 00, DOOR HARDWARE.
   b. Locate hardware, devices, and accessories as shown and scheduled (including on approved shop drawings) or, if not otherwise indicated: 1) in accordance with DHI Recommended Locations for

Builder's Hardware or, 2) in accordance with security device manufacturer's recommendation for optimum responses, but 3) in any case, as required to achieve required assembly performances.

c. Except where assembly is equipped with door-seal stripping at jambs and head, provide neoprene door silencers on stops; three at strike jamb for single door, and four at head for double door.

d. Except as otherwise indicated, pre-fabricate and preassemble security door assemblies to include full extent of required conduit-protected electrical/electronic power-and-control wiring placed and supported to avoid conflicts with other elements and subsequent drilling/cutting-in of work during installation of units. Provide access ports as required to support 1 inch (25 mm) conduit.

e. Clearances: Not more than 1/8 inch (3 mm) at jambs and heads, except not more than 1/4 inch (6 mm) between fire-rated pair of doors. Nor more than 1/4 inch (6 mm) at bottom. Undercut for carpets are not permitted where doors are used in corridors. Fabricate frames with horizontally slotted bolt holes.

2. Provide removable glazing stops and similar moldings on interior or “safe” side of assemblies. Glazing shall be removable without removing door from frame.

3. Shop Painting: Provide base-coat, factory-applied painting of ferrous metal elements of assemblies excluding other specified exposed-finish surfaces of stainless steel, aluminum, bronze, and similar metals not intended for painting.

   a. Clean steel and zinc-coated steel surfaces of mill scale, rust, oil, grease, dirt and other substances, immediately before finish application.

   b. Apply pretreatment of cold phosphate solution (SSPC-SP2) or basic zinc chromate/vinyl-butyl solution (SSPC-SP3).

   c. Apply paint coat specified for shop application, and bake on within time limits recommended by manufacturer of pretreatment. Apply in a uniform, smooth coat to result in dry film thickness of not less than 0.002 inch (0.05 mm).

4. Vision panels:

   a. The transparencies shall be enclosed and cushioned within core of door for continuous perimeter bite of not less than ¾ inch (20

mm) on each side and 1/4 inch (6 mm) cushion clearance to fixed metal stop on glazing edges. Glazing shall be installed by manufacturer with no raw metal edges evident or in contact with glass in door vision openings. Vision opening edges shall be cushioned and trimmed neatly to provide acceptable appearance.

b. If external frames are used to either side or to both faces of door, frame(s) shall not exceed 1-9/16 inch (40 mm) in width and shall be configured internally to cushion all perimeter edges and faces of glazing and provide minimum bite of 3/4 inch (20 mm) and 1/4 inch (6 mm) cushion clearance to fixed metal stop on glazing edges. Frame shall not produce pinch point with hardware. All external bolts to attach frame shall be flush mounted. Alternatively, protruding bolt heads shall be covered with additional trim frame and flush mounted screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install security door assemblies in accordance with approved shop drawings, manufacturer's data and instructions, and requirements of these specifications. Install as required to achieve specified performances, and to comply with recommendations of related industry association or testing agency sponsoring standards for required non-security performances. Install door assemblies plumb and level:

1. Install assemblies in compliance with recommendations and instructions of ANSI A250.8 and ANSI A250.11.
2. At fire-rated door openings, comply with NFPA Standard No. 80.
3. Properly hang and align FE/BR doors so that pull open exertion does not exceed 12 lbs (5.4 kg.).
4. Installer shall not grind any portion of door, frame or locking device strikes.
5. Locking device strikes shall engage strike plate without binding.

B. Anchorage: The door manufacturer shall provide anchors appropriate for substrate to which door frame is to be fastened. Structural frames shall have pre-drilled bolt hole patterns not to exceed 12 inches (300 mm) on center. The manufacturer shall verify substrates involved, and supply any special fastening tools (e.g., special drill or bit) required by anchoring system. The anchor shall be acceptable for shock/short duration loading, and have potential for removal during

life of building. The anchor shall also meet the following requirements:

1. Anchor diameter: 3/8 inch (10 mm) minimum.
2. Embedment and edge distances shall be as indicated on Contract Drawings and as appropriate for anchor and substrate, but not less than the following:
   a. Embedment in concrete: 3 1/2 inches (90 mm).
   b. Embedment in solid masonry: 6 inches (150 mm).
   c. Edge distance: 3 inches (75 mm).
3. The minimum anchor strengths shall be:
   a. Yield Strength: 135,000 psi (900 MPa)
   b. Tensile Strength: 186,000 psi (1240 MPa)
4. Avoid cutting of rebar during concrete anchor installation. Shims provided for rough opening (RO) frame clearance should not exceed ¼ inch (6 mm). Cap plugs used in frame shall match frame finish.

3.2 ADJUST AND CLEAN

A. General: Upon request of COTR, remove protective coverings and clean exposed surfaces. Repair damaged elements, restore abraded surfaces, touch-up base-coat paint finish with air-drying primer, and remove imperfections from exposed natural metal finishes.

B. Check and readjust hardware, devices, and accessories with door-to-frame-and-sill/threshold clearances set for proper operation of locks, door seals, and other operational units. Do not remove permanently applied performance labels.

C. Comply with "Door Hardware" section requirements for protection and handling of keys and locking devices, and associated information.

D. Exercise extreme care in the cleaning of exposed surfaces of polycarbonate; comply with manufacturer’s directions.

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SECTION 08 35 13
OPERABLE PARTITIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. General

1. Furnish and install operable partitions and suspension system. Provide all labor, materials, tools, equipment, and services for operable walls in accordance with provisions of contract documents.

1.02 RELATED WORK

A. Preparation of opening will be by Contractor. Any deviation of site conditions contrary to approved shop drawings must be called to the attention of the Contracting Officer’s Technical Representative (COTR).

B. All header, blocking, support structures, jambs, track enclosures, surrounding insulation, and sound baffles as required in 1.04 Quality Assurance.

C. Pre-punching of support structure in accordance with approved shop drawings.

D. Paint or otherwise finishing all trim and other materials adjoining head and jamb of operable partitions.

E. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES

1.03 SUBMITTALS

A. Complete shop drawings are to be provided prior to fabrication indicating construction and installation details. Shop drawings must be submitted within 60 days after receipt of signed contract.

1.04 QUALITY ASSURANCE

A. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions

B. The partition STC (Sound Transmission Classification) shall be achieved per the standard test methods ASTM E90.

C. Noise isolation classifications shall be achieved per the standard test methods ASTM E336 and ASTM E413.

D. Noise Reduction Coefficient (NRC) ratings shall be per ASTM C423.

E. Rack testing for 10 years. (tensional strength stress test)

F. The manufacturer shall have a quality system that is registered to the ISO 9001 standards.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Proper storage of partitions before installation and continued protection during and after installation will be the responsibility of the Contractor.

1.06 WARRANTY

A. Partition system shall be guaranteed for a period of two years against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Upon compliance with all of the criteria specified in this section, Manufacturers wishing to bid products equal to the product specified must submit to the A-E 10 days prior to bidding complete data in support of compliance and a list of three past installations of products similar to those listed. The submitting manufacturer guarantees the proposed substituted product complies with the performance items specified and as detailed on the drawings.

2.02 MATERIALS

A. Product to be top supported paired panels.
   1. Panels shall be nominally 4″ (100mm) thick, to 48″ (1220mm) in width, and hinged in pairs.
   2. Panel faces shall be laminated to appropriate substrate to meet the STC requirement in 2.04 Acoustical Performance.
      a. Face material:
         Steel
   3. Frames shall be of 16 gauge (1.40mm) painted steel with integral factory applied aluminum vertical edge and face protection. Face finish shall wrap around the vertical panel edges and provide no protective vertical face trim.
   4. Vertical sound seals shall be of tongue and groove configuration, ensure panel-to-panel alignment and prevent sound leaks between panels.
   5. Horizontal top seals shall be retractable, provide 1″ (25mm) nominal operating clearance, and exert upward force when extended.

All panels, including pass door panels and lever closure panels must have retractable top and bottom seals.

Optional top seals: Horizontal top seals shall be fixed continuous contact dual 4 finger vinyl.

6. Horizontal bottom seals shall be retractable, provide up to 2″ (50mm) nominal operating clearance, and exert downward force when fully extended.

   Optional bottom seals: Horizontal bottom seals shall be fixed continuous contact 4-finger vinyl.

7. Horizontal trim shall be of aluminum.
8. Low profile hinges on basic panels shall be of steel and project no more than 1/4″ (6mm) beyond panel faces. Each pair of panels to have a minimum of three hinges.

B. Weight of the panels shall be 7.8-10.9 lbs./sq. ft. (37.8-53.2 kg/sq.m) based on options selected.

C. Suspension system:

1. Track shall be of clear anodized architectural grade extruded aluminum alloy 6063-T6. Track design shall provide precise alignment at the trolley running surfaces and provide integral support for adjoining ceiling, soffit, or plenum sound barrier. Track shall be connected to the structural support by pairs of minimum 3/8″ (10) dia. threaded steel hanger rods. Guide rails and/or track sweep seals shall not be required.
   a. Each panel shall be supported by one 4-wheeled carrier. Wheels to be of hardened steel ball bearings encased with molded polymer tires.
2. Plenum closure: Design of plenum closure must permit lifting out of header panels to adjust track height. Plenum closure required for optimum sound control of partition.

D. Finishes

1. Face finish shall be:
   a. Factory applied reinforced vinyl fabric with woven backing, weighing not less than 15 oz. per lineal yard (465 g/m). Color shall be selected from manufacturer’s standard color selector.
   b. Standard fabrics (color shall be selected from manufacturer’s standard color selector):

(1) Factory applied vertical ribbed carpet (N.R.C. .20)selected by COTR.

2. Exposed metal trim and seal color shall be
   a. Brown
3. Aluminum track shall be clear anodized.

E. Accessories
1. Inset tackboard.
2. Finished end cover.

2.03 OPERATION

A. Panels shall be manually moved from the storage area, positioned in the opening, and seals set.

B. Retractable Horizontal Seals
1. Retractable horizontal seals shall be activated by a removable quick-set operating handle located approximately 42″ (1065mm) from the floor in the panel edge.
2. All retractable seals in each hinged panel group shall be operated simultaneously.
3. Seal activation requires a 190 degree turn of the removable handle.

C. Final partition closure to be by lever closure panel with expanding jamb which compensates for minor wall irregularities and provides a minimum of 250 lbs. (113.4 kg) seal force against the adjacent wall for optimum sound control. The jamb activator shall be located approximately 45″ (1140mm) from the floor in the panel face and be accessed from either side of the panel. The jamb is equipped with a mechanical rack and pinion gear drive mechanism and shall extend 4″-6″ (100mm-150mm) by turning the removable operating handle.

D. Stack/Store Panels
1. Retract seals with removable operating handle and move to storage area. Panels may be stored at either or both ends of the track or in a pocket.

2.04 ACOUSTICAL PERFORMANCE

A. Acoustical performance shall be tested at a laboratory accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) and in accordance with ASTM E90 Test Standards. Standard panel construction shall have obtained an **STC rating of 54**

1. Complete, unaltered written test report is to be made available upon request.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The complete installation of the operable wall system shall be by an authorized factory-trained installer and be in strict accordance with the approved shop drawings and manufacturer’s standard printed specifications, instructions, and recommendations.

3.02 CLEANING

A. All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.

B. Cartoning and other installation debris shall be removed to onsite waste collection area, provided by others.

3.03 TRAINING

A. Installer shall demonstrate proper operation and maintenance procedures to owner’s representative.

B. Operating handle and owner’s manuals shall be provided to owner’s representative.

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SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies aluminum entrance work including storefront construction, hung doors, and other components to make a complete assembly.

1.2 RELATED WORK:

A. Sealants: Section 07 92 00, JOINT SEALANTS.

B. Door and Frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.

C. Windows: Section 08 51 13, ALUMINUM WINDOWS.

D. Glass and Glazing: Section 08 80 00, GLAZING.

E. Hardware: Section 08 71 00, DOOR HARDWARE.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: (1/2 full scale) showing construction, anchorage, reinforcement, and installation details.

C. Manufacturer’s Literature and Data:

1. Doors, each type.
2. Entrance and Storefront construction.

D. Samples:

1. Two samples of anodized aluminum of each color showing finish and maximum shade range.
2. Two samples of organic finish of each color specified.

E. Manufacturer's Certificates:

1. Stating that aluminum has been given specified thickness of anodizing.
2. Indicating manufacturer's qualifications specified.

1.4 QUALITY ASSURANCE:

A. Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.

B. Certify manufacturer regularly and presently manufactures aluminum entrances and storefronts as one of their principal products.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver aluminum entrance and storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.

B. Store aluminum entrance and storefront material in weather-tight and dry storage facility.

C. Protect from damage from handling, weather and construction operations before, during and after installation.

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):

B209-06.....Aluminum and Aluminum-Alloy Sheet and Plate

B221-05.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

E283-04.....Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E331-00.....Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

F468-06.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

F593-04.....Stainless Steel Bolts, Hex Cap Screws, and Studs

C. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series.....Metal Finishes Manual

D. American Architectural Manufacturer's Association (AAMA):

2604-05.....High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels

E. American Welding Society (AWS):

D1.2-03.....Structural Welding Code Aluminum

1.7 PERFORMANCE REQUIREMENTS:

A. Shapes and thickness of framing members shall be sufficient to withstand a design wind load of not less than [30] thirty pounds per

square foot of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65 (applied to overall load failure of the unit). Provide glazing beads, moldings, and trim of not less than 1.25 mm (0.050 inch) nominal thickness.

B. Air Infiltration: When tested in accordance with ASTM E 283, air infiltration shall not exceed 2.63 x 10-50 cm per square meter (0.06 cubic feet per minute per square foot) of fixed area at a test pressure of 0.30 kPa (6.24 pounds per square foot) 80 kilometers (50 mile) per hour wind.

C. Water Penetration: When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 0.38 kPa (8 pounds per square foot) of fixed area.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Aluminum, ASTM B209 and B221:

1. Alloy 6063 temper T5 for doors, door frames, fixed glass sidelights, storefronts and transoms.
2. Alloy 6061 temper T6 for guide tracks for sliding doors and other extruded structural members.
3. For color anodized finish, use aluminum alloy as required to produce specified color.

B. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.

C. Fasteners:

1. Aluminum: ASTM F468, Alloy 2024.
2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.

2.2 FABRICATION:

A. Fabricate doors, of extruded aluminum sections not less than 3 mm (0.125 inch) thick. Fabricate glazing beads of aluminum not less than 1.0 mm (0.050 inch) thick.

B. Accurately form metal parts and accurately fit and rigidly assemble joints, except those joints designed to accommodate movement. Seal joints to prevent leakage of both air and water.

C. Make welds in aluminum in accordance with the recommended practice AWA D1.2. Use electrodes and methods recommended by the manufacturers of

the metals and alloys being welded. Make welds behind finished surfaces so as to cause no distortion or discoloration of the exposed side. Clean welded joints of welding flux and dress exposed and contact surfaces.

D. Make provisions in doors and frames to receive the specified hardware and accessories. Coordinate schedule and template for hardware specified under Section 08 71 00, DOOR HARDWARE. Where concealed closers or other mechanisms are required, provide the necessary space, cutouts, and reinforcement for secure fastening.

E. Fit and assemble the work at the manufacturer's plant. Mark work that cannot be permanently plant-assembled to assure proper assembly in the field.

2.3 PROTECTION OF ALUMINUM:

A. Isolate aluminum from contact with dissimilar metals other than stainless steel, white bronze, or zinc by any of the following:

1. Coat the dissimilar metal with two coats of heavy-bodied alkali resistant bituminous paint.
2. Place caulking compound, or non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
3. Paint aluminum in contact with mortar, concrete and plaster, with a coat of aluminum paint primer.

2.4 FRAMES:

A. Fabricate doors, frames, mullions, transoms, frames for fixed glass and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.

B. Provide integral stops and glass rebates and applied snap-on type trim.

C. Use concealed screws, bolts and other fasteners. Secure cover boxes to frames in back of all lock strike cutouts.

D. Fabricate framework with thermal breaks in frames where insulating glass is scheduled and specified under Section 08 80 00, GLAZING.

2.5 STILE AND RAIL DOORS:

A. Nominal 45 mm (1-3/4 inch) thick, with stile and head rail 90 mm (3-1/2 inches) wide, and bottom rail 250 mm (10 inches) wide.

B. Bevel single-acting doors 3 mm (1/8 inch) at lock, hinge and meeting stile edges. Provide clearances of 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. Form glass rebates integrally with stiles and rails. Glazing beads may be formed integrally with stiles and rails or applied type secured with fasteners at 150 mm (six inches) on centers.

C. Construct doors with a system of welded joints or interlocking dovetail joints between stiles and rails. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel rod extending into the stiles, and having a self-locking nut and washer at each end. Reinforce stiles and rails to prevent door distortion when tie rods are tightened. Provide a compensating spring-type washer under each nut to take up any stresses that may develop. Construct joints between rails and stiles to remain rigid and tight when door is operated.

D. Weather-stripping: Provide removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder. Make slots for applying weather-stripping integral with doors and door frame stops. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames. Install weather-stripping so doors can swing freely and close positively.

2.6 FLUSH PANEL DOORS:

A. Nominal 45 mm (1-3/4 inches) thick. Form from aluminum face sheets not less than 1.5 mm (0.060 inch) thick with internal impact reinforcement, laminated to the door edges and the core.

B. Provide extruded aluminum tubular members to form the perimeter of the door. Reinforce doors internally with extruded tubular members welded in place, and extending full width of door at top, bottom, and intermediate points.

C. Fill voids between tubular members with noncombustible mineral insulation.

2.7 REINFORCEMENT FOR BUILDERS HARDWARE:

A. Fabricate from stainless steel plates.

B. Hinge and pivot reinforcing: 4.55 mm (0.1793 inch) thick.

C. Reinforcing for lock face, flush bolts, concealed holders, concealed or surface mounted closers: 2.66 mm (0.1046 inch) thick.

D. Reinforcing for all other surface mounted hardware: 1.5 mm (0.0598 inch) thick.

2.8 FINISH

A. In accordance with NAAMM AMP 500 series.

B. Anodized Aluminum:

1. Clear Finish: Chemically etched medium matte, with clear anodic coating, Class I Architectural, 7 mils thick.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Allowable Installation Tolerances: Install work plumb and true, in alignment and in relation to lines and grades shown. Variation of 3 mm (1/8 inch) in 2400 mm (eight feet), non-accumulative, is maximum permissible for plumb, level, warp, bow and alignment.

B. Anchor aluminum frames to adjoining construction at heads, jambs and bottom and to steel supports, and bracing. Anchor frames with stainless steel or aluminum countersunk flathead, expansion bolts or machine screws, as applicable. Use aluminum clips for internal connections of adjoining frame sections.

C. Where work is installed within masonry or concrete openings, place no parts other than built-in anchors and provision for operating devices located in the floor, until after the masonry or concrete work is completed.

D. Install hardware specified under Section 08 71 00, DOOR HARDWARE.

3.2 ADJUSTING:

A. After installation of entrance and storefront work is completed, adjust and lubricate operating mechanisms to insure proper performance.

3.3 PROTECTION, CLEANING AND REPAIRING:

A. Remove all mastic smears and other unsightly marks, and repair any damaged or disfiguration of the work. Protect the installed work against damage or abuse.

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SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Aluminum windows of type and size shown, complete with hardware, related components and accessories.

B. Types:

1. Hung windows with integral blinds.
2. Fixed windows with integral blinds.

C. Special VA Mental Health requirements: Exterior windows in patient rooms (Residential Villas) shall be heavy gauge commercial units with insulated double glazing. The interior glazed face shall be 7/16" laminated glass. Patient and resident rooms are required by VA standards to be operable for emergency ventilation. These windows should be able to be locked with a custodial lock with the custodial wrench, however at least one operable window need to comply with NFPA 101, Section 22-2.2.3 to act as a Secondary Means of Escape per sleeping unit. Please refer to the drawings for location of the Secondary Means of Escape window. The operable portion of the window should open to the exterior and a security screen should cove the interior of the operable frame. The screen should be attached with tamper resistant screws. All exterior windows in patient bedrooms should have integral blinds. The glazing thickness and composition should be based on attack rating requirements, as established by NCPS. Windows not in patient rooms or resident rooms (Community Building) may be fixed with insulated double glazing. The interior face of these windows should be laminate glazing. The exterior face should be laminated glazing if the sill is less than 6'-6" and the window opens onto an exterior space accessed by patients.

1.2 DEFINITIONS

A. Accessories: Mullions, staff beads, casings, closures, trim, moldings, panning systems, sub-sills, clips anchors, fasteners, weather-stripping, insect screens and other necessary components required for fabrication and installation of window units.

B. Uncontrolled Water: Water not drained to the exterior, or water appearing on the room side of the window.

1.3 RELATED WORK

A. Steel subframes: Section 05 50 00, METAL FABRICATIONS.

B. Storefront: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

C. Glazing: Section 08 80 00, GLAZING.

D. Color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect windows from damage during handling and construction operations before, during and after installation.

B. Store windows under cover, setting upright.

C. Do not stack windows flat.

D. Do not lay building materials or equipment on windows.

1.5 QUALITY ASSURANCE

A. Approval by Contracting Officer’s Technical Representative (COTR) is required of products or service of proposed manufacturers and installers.

B. Approval will be based on submission of certification by Contractor that:

1. Manufacturer regularly and presently manufactures the specified windows as one of its principal products.
2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items.

C. Provide each type of window produced from one source of manufacture.

D. Quality Certified Labels or certificate:

1. Architectural Aluminum Manufacturers Association, "AAMA label" affixed to each window indicating compliance with specification.
2. Certificates in lieu of label with copy of recent test report (not more than 4 years old) from an independent testing laboratory and certificate signed by window manufacturer stating that windows provided comply with specified requirements and AAMA 101/I.S.2 for type of window specified.

1.6 SUBMITTAL

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Minimum of 1/2 full scale for all types of windows on project.

2. Identifying parts of window units by name and kind of metal or material, show construction, locking systems, mechanical operators, trim, installation and anchorages.
3. Include glazing details and standards for factory glazed units.

C. Manufacturer's Literature and Data:

Window.

Sash locks, keepers, and key.

D. Certificates:

1. Certificates as specified in paragraph QUALITY ASSURANCE.
2. Indicating manufacturers and installers qualifications.
3. Manufacturer's Certification that windows delivered to project are identical to windows tested.

E. Test Reports:

Copies of test reports as specified in paragraph QUALITY ASSURANCE.

F. Samples: Provide 150 mm (six-inch) length samples showing finishes, specified.

1.7 WARRANTY

A. Warrant windows against malfunctions due to defects in thermal breaks, hardware, materials and workmanship, subject to the terms of Article “WARRANTY OF CONSTRUCTION”, FAR clause 52.246-21, except provide 10 year warranty period.

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 Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

90.1-07.....Energy Standard of Buildings

C. American Architectural Manufacturers Association (AAMA):

101/I.S.2/A440-08.....Windows, Doors, and Unit Skylights

505-09.....Dry Shrinkage and Composite Performance Thermal Cycling Test Procedures

2605-05.....Superior Performing Organic Coatings on Architectural Aluminum Extrusions and Panels

TIR-A8-08.....Structural Performance of Poured and Debridged Framing Systems

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

A653/A653M-09.....Steel Sheet, Zinc Coated (Galvanized), Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-dip Process

E 90-09.....Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

E. National Fenestration Rating Council (NFRC):

NFRC 100-10.....Determining Fenestration Product U-Factors

NFRC 200-10.....Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

F. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

PART 2- PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions; Sheet and Plate: AAMA 101/I.S.2.

B. Sheet Steel, Galvanized: ASTM A653; G90 galvanized coating.

C. Weather-strips: AAMA 101/I.S.2; except leaf type weather-stripping is not permitted.

D. Insect Screening:

1. Regular mesh, 18 by 18, AAMA 101/I.S.2.
2. Aluminum with dark bronze anodized finish unless specified otherwise.

E. Fasteners: AAMA 101/I.S.2. Screws, bolts, nuts, rivets and other fastening devices to be non-magnetic stainless steel.

1. Fasteners to be concealed when window is closed. Where wall thickness is less than 3 mm (0.125 inch) thick, provide backup plates or similar reinforcements for fasteners.
2. Stainless steel self tapping screws may be used to secure Venetian blind hanger clips, vent guide blocks, friction adjuster, and limit opening device.
3. Attach locking and hold-open devices to windows with concealed fasteners. Provide reinforcing plates where wall thickness is less than 3 mm (0.125 inch) thick.

F. Weather-strips: AAMA 101/I.S.2.

G. Hardware:
   1. Locks: Two position locking bolts or cam type tamperproof custodial locks with a single point control located not higher than five feet from floor level. Locate locking devices in the vent side rail. Fastenings for locks and keepers shall be concealed or nonremovable.
   2. Locking Device Strikes: Locate strikes in frame jamb. Strikes shall be adjustable for locking tension. Fabricate strikes from Type 304 stainless steel or white bronze.
   3. Guide Blocks: Fabricate guide blocks of injection molded nylon. Install guide block fully concealed in vent/frame sill.
   4. Hardware for Emergency Ventilation of Windows:
      a. Provide windows with a hold open linkage for emergency ventilation.
      b. Hold open hardware shall provide for maximum six inches of window opening and shall include an adjustable friction shoe to provide resistance when closing the window.
      c. Handles shall be removable.
   5. Hardware for Maintenance Opening of Windows: Opening beyond the six inch position shall be accomplished with a window washers key. The release device shall capture the key when window is in the open position.
   7. Design operating device to prevent opening with standard tools, coins or bent wire devices.

H. Pole Operators:
   1. Provide pole operator and pole hanger where operable windows have hardware more than 1500 mm (five feet) above the finished floor, but not over 3000 mm (10 feet) above floor.
   2. Fabricate pole of tubular anodized aluminum with rubber cap at lower end and standard push-pull hook at top end to match hardware design.
   3. Provide sufficient length for window operation without reaching more than 1500 mm (five feet) above floor.

I. Integral Blinds: Provide integral blinds on all windows per manufactures specification. Provide A-E with full range of color options.

J. Patient bedroom windows are required by VA standards to be operable for emergency ventilation. These windows should be able to be locked with a custodial lock with the custodial wrench located at the nurse’s

station. Operable window openings should not exceed 4” [101.6 mm] to prevent elopement or to allow an unauthorized visitor into the facility.

2.2 THERMAL AND CONDENSATION PERFORMANCE

A. Condensation Resistance Factor (CRF): Minimum CRF of C 50.

B. Thermal Transmittance:

1. Maximum U value class for insulating glass windows: 57 (U=0.57).
2. Maximum U value class for dual glazed windows: 70 (U=0.70), or as required by ASHRAE 90.1.

C. Solar Heat Gain Coefficient (SHGC): 0.448.

2.3 FABRICATION

A. Fabrication to exceed or meet requirements of Physical Load Tests, Air Infiltration Test, and Water Resistance Test of AAMA 101/I.S.2.

B. Glazing:

1. Factory or field glazing optional.
2. Glaze in accordance with Section 08 80 00, GLAZING.
3. Windows reglazable without dismantling sash framing.
4. Design rabbet to suit glass thickness and glazing method specified.
5. Glaze from interior except where not accessible.
7. Provide removable fin type glazing beads.

C. Trim:

1. Trim includes casings, closures, and panning.
2. Fabricate to shapes shown of aluminum not less than 1.6 mm (0.062 inch) thick
3. Extruded or formed sections, straight, true, and smooth on exposed surfaces.
4. Exposed external corners mitered and internal corners coped; fitted with hairline joints.
5. Reinforce 1.6 mm (0.062 inch) thick members with not less than 3 mm (1/8-inch) thick aluminum.
6. Except for strap anchors, provide reinforcing for fastening near ends and at intervals not more than 305 mm (12 inches) between ends.
7. Design to allow unrestricted expansion and contraction of members and window frames.
8. Secure to window frames with machine screws or expansion rivets.
9. Exposed screws, fasteners or pop rivets are not acceptable on exterior of the casing or trim cover system.

D. Thermal-Break Construction:
   1. Manufacturer’s Standard.
   2. Low conductance thermal barrier.
   3. Capable of structurally holding sash in position and together.
   4. All Thermal Break Assemblies (Pour & Debridge, Insulbar or others) shall be tested as per AAMA TIR A8 and AAMA 505 for Dry Shrinkage and Composite Performance.
   5. Location of thermal barrier and design of window shall be such that, in closed position, outside air shall not come in direct contact with interior frame of the window.

E. Mullions: AAMA 101.

F. Subsills and Stools:
   1. Fabricate to shapes shown of not less than 2 mm (0.080 inch) thick extruded aluminum.
   2. One piece full length of opening with concealed anchors.
   3. Sills turned up back edge not less than 6 mm (1/4 inch). Front edge provide with drip.
   4. Sill back edge behind face of window frame. Do not extend to interior surface or bridge thermal breaks.
   5. Do not perforate for anchorage, clip screws, or other requirements.

G. Insect Screens:
   1. AAMA 101/I.S.2.
   2. Vinyl clad aluminum screen cloth.

2.4 DOUBLE HUNG WINDOWS:

A. AAMA 101/I.S.2. Single hung type H-DW-LC25

B. AAMA certified product to the AAMA 101/I.S.2.-97 standard.
   1. Provide units with "Tilt-in" feature permitting both sides of both sash to be cleaned from interior.
   2. Do not tilt-in sash without use of a maintenance only release mechanism and removable locking handle. Finger operated tilt latches not acceptable.

2.5 FIXED WINDOWS

A. AMMA 101/I.S.2; Type HC25.

B. AAMA certified product to the AAMA 101/I.S.2. - 97 standard.

2.6 FINISH

A. In accordance with NAAMM AMP 500 series.

B. Finish exposed aluminum surfaces as follows:
   1. Anodized Aluminum:
      a. Finish in accordance with AMP 501 letters and numbers.
      b. Clear anodized Finish: AA-C22A41 Medium matte, clear anodic coating, Class 1 Architectural, 0.7 mils thick.
      c. Colored anodized Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 0.7 mils thick.
         1) Dyes not accepted.
         2) Coated Aluminum:
         3) Variation of more than 50 percent of maximum shade range approved will not be accepted in a single window or in adjacent windows and mullions on a continuous series.
            a) AMP 501 and 505.
            b) Fluorocarbon Finish: AAMA 2605, superior performing organic coating.
            c) Steel: AMP 504.
            d) Stainless steel: AMP 503.
               1. Concealed: 2B or 2D.
               2. Exposed: No. 4 unless specified otherwise.

C. Hardware: Finish hardware exposed when window is in the closed position: Match window color.

PART 3 - EXECUTION

3.1 PROTECTION (DISSIMILAR MATERIALS): AAMA 101/I.S.2.

3.2 INSTALLATION, GENERAL

A. Install window units in accordance with manufacturer's specifications and recommendations for installation of window units, hardware, operators and other components of work.

B. Where type, size or spacing of fastenings for securing window accessories or equipment to building construction is not shown or specified, use expansion or toggle bolts or screws, as best suited to construction material.
   1. Provide bolts or screws minimum 6 mm (1/4-inch) in diameter.
   2. Sized and spaced to resist the tensile and shear loads imposed.
   3. Do not use exposed fasteners on exterior, except when unavoidable for application of hardware.

4. Provide non-magnetic stainless steel Phillips flat-head machine screws for exposed fasteners, where required, or special tamper-proof fasteners.
5. Locate fasteners to not disturb the thermal break construction of windows.

C. Set windows plumb, level, true, and in alignment; without warp or rack of frames or sash.

D. Anchor windows on four sides with anchor clips or fin trim.
1. Do not allow anchor clips to bridge thermal breaks.
2. Use separate clips for each side of thermal breaks.
3. Make connections to allow for thermal and other movements.
4. Do not allow building load to bear on windows.
5. Use manufacturer's standard clips at corners and not over 600 mm (24 inches) on center.
6. Where fin trim anchorage is shown build into adjacent construction, anchoring at corners and not over 600 mm (24 inches) on center.

3.3 MULLIONS CLOSURES, TRIM, AND PANNING

A. Cut mullion full height of opening and anchor directly to window frame on each side.

B. Closures, Trim, and Panning: External corners mitered and internal corners coped, fitted with hairline, tightly closed joints.

C. Secure to concrete or solid masonry with expansion bolts, expansion rivets, split shank drive bolts, or powder actuated drive pins.

D. Toggle bolt to hollow masonry units. Screwed to wood or metal.

E. Fasten except for strap anchors, near ends and corners and at intervals not more than 300 mm (12 inches) between.

F. Seal units following installation to provide weathertight system.

3.4 ADJUST AND CLEAN

A. Adjust ventilating sash and hardware to provide tight fit at contact points, and at weather-stripping for smooth operation and weathertight closure.

B. Clean aluminum surfaces promptly after installation of windows, exercising care to avoid damage to protective coatings and finishes.

C. Remove excess glazing and sealant compounds, dirt, and other substances.

D. Lubricate hardware and moving parts.

E. Clean glass promptly after installation of windows. Remove glazing and sealant compound, dirt and other substances.

F. Except when a window is being adjusted or tested, keep locked in the closed position during the progress of work on the project.

3.5 OPERATION DEVICES

A. Provide wrenches, keys, or removable locking operating handles, as specified to operate windows.

B. Provide one emergency ventilating operating handle for every four windows.

C. Provide 2 maintenance or window washer operating handles.

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SECTION 08 56 59
SERVICE AND TELLER WINDOW UNITS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Manufacturer's standard commercial product, complete with bullet resistant glazing material, frames, counters with deal trays and other features as specified.

B. Location:

1. Pharmacy.

1.2 RELATED WORK:

A. Doors and frames of a forced entry/ballistic resistant rated: Section 08 34 53, SECURITY DOORS AND FRAMES.

B. Specification for bullet resistive glazing: Section 08 80 00, GLAZING

C. Intrusion alarm: Section 28 16 11, INTRUSION DETECTION SYSTEM

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Service windows, showing design, construction and installation.

C. Manufacturer's Literature and Data: Service windows.

D. Manufacturer's Certificates: Certificates stating that service windows meet the requirements of UL 752 for the specified power rating.

E. Certification that units comply with requirements for levels of resistance specified and meets requirements of Certification Standards Forced Entry and Ballistic Resistance of Structural Systems.

1.4 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 Materials (ASTM):

A167-99 R(2004).....Stainless and Heat Resisting Chromium-Nickel Steel Plates, Sheet, and Strip.

C. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-88.....Metal Finishes Manual

D. Underwriters Laboratories Inc. (UL):

752-06.....Bullet-Resisting Equipment.

E. United States Department of State Bureau of Diplomatic Security (DS): Certification Standard for Forced Entry and Ballistic Resistance of Structural Systems

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Stainless Steel: ASTM A167, Type 302 or 304.

B. Bullet Resistive Glazing: Use bullet resistant assembly UL 752, Power Rating for Super-Small Arms ballistic level; glazing assembly G30, G31 or G32 as specified in Section 08 80 00, GLAZING.

2.2 FABRICATION:

A. Fabricate service windows to conform to UL 752, Power Rating for Super-Small Arms, except for nonconforming oversized deal trays at Pharmacy service windows. Also provide resistance of 5 minutes for forced entry using basic hard tools.

B. Frames:

1. Stainless steel not less than 3 mm (0.1094 inch) thick.
2. Continuous around each opening and with integral glazing stop on corridor side and removable glazing stop on the opposite side.
3. Miter and weld removable stops at corners, and secure to frames with countersunk screws, spaced as required for power rating protection.
4. Provide voice communication baffled jamb openings with glazing frame.
5. Provide three anchors per jamb; anchor types shall be designed to be compatible with the wall construction.

C. Sill:

1. Stainless steel not less than 3 mm (0.1094 inch) thick.
2. Sill to project full width of opening to edge of jamb with extension for writing shelf on both sides of opening; complete with stainless steel deal tray.
3. Deal tray to comply with UL 752, except deal tray at pharmacy service windows shall permit the passage of a package 38 by 75 by 375 mm (1-1/2 by 3 by 15 inches).

D. Glazing:

1. Factory set and glaze bullet resistive glazing material in stainless steel continuous channel frame not less than 3 mm (0.01094 inch) thick.
2. Secure channel frame to service window frame permitting expansion and contraction.

E. Finish on Stainless Steel: NAAMM Mechanical Finish Number 4.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install service windows in accordance with manufacturers installation instructions. Securely anchor and join frame components as shown on shop drawings.

B. Set units accurately, plumb, and level.

C. After installation, clean window unit and protect from damage until completion of project.

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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

C. Finishes: AS indicated in Hardware Sets.

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 UFAS, (Uniform Federal Accessible Standards) 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, if possible, except as otherwise specified:

1. Mortise locksets.
2. Hinges for hollow metal and wood doors.
3. Surface applied overhead door closers.

4. Exit devices.
5. Floor closers.

1.4 WARRANTY

A. Automatic door operators shall be subject to the terms of FAR Clause 52.24-21, 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. Furnish maintenance manuals and instructions on all door hardware.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23 plus 2 copies to the VAMC Locksmith (VISN Locksmith if the VAMC does not have a locksmith).

B. Hardware Schedule: 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 the Contracting Officer’s Technical Representative (COTR) for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COTR's office until all other similar items have been installed in project, at which time the COTR 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-Engineer (A-E), COTR, and 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 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 7 pin type. Keying information shall be furnished at a later date by the COTR.

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. American Society for Testing and Materials (ASTM):

F883-04.....Padlocks

E2180-07.....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)

A156.5-01.....Auxiliary Locks and Associated Products

A156.6-05.....Architectural Door Trim

A156.8-05.....Door Controls-Overhead Stops and Holders

A156.12-05 .....Interconnected Locks and Latches

A156.13-05.....Mortise Locks and Latches Series 1000

A156.14-07 .....Sliding and Folding Door Hardware

A156.15-06.....Release Devices-Closer Holder, Electromagnetic and Electromechanical

A156.16-08.....Auxiliary Hardware

A156.17-04 .....Self-Closing Hinges and Pivots

A156.18-06.....Materials and Finishes

A156.20-06 .....Strap 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
A156.25-07 .....Electrified Locking Devices
A156.26-06.....Continuous Hinges
A156.28-07 .....Master Keying Systems
A156.29-07 .....Exit Locks and Alarms
A156.30-03 .....High Security Cylinders
A156.31-07 .....Electric Strikes and Frame Mounted Actuators
A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):
80-10.....Fire Doors and Fire Windows
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 lbs.) or more, furnish 127 mm (5 inch) high hinges.

C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and 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: Steel.
3. Base Metal for Hinges for Fire-Rated Assemblies: 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 COMBINATION CLOSER – HOLDER

A. Conform to ANSI A156.15; combination closer-holder with built-in electronic release.

B. Combination closer-holder shall have the following features:
   1. Control door closing and latching sequence by hydraulic action.
   2. Wiring for 24V DC current. Current draw shall not exceed 0.16 amperes.
   3. Combination closer-holder type:
      a. At doors with 90-110° hold-open point: Single lever arm with slide track closing action, and adjustable hydraulic back-check. Provide tracks with spring-cushion stop assemblies to avoid the necessity of a separate wall or floor stop. Provide with double egress arm where required.
      b. At doors with over 110° to 175° hold-open point: Single or double lever arm and adjustable hydraulic back-check. Provide with long arms where required for deep frame reveals.
   4. Spring power for closing force shall conform to ANSI A156.4 and have 50% spring power adjustment.
   5. Size closers per manufacturer's printed catalog recommendations.
   6. Hold open mechanism shall hold door open between 85 degrees and 175 degrees depending on wall and frame conditions. Mount device to provide maximum door opening permitted by building construction or equipment.
   7. Electronic release shall release door when signaled by smoke detector. Smoke detectors shall not be incorporated as an integral part of door holders. Smoke detectors are specified in the ELECTRICAL Section.
   8. All closers to have full covers.
   9. All closers shall have a 1 ½" minimum piston diameter and an adjustable back check position valve.

2.6 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 lead 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).

2.7 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.

2.8 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 seven 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 of 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, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching **Corbin Russwin style NSA “Newport”.** 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 ML2030 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 A-E or to match existing lever design. Where two turn pieces are specified for lock, 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 A156.5.
4. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.
5. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance.
6. Lock cylinders to be “zero bitted” to work on a blank key that will be rekeyed to the VA Medical Center’s keying system.

2.9 PUSH-BUTTON COMBINATION LOCKS

A. ANSI/BHMA A156.13, Grade 1. Battery operated 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 UFAS 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 ELECTROMAGNETIC LOCKS

A. ANSI/BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door. Listed under Category E in BHMA's "Certified Product Directory."

1. Type: Full exterior or full interior, as required by application indicated.
2. Strength Ranking: 1500 lbf (6672 N).
3. Inductive Kickback Peak Voltage: Not more than 53 V.
4. Residual Magnetism: Not more than 4 lbf (18 N) to separate door from magnet.

B. Delayed-Egress Locks: BHMA A156.24. Listed under Category G in BHMA's "Certified Product Directory".

1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds, as required by NFPA 101.
2. Security Grade: Activated from secure side of door by initiating device.
3. Movement Grade: Activated by door movement as initiating device.
4. The lock housing shall not project more than 4-inches (101mm) from the underside of the frame head stop.

2.11 ELECTRIC STRIKES

A. ANSI/ BHMA A156.31 Grade 1.

B. General: Use fail-secure electric strikes at fire-rated doors.

2.12 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	2 for each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

2.13 KEY CABINET

A. ANSI Standard A156.5. 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 COTR.

2.14 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING

A. Conform to ANSI Standard A156.6.

B. Provide protective plates and door edging as specified below:

1. Kick plates, mop plates and armor plates of clear plastic.
2. Provide kick plates and mop plates where specified. Kick plates shall be 203 mm (8 inches) high. Adjust as required to match heights of those used in existing facility. Mop plates shall be 152 mm (6

inches) high or 203 mm (8 inches) high, to match heights used in existing facility. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. 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. Interior side of exterior doors;
   c. Closet side of closet doors;
4. Armor plates for doors are listed under Article "Hardware Sets". The Cincinnati VA Hospital – Facility Specific Hardware Standards require “kick plates” and “armor plates” fabricated from clear plastic. Kick plates shall match heights of those used in existing facility.
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 surface type instead of mortised type. 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.

2.15 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.

2.16 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).

2.17 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.

2.18 DOOR PULLS

A. Conform to ANSI A156.6. Pull plate 90 mm by 350 mm (3-1/2 inches by 14 inches), unless otherwise specified. Cut plates of door pulls for cylinders, or turn pieces where required.

2.19 PUSH PLATES

A. Conform to ANSI A156.6. Metal, Type J302, 200 mm (8 inches) wide by 350 mm (14 inches) high. Provide metal Type J300 plates 100 mm (4 inches wide by 350 mm (14 inches) high) where push plates are specified for doors with stiles less than 200 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

2.20 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.

2.21 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.

2.22 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) from fame face.

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 (0.000774m^3/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 E76213, conforming to ANSI A156.5. 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. Swing-up doors.
2. 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, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.25 FINISHES

A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, 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. Cover plates for floor hinges and pivots: 630.
6. Other primed steel hardware: 600.

D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces.

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.

F. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag+). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

2.26 BASE METALS

A. Apply specified U.S. Standard finishes on different base metals as per the following, unless indicated otherwise:

Finish	**Base Metal**
652	Steel
626	Brass or bronze
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. 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:

B. 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 sex 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 COTR. 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:

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 COTR 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 COTR 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 COTR 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 COTR and 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.

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:
ADO = Automatic Door Operator
EMCH = Electro-Mechanical Closer-Holder
MHO = Magnetic Hold-Open (wall- or floor-mounted)

SECURITY HARDWARE ABBREVIATIONS LEGEND:

AC = Access Control Device (Card reader, biometric reader, keypad, etc.)

ADO = Automatic Door Operator

DEML = Delayed Egress Magnetic Lock

DEPH = Delayed Egress Panic Exit Device

DPS = Door Position Switch (Door or Alarm Contact)

EL = Electric Lock or Electric Lever Exit Device

PB = Push-button Combination Lock (stand-alone)

RR = Remote Release Button

ELR = Electric Latch Retraction Exit Device

REX = Request-to-Exit Switch in Latching Device Inside Trim

HW SET: 01 - NOT USED

HW SET: 02

3	EA	HINGE	A8112
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	WALL STOP	L52101

HW SET: 03 - NOT USED

HW SET: 04 - NOT USED

HW SET: 05

3	EA	HINGE	A8112
1	EA	OFFICE LOCK	F04
1	EA	MORTISE CYLINDER	1E74
1	EA	WALL STOP	L52101
1	SET	SEALS	ROE154
1	EA	DOOR BOTTOM	ROY346
1	EA	COAT HOOK	L03121

HW SET: 06

3	EA	HINGE	A8112
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101

HW SET: 06A – SEE HW SET 41

HW SET: 07

1	EA	CONTINUOUS HINGE	A51031B
1	EA	PRIVACY SET	F22

1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 4" X 1" LDW
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101
1	SET	SEALS	ROE154
1	EA	DOOR BOTTOM	ROY346

HW SET: 08

3	EA	HINGE	A8112
1	EA	PASSAGE SET	F01
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101
1	SET	SEALS	ROE154

HW SET: 09

1	EA	CONTINUOUS HINGE	A51031B
1	EA	OFFSET DOOR PULL	1" DIA. 12" C-C
1	EA	DUMMY TOUCH BAR	330 (SIMILAR)
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	WALL STOP	L52101

HW SET: 10

3	EA	HINGE	A8112
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	OVERHEAD HOLDER	C52511 (SURF. TYPE)

HW SET: 11 (FOR DOOR C211 SEE HW SET 40)

3	EA	HINGE	A8112
1	EA	PRIVACY SET	F22
1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4G-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW

HW SET: 12

1	EA	CONTINUOUS HINGE	A51031B
1	EA	CLASSROOM LOCK	F05
1	EA	MORTISE CYLINDER	1E74
1	EA	WALL STOP & HOLDER	L11291

HW SET: 13

3	EA	HINGE	A8112
1	EA	CLASSROOM LOCK	F05
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101
1	SET	SEALS	ROE154
1	EA	DOOR BOTTOM	ROY346

HW SET: 14

3	EA	HINGE	A8112
1	EA	PRIVACY SET	F22
1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4G-PT4H
1	EA	KICK PLATE	J102 4" X 1" LDW
1	EA	KICK PLATE	J102 8" X 2" LDW

HW SET: 15

2	EA	CONTINUOUS HINGE	A51031B
2	EA	MANUAL FLUSH BOLT	L04251
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H (ACT.)
2	EA	OVERHEAD HOLDER	C52511 (SURF. TYPE)
1	SET	SEALS	ROE154
2	EA	DRIP CAP	17 (SIMILAR)

1	EA	THRESHOLD	J32300
			ASTRAGAL BY DOOR SUPPLIER

HW SET: 16

3	EA	HINGE	A8112
1	EA	FIRE EXIT HARDWARE	GRD.1 TYPE 1 FUNC. 08
1	EA	RIM CYLINDER	1E72
1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4G-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	SET	SEALS	ROE154

HW SET: 17

3	EA	HINGE	A8112
1	EA	CLASSROOM LOCK	F05
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101

HW SET: 18

1	EA	CONTINUOUS HINGE	A51031B
1	EA	PANIC HARDWARE	GRD. 1 TYPE 1 FUNC. 01
1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4G-PT4H
1	SET	SEALS	ROE154
1	EA	DRIP CAP	17 (SIMILAR)
1	EA	THRESHOLD	J32300
1	EA	DOOR POSITION SWITCH	7764 (SIMILAR)

HW SET: 19

3	EA	HINGE	A8112
1	EA	CLASSROOM LOCK	F05
1	EA	MORTISE CYLINDER	1E74
1	EA	WALL STOP	L52101

1	SET	SEALS	ROE154
1	EA	DOOR BOTTOM	ROY346

HW SET: 20

1	EA	CONTINUOUS HINGE	A51031B EPT
1	EA	PANIC HARDWARE	GRD. 1 TYPE 1 FUNC. 03 L/TRIM
1	EA	ELECTRONIC EXIT TRIM	CO-200-993R-70-KP-RHO-PD (SIMILAR)
1	EA	RIM CYLINDER	1E72
1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4H X 61
1	EA	OVERHEAD STOP	C51541 (CONCEAL TYPE)
1	SET	SEALS	ROE154
1	EA	DRIP CAP	17 (SIMILAR)
1	EA	THRESHOLD	J32300
1	EA	DOOR POSITION SWITCH	7764 (SIMILAR)
1	EA	POWER TRANSFER	EPT-10
1	EA	POWER SUPPLY	PS914
			SEALS BY DOOR SUPPLIER

HW SET: 21

1	EA	CONTINUOUS HINGE	A51031B
1	EA	PANIC HARDWARE	GRD.1 TYPE 1 FUNC. 03 L/TRIM
1	EA	RIM CYLINDER	1E72
1	EA	OFFSET DOOR PULL	1" DIA. 12" C-C
1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4H X 61
1	EA	OVERHEAD STOP	C51541 (CONCEAL TYPE)
1	EA	THRESHOLD	J32300
1	EA	DOOR POSITION SWITCH	7764 (SIMILAR)
			SEALS BY DOOR SUPPLIER

HW SET: 22

1	EA	CONTINUOUS HINGE	A51031B
1	EA	PANIC HARDWARE	GRD. 1 TYPE 1 FUNC. 01

1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4H X 61
1	EA	WALL STOP	L12021
1	EA	THRESHOLD	J32300
1	EA	DOOR POSITION SWITCH	7764 (SIMILAR)
			SEALS BY DOOR SUPPLIER

HW SET: 23

3	EA	HINGE	A8112
1	EA	PUSH PLATE	8200 4" X 16" (SIMILAR)
1	EA	PULL PLATE	8305-8 4" X 16" (SIMILAR)
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 4" X 1" LDW
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101

HW SET: 24

2	EA	CONTINUOUS HINGE	A51031B
2	EA	OFFSET DOOR PULL	1" DIA. 12" C-C
2	EA	DUMMY TOUCH BAR	330 (SIMILAR)
2	EA	SURFACE CLOSER	CO2021-PT4C-PT4D-PT4H (TJ MOUNT)
2	EA	WALL STOP	L52101

HW SET: 25

1	EA	CONTINUOUS HINGE	A51031B EPT
1	EA	PANIC HARDWARE	GRD. 1 TYPE 1 FUNC. 03 L/TRIM
1	EA	ELECTRONIC EXIT TRIM	CO-200-993R-70-KP-RHO-PD (SIMILAR)
1	EA	RIM CYLINDER	1E72
1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4H X 61
1	EA	OVERHEAD STOP	C51541 (CONCEAL TYPE)
1	EA	THRESHOLD	J32300
1	EA	DOOR POSITION SWITCH	7764 (SIMILAR)

1	EA	POWER TRANSFER	EPT-10
1	EA	POWER SUPPLY	PS914
			SEALS BY DOOR SUPPLIER

HW SET: 26

2	EA	CONTINUOUS HINGE	A51031B
1	EA	PANIC HARDWARE	GRD.1 TYPE 8 FUNC. 01
1	EA	PANIC HARDWARE	GRD1 TYPE1 FUNC 03 L/TRIM
1	EA	RIM CYLINDER	1E72
2	EA	OFFSET DOOR PULL	1" DIA. 12" C-C
2	EA	SURFACE CLOSER	CO2021-PT4C-PT4D-PT4H (TJ MOUNT)
2	EA	OVERHEAD STOP	C51541 (CONCEAL TYPE)
1	EA	THRESHOLD	J32300
2	EA	DOOR POSITION SWITCH	7764 (SIMILAR)
			SEALS BY DOOR SUPPLIER

HW SET: 27

3	EA	HINGE	A8112
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101

HW SET: 28 (REFER TO SHEET ES503 FOR ACCESS CONTROL RACEWAY INSTALLATION DETAILS)

1	EA	CONTINUOUS HINGE	A51031B
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	ELECTRIC STRIKE	6211 FSE 24VDC
1	EA	SURFACE CLOSER	C02021 PT4C-PT4D-PT4G-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	POWER SUPPLY	PS914 (SIMILAR)

CONTROLLER, KEYPAD AND REQUEST TO EXIT FURNISHED BY THE V.A. AND INSTALLED BY THE GENERAL CONTRACTOR

HW SET: 29

6	EA	HINGE	A8112
2	EA	MANUAL FLUSH BOLT	L04251
1	EA	DUST PROOF STRIKE	L14011
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
2	EA	OVERHEAD HOLDER	C52511 (SURF. TYPE)

HW SET: 30

3	EA	HINGE	A8112
1	EA	CLASSROOM LOCK	F05
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 4" X 1" LDW
1	EA	KICK PLATE	J102 4" X 2" LDW
1	EA	WALL STOP	L52101

HW SET: 31

3	EA	HINGE	A8112
1	EA	CLASSROOM LOCK	F05
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	OVERHEAD STOP	C51541 (CONCEAL TYPE)
1	EA	KICK PLATE	J102 8" X 2" LDW

HW SET: 32

3	EA	HINGE	A8112
1	EA	STORE LOCK	F14
2	EA	MORTISE CYLINDER	1E74
1	EA	WALL STOP	L52101

HW SET: 33

3	EA	HINGE	A8112
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	KICK PLATE	J102 4" X 1" LDW
1	EA	WALL STOP	L52101

HW SET: 34

3	EA	HINGE	A8112
1	EA	CLASSROOM LOCK	F05
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	CO2051-PT4C-PT4D-PT4F-PT4H
1	EA	KICK PLATE	J102 4" X 1" LDW
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101
1	SET	SEALS	ROE154

HW SET: 35

3	EA	HINGE	A8112
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	SURFACE CLOSER	C02051/C02061 PT4C PT4D PT4H
1	EA	KICK PLATE	J102 4" X 1" LDW
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101

HW SET: 36

3	EA	HINGE	A8112
1	EA	PASSAGE SET	F01
1	EA	SURFACE CLOSER	CO2051-PT4C-PT4D-PT4F-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW

HW SET: 37

3	EA	HINGE	A8112
1	EA	STOREROOM LOCK	F07
1	EA	MORTISE CYLINDER	1E74
1	EA	OVERHEAD STOP	C52541 (SURF. TYPE)

HW SET: 38

6	EA	HINGE	A8112
2	EA	DUMMY TRIM	LO170 (SIMILAR)
2	EA	ROLLER LATCH	B23013
2	EA	WALL STOP	L52101

HW SET: 39

2	EA	HINGE	A8112
1	EA	ELECTRIC HINGE	A8112 8-WIRE
2	EA	MORTISE CYLINDER	1E74
1	EA	EL INSTITUTION LOCK	2-CYLINDER RIGID ELECTRIC
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101
1	EA	POWER SUPPLY	PS914 (SIMILAR)
1	EA	WALL STOP	L52101
1	EA	CONTROLLER	CT5000
2	EA	KEYPADS	SEKPDMWG

HW SET: 40

1	EA	PRIVACY SET	F22
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101

HW SET: 41

2	EA	HINGE	A8112
1	EA	HINGE	A8112 ETW
1	EA	CYLINDER CORE	AS REQUIRED
1	EA	ELECTRONIC LOCK	CO-200-MS-70-KP-RHO-BD (SIMILAR)
1	EA	SURFACE CLOSER	CO2011/CO2021 PT4C-PT4D-PT4H
1	EA	KICK PLATE	J102 8" X 2" LDW
1	EA	WALL STOP	L52101
1	EA	POWER SUPPLY	PS914

MISCELLANEOUS:

1	EA	HANDHELD DEVICE	HHD KIT
1	EA	OFFLINE LOCK SFTWARE	SXPR-SFT-1

- - - E N D - - -

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

1.2 RELATED WORK

A. Factory glazed by manufacturer in following units:
   1. Sealants: Section 07 92 00, JOINT SEALANTS
   2. Sound resistant doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, and Section 08 14 00, WOOD DOORS.
   3. Security Doors: Section 08 34 53, SECURITY DOORS AND FRAMES.
   4. Entrances and Storefronts: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
   5. Windows: Section 08 51 13, ALUMINUM WINDOWS.
   6. Mirrors: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.
   7. Bullet resisting glass: Section 08 56 59, SERVICE AND TELLER WINDOW UNITS.
   8. Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
   9. Section 28 16 11, INTRUSION DETECTION SYSTEM.

1.3 LABELS

A. Temporary labels:
   1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
   2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
   3. Temporary labels shall remain intact until glass is approved by the Contracting Officer Technical Representative (COTR).

B. Permanent labels:
   1. Locate in corner for each pane.
   2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
      a. Tempered glass.
      b. Laminated glass or have certificate for panes without permanent label.

c. Organic coated glass.

3. Bullet resistance glass or plastic assemblies:

a. Bullet resistance glass or plastic assemblies in accordance with UL 752 requirements for power rating specified.

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" shall be identified in bold lettering on each side of glazing with removable label.

1.4 PERFORMANCE REQUIREMENTS

A. 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.

B. Glass Thickness:

1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7 and applicable local code.

2. Test in accordance with ASTM E 1300.

3. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

C. Bullet resistance glass or plastic assemblies:

1. For blast resistant windows follow Unified Facilities Criteria, DOD Minimum Antiterrorism Standards for Buildings UFC4-010-01.

2. Spall Resistance: Laminated glazing shall not produce spall to interior (protected side) when impacted with scheduled ballistics. Tolerances:

3. Outside dimensions: Overall outside dimensions (height and width) of laminated security glazing shall maintain tolerance of ± 3 mm.

4. Warpage: Out-of-flat (warpage or bowing) condition of laminates shall not exceed 2.5 mm per lineal meter. The condition, if present, shall be localized to extent not greater than 0.75 mm for any 0.3 meter section.

5. Coordinate with Physical Security Design Manual requirements.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Certificates:

1. Certificates stating that wire glass, meets requirements for safety glazing material as specified in ANSI Z97.1.
2. Certificate on shading coefficient.
3. Certificate on "R" value when value is specified.
4. Certificate test reports confirming compliance’s with specified bullet resistive rating.
5. Certificate that blast resistant glass meets the requirements of UFC4-010-01.

C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to “Warranty of Construction” Article in this Section.

D. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Insulating glass units.
3. Transparent (one-way vision glass) mirrors.
4. Elastic compound for metal sash glazing.
6. Glazing cushion.
7. Sealing compound.
8. Bullet resistive material.
9. Plastic glazing material, each type required.

E. Samples:

1. Size: 150 mm by 150 mm (6 inches by 6 inches).
2. Tinted glass.
3. Reflective glass.
4. Transparent (one-way vision glass) mirrors.

F. 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 shall 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 shall 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 shall be approved and applied by manufacturer.
4. Edge protection: To cushion and protect glass clad, polycarbonate, and Noviflex edges from contamination or foreign matter, the four edges shall be sealed the depth of glazing with continuous standard-thickness Santoprene tape. Alternatively, continuous channel shaped extrusion of Santoprene shall 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 C, 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. Be responsible for proper fit of field measured products.

1.8 WARRANTY

A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21, except extend warranty period for the following:
   1. Bullet resistive plastic material to remain visibly clear without discoloration for 10 years.
   2. Insulating glass units to remain sealed for 10 years.
   3. Laminated glass units to remain laminated for 5 years.
   4. Polycarbonate to remain clear and ultraviolet light stabilized for 5 years.
   5. Insulating plastic to not have more than 6 percent decrease in light transmission and be ultraviolet light stabilized for 10 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 National Standards Institute (ANSI):

Z97.1-04.....Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test.

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

C1363-05.....Thermal Performance of Building Assemblies, by Means of A Hot Box Apparatus

C542-05.....Lock-Strip Gaskets.

C716-06.....Installing Lock-Strip Gaskets and Infill Glazing Materials.

C794-06.....Adhesion-in-Peel of Elastomeric Joint Sealants.

C864-05.....Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

C920-08.....Elastomeric Joint Sealants.

C964-07.....Standard Guide for Lock-Strip Gasket Glazing.

C1036-06.....Flat Glass.

C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C1172-09.....Laminated Architectural Flat Glass.

C1376-10.....Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

D635-06.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position.

D4802-02.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet.

E84-09.....Surface Burning Characteristics of Building Materials.

E1300-09.....Determining Load Resistance of Glass in Buildings.

E2190-08.....Insulating Glass Unit

D. Commercial Item Description (CID):

A-A-59502.....Plastic Sheet, Polycarbonate

E. Code of Federal Regulations (CFR):

16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 1977, with 1984 Revision.

F. National Fire Protection Association (NFPA):

80-08.....Fire Doors and Windows.

G. National Fenestration Rating Council (NFRC)

H. Safety Glazing Certification Council (SGCC)2009:

Certified Products Directory (Issued Semi-Annually).

I. Underwriters Laboratories, Inc. (UL):

752-06.....Bullet-Resisting Equipment.

J. Unified Facilities Criteria (UFC):

4-010-01-2007.....DOD Minimum Antiterrorism Standards for Buildings

K. Glass Association of North America (GANA):

Glazing Manual (Latest Edition)

Sealant Manual (2008)

L. American Society of Civil Engineers (ASCE):

ASCE 7-10.....Wind Load Provisions

PART 2 - PRODUCT

2.1 GLASS

A. Use thickness stated unless specified otherwise in assemblies.

B. Clear Glass:

1. ASTM C1036, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch)
3. Coordinate color/tint/coating to accommodate required security monitoring.

C. Tinted Heat reflective and low emissivity coated glass:

1. ASTM C1036, Type I, Class 2, Quality q3.
2. Color: Clear
3. Thickness, 6 mm (1/4 inch)

2.2 HEAT-TREATED GLASS

A. Clear Heat Strengthened Glass:

1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch).

B. Tinted Heat Strengthened Glass:

1. ASTM C1048, Kind HS, Condition A, Type I, Class 2, Quality q3.
2. Color: Clear.
3. Thickness, 6 mm (1/4 inch).

C. Clear Tempered Glass:

1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch).

D. Tinted Tempered Glass.

1. ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3.
2. Color: Clear
3. Thickness, 6 mm (1/4 inch).

E. Tempered Patterned Glass (obscure):

1. ASTM C1048, Kind FT, Type II, Class 1, Form 3, Quality q8, Finish f1, Pattern p3.
2. Thickness 10.7 mm (0.422 inch).

2.3 COATED GLASS

A. Low-E Tempered Glass:

1. ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with low emissivity pyrolytic coating having an E of 0.15.

2. Apply coating to second surface of insulating glass units.
3. Thickness, 4.8 mm (3/16 inch)

B. Ceramic Coated Vision Glass:

1. ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with ceramic coating applied by silk-screen process.
2. Pattern as indicated in Drawings.
3. Apply coating to second surface of monolithic glass
4. Thickness, 6 mm (1/4 inch.

2.4 PLASTIC

A. Clear Polycarbonate Sheet:

1. Fed. Spec. A-A-59502, Type I, standard sheet, Class 1, ultraviolet light stabilized. Flame spread of 10 or less when tested per ASTM E84.
2. Thickness, 9.5mm (0.375 inch).

B. Clear Polycarbonate Sheet, Abrasion Resistant:

1. Fed. Spec. A-A-59502, Type III, coated mar resistant, Class 1, ultraviolet light stabilized, Grade A, High abrasion resistance. Flame spread of 10 or less when tested per ASTM E84.
2. Thickness, Thickness, 9.5mm (0.375 inch).

2.5 LAMINATED GLASS

A. Two or more lites of glass bonded with an interlayer material for use in building glazing

B. Colored Interlayer:

1. Use color interlayer ultraviolet light color stabilization.
2. Option: Use colored interlayer with clear glass in lieu of tinted glass and clear interlayer.
3. Option: Use white interlayer with clear glass in lieu of obscure glass and clear interlayer.
4. The interlayer assembly shall have uniform color presenting same appearance as tinted glass assembly.

C. Use 1.5 mm (0.060 inch) thick interlayer for:

1. Horizontal or Sloped glazing.
2. Acoustical glazing.
3. Heat strengthened or fully tempered glass assembles.

D. Use min. 0.75 mm (0.030 inch) thick interlayer for vertical glazing where 1.5 mm (0.060 inch) interlayer is not otherwise shown or required.

2.6 LAMINATED GLAZING ASSEMBLIES

A. Clear Glazing:
   1. Both panes clear glass ASTM C1036, Type I, Class 1, Quality q3.
   2. Thickness: Each pane, 3 mm (1/8 inch) thick

B. Clear Tempered Glazing:
   1. Both panes ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
   2. Thickness: Each pane 4.8 mm (3/16 inch) thick

C. Clear Heat Strengthened Glazing:
   1. Both panes, ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
   2. Thickness: Each pane, 3 mm (1/8 inch) thick

2.7 BULLET RESISTIVE ASSEMBLY

A. Provide protection listed by UL ABPMED as bullet resisting, with a power rating of Medium Power-Small Arms (MSA) ballistic level in accordance with UL 752.

B. Fabricate from Type I, Class 1, Quality q3 glass with polyvinyl butyral plastic interlayers between the layers of glass.

2.8 GLASS CLAD POLYCARBONATE SECURITY GLAZING ASSEMBLY

A. Use 1.3 mm (0.050 inch) polyurethane sheeting for interlayer between glass and polycarbonate.

B. Clear Heat Strengthened Glass Clad Polycarbonate.
   1. Use ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3, outer glass panes.
   2. Use clear polycarbonate sheet, 3 mm (1/8 inch) thick core.
   3. Thickness, 11 mm (7/16 inch).

C. Clear Tempered Glass Clad Polycarbonate:
   1. Use ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 3 mm (1/8 inch) thick outer glass panes.
   2. Use clear polycarbonate sheet, 3 mm (1/8 inch) thick core.
   3. Thickness, 11 mm (7/16 inch).

D. Maximum Allowable Area: Laminated glazing shall not exceed 1.32 meter

E. square unless glazing has been certified.

2.9 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.

B. Assemble units using glass types specified:

C. Sealed Edge Units (SEU):

1. Insulating Glass Unit Makeup
   a. Outboard Lite
      1. Glass type: Class 2 (Clear)
      2. Glass Tint: Solarban 60, Low-E
      3. Nominal Thickness: 4.8mm (3/16 inch).
      4. Glass Strength: Heat-Strengthened)
      5. Coating Orientation: (Surface #2)
   b. Spacer
      1. Nominal Thickness:
      2. Gas Fill: (Air)
   c. Inboard Lite
      1. Glass Type: Class 1 (clear) float.
      2. Glass Tint: Clear.
      3. Nominal Thickness: 6mm (1/4 inch).
      4. Glass Strength: (Annealed)
      5. Coating Orientation: (N/A)
2. Performance Characteristics (Center of Glass)
   a. Visible Transmittance: 70%
   b. Visible Reflectance: 12%
   c. Winter U-factor (U-value): .57
   d. Shading Coefficient (SC): .44
   e. Solar heat Gain Coefficient (SHGC): .448
3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.

D. Fused Edge Units, (FEU)

1. Glass to glass sealed edges electrically fused.
2. Air space not less than 4.8 mm (3/16 inch) wide up to 6 mm (1/4 inch) wide.

3. R value not less than 1.5.

E. FEU Clear Glass

1. Interior and exterior panes, ASTM C1036, Type I, Class 1, Quality q3, 3 mm (1/8 inch) thick.
2. Thickness, 11 mm (7/16 inch) minimum.

2.10 INSULATING PLASTIC SHEETS

A. Homogenous polycarbonate assembly integrally joined face sheets separated by either vertical or angled ribs forming airspace cells between face sheets:

1. Treated to prevent ultraviolet light discoloration.
2. Flammability Rating: CCI classification by BOCA, ICBO, and SBCC Building Code Organizations when tested in accordance with ASTM D635 showing a burn rating of 25.4 mm (one inch) or less.
3. Nominal Thickness: 9.5 mm (3/8 inch) minimum, 17.4 mm (11/16 inch) maximum.
4. Thermal: U factors 0.55 when tested in accordance with ASTM C236.
5. Impact Resistance: No rupture when subjected to a falling dart with 13 mm (½ inch) radius tip at 298 J (220 ft. lbs).

B. Clear Insulating Plastic Sheet:

1. Light Transmission: Not less than 70 percent.
2. Shading Coefficient: Not less than 44 percent.

2.11 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 shall have a finish that will not corrode or stain while in service.

B. Setting Blocks: ASTM C864:

1. Channel shape; having 6 mm (1/4 inch) internal depth.
2. Shore a hardness of 80 to 90 Durometer.
3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
5. 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: One to 25 to 76 mm (one to three inches).
4. Shore a hardness of 40 to 50 Durometer.

D. Sealing Tapes:
1. Semi-solid polymeric based 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.

E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.

G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond shaped pieces, 6 mm (1/4 inch) minimum size.

H. 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.

I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

J. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
2. Class 25
3. Grade NS.
4. Shore A hardness of 25 to 30 Durometer.

K. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
2. Designed for dry glazing.

L. Color:
1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall 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 shall be black, gray, or neutral color.

M. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

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’s approved shop drawings.

B. Advise Contractor of 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 to prevent damage to glass and glazing units by cleaning materials.

3.2 PREPARATION

A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 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-01 Glazing Manual and GANA-02 Sealant Manual 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. Patterned Glass:
   1. Install units with one patterned surface with smooth surface on the weather side.
   2. Install units in interior partitions with pattern in same direction in all openings.
G. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
H. Transparent (One-Way Vision Glass) Mirror: Use continuous channel glazing gasket.
I. Plastic:
   1. Use dry glazing method.
   2. Use only neoprene or EPDM gaskets.
J. Laminated Glass:
   1. Tape edges to seal interlayer and protect from glazing sealants.
   2. Do not use putty or glazing compounds.
K. Insulating Glass Units:
   1. Glaze in compliance with glass manufacturer's written instructions.
   2. When glazing gaskets are used, they shall 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.
   5. Install with tape or gunnable sealant in wood sash.
L. 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 shall not be cleaned by scraping, razor blade, squeegee, or use of highly alkaline cleaner. At no time shall polycarbonate material be exposed to chemical solvents (benzene,

gasoline, acetone, paint thinners) or aromatic hydrocarbons (toluene or xylene), nor shall any of these solvents or fumes by used or present in confined area such as Marine Guard Booth. Due care shall 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).

3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing spline 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 150 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 S1 or S2 type sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line.

G. Apply cap bead of S1 or S2 type 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 - 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 S1 or S2 type sealant to depth equal to bite on glazing, to uniform and level line.

F. Trim protruding tape edge.

3.7 REPLACEMENT AND CLEANING

A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COTR.

B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.

C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.8 PROTECTION

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.9 GLAZING SCHEDULE

A. Fire Resistant Glass:

1. Install clear wire glass in interior fire rated or labeled doors and windows.
2. Install clear wire glass in exterior windows and doors indicated to receive wire glass.

3. Install patterned (obscure) wire glass in bath, toilet, and locker room windows, except where indicated to receive clear wire glass.

B. Tempered Glass:
   1. Install in full and half glazed doors unless indicated otherwise.
   2. Install in storefront, windows, and door sidelights adjacent to doors.
   3. Use clear tempered glass on interior side lights and doors, and on exterior doors and sidelights unless otherwise indicated or specified.
   4. Use SEU clear tempered insulating glass on storefronts and sidelights.
   5. Use SEU Low E tempered and clear glass, G-41, on storefront and sidelights.
   6. Use clear tempered glass in exterior and interior panes unless specified otherwise at insulating glass units adjacent to door.

C. Clear Glass:
   1. Interior observation windows not specified otherwise.
   2. Interior pane of dual glazed windows not receiving tempered, laminated or organic coated glass, or other special glass indicated or specified.

D. Insulating Glass:
   1. Install SEU clear tempered glass in windows, interior pane of dual glazed windows, storefronts, adjacent to entrances or walks.
   2. Install SEU clear glass in windows, interior pane of dual glazed windows, storefronts, not adjacent to entrances or walks.
   3. Install SEU tinted tempered and clear tempered glass in storefronts, adjacent to entrances or walks.

E. Laminated Glass: Install as specified in doors, observation windows and interior pane of dual glazed windows where indicated.
   1. Provide laminated glass for all windows in Psychiatric Nursing Units, Alcohol Dependency Treatment Nursing Units, Drug Abuse Treatment Nursing Units and Security Bedrooms. Laminated glass shall be 7/16-in thick in locked patient units and security rooms, 5/16-in thick elsewhere.(min. 1.5 mm interlayer).
   2. If laminated glass is required for double glazed windows, provide it for interior panes only.

3. Where laminated glass is required for blast-resistant windows, follow UFC4-010-01, DOD Minimum Antiterrorism Standards for Buildings.

F. Bullet Resisting Assembly, Install specified assembly in service windows at Pharmacy.

PART 4 - ETCHED GLASS PATTERNS

A. Service Emblems: Location as indicated in the drawings.

B. Service emblems shall be 24″ in diameter.

SEE FOLLOWING PAGES.

U.S. Army

U.S. Navy

U.S. Air Force

U.S. Marines

U.S. Coast Guard

- - - E N D - - -

SECTION 09 06 00
SCHEDULE FOR FINISHES

SECTION 09 06 00-SCHEDULE FOR FINISHES

VAMC: Louis A. Johnson VA Medical Center
Location: Clarksburg, WV 26301 - 4199
Project no. 540-CSI-201
Name: Construct OEF/OIF/PRRTP Villas for Resident Rehab/Treatment Program
Submission: 90% Submission
Date: 6 April 2011

INSTRUCTIONS FOR PREPARATON OF SECTION 09 06 00-SCHEDULE FOR FINISHES

REFER TO ATTACHED:

COLOR MATERIAL LEGEND

AND

ROOM FINISH SCHEDULE

--- E N D---

ROOM FINISH SCHEDULE

ROOM NO	ROOM NAME	FINISHES									REMARKS
		FLOOR	BASE	WALLS				CLG	CSWK TOP	CSWK FACE	
				NORTH	EAST	SOUTH	WEST				
FIRST FLOOR											
C100	VESTIBULE	WLK 1	RB 1	P 2	P 2	P 2	P 2	P8	X	X	
C101	RECEPTION	WSF 2,3	RB 1	P1	P1	X	P4	AT1,P8	S1	PL1	
C102	WAITING	WSF 2,3	RB 1	X	P1	P1	P4	AT1	X	X	
C103	VESTIBULE	WLK 1	RB 1	P2	P2	P2	P2	P8	X	X	
C104	RESTROOM	PT 2	PT 1	CT1/PT1	CT1/PT1	CT1/PT1	CT1/PT1	P8	X	X	CT1: 6" ACCENT STRIP AT 60" AFF
C105	RESTROOM	PT 2	PT 1	CT1/PT1	CT1/PT1	CT1/PT1	CT1/PT1	P8	X	X	CT1: 6" ACCENT STRIP AT 60" AFF
C106	HOUSE KEEPING	EPY 1	RB 1	RV1/P1	RV1/P1	RV1/P1	RV1/P1	AT1	X	X	RV1 TO 42" AFF
C107	TRASH RECYCLE	EPY 1	RB 1	RV1/P1	RV1/P1	RV1/P1	RV1/P1	AT1	X	X	RV1 TO 42" AFF
C110	RESOURCE CENTER	WSF 2	RB 1	P1	P1	P5	P1	AT1	PL2	PL1	
C112	STAFF LOUNGE	WSF 2	RB 1	P1	P1	P1	P1	AT1	X	X	
C113	MECHANICAL ROOM	EPY 1	RB 1	P1	P1	P1	P1	X	X	X	
C113A	BOILER ROOM	EPY 1	RB 1	P1	P1	P1	P1	X	X	X	
C114	SOILED LINEN	WSF 1	RB 1	RV1/P1	RV1/P1	RV1/P1	RV1/P1	AT1	X	X	RV1 TO 42" AFF
C115	CLEAN LINEN	WSF 1	RB 1	RV1/P1	RV1/P1	RV1/P1	RV1/P1	AT1	X	X	RV1 TO 42" AFF
C116	OCCUPATIONAL THERAPY	WSF 2	RB 1	P1	P4	P1	P1	AT1	S1	PL1	
C117	STORAGE	WSF 1	RB 1	P1	P1	P1	P1	AT1	X	X	
C118	TELECOM ROOM	EPY 2	RB 1	P1	P1	P1	P1	X	X	X	
C119	ELECTRICAL ROOM	EPY 1	RB 1	P1	P1	P1	P1	X	X	X	
C120	PATIENT LNG REC THER	WSF 2,3	RB 1	P1	P4	P1	P1	AT1	S1	PL1	
C121	STORAGE	WSF 1	RB 1	P1	P1	P1	P1	AT1	X	X	
C122	REC THERAPY OFFICE	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C123	DINING ROOM	WSF 2,3	RB 1	P1	P1	P3	P3	AT1,P8	S1	PL1	
C123A	KITCHEN	EPY 3	EPY 3	P1	RV1	RV1	P1	P8	S1	PL1	
C124	GROUP ROOM	WSF 2,3	RB 1	P1	P1	P3	P3	AT1,P8	S1	PL1	
C125	GROUP ROOM	WSF 2,3	RB 1	P1	P1	X	P3	AT1,P8	X	X	WALL TALKER AT NORTH WALL

ROOM FINISH SCHEDULE

ROOM NO	ROOM NAME	FINISHES									REMARKS
		FLOOR	BASE	WALLS				CLG	CSWK TOP	CSWK FACE	
				NORTH	EAST	SOUTH	WEST				
C126	GROUP ROOM	WSF 2,3	RB 1	X	P1	X	P3	AT1,P8	S1	PL1	
C127	PHYSICAL THERAPY	RF 1	RB 1	P1,5	P1	P1	P1	AT1	X	X	
C127A	TOILET/SHOWER	PT 2	PT 1	CT1/PT1	CT1/PT1	CT1/PT1	CT1/PT1	P8	S1	PL1	CT1: 6" ACCENT STRIP AT 60" AFF CT2: WALL TILE AT SHOWER STALLS
C127B	TOILET/SHOWER	PT 2	PT 1	CT1/PT1	CT1/PT1	CT1/PT1	CT1/PT1	P8	S1	PL1	CT1: 6" ACCENT STRIP AT 60" AFF CT2: WALL TILE AT SHOWER STALLS
C128	STORAGE	WSF 1	RB 1	P1	P1	P1	P1	AT1	X	X	
C129	MACHINE ROOM	EPY 1	RB 1	P1	P1	P1	P1	X	X	X	
C130	CLOTH STORAGE	WSF 1	RB 1	P1	P1	P1	P1	AT1	X	X	
C131	PHARMACIST OFFICE	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C132	MEDS ROOM	WSF 2	RB 1	P1	P1	P1	P1	P8	S1	X	
C133	NURSE MANAGER	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C134	PSYCH TECH OFFICE	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C135	PSYCH OFFICE	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C136	ELEC CLOSET	EPY 1	RB 1	P1	P1	P1	P1	X	X	X	
C137	EXAM / PHYSICIAN ASST	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C138	PSYCH OFFICE	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C139	PSYCH OFFICE	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C140	TOILET	PT 2	PT 1	CT1/PT1	CT1/PT1	CT1/PT1	CT1/PT1	P8	X	X	CT1: 6" ACCENT STRIP AT 60" AFF
C141	CONSULT	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C142	CONSULT	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C143	CORRIDOR	WSF 2	RB 1	P1	P1	P1	P1	AT1	X	X	
C143A	CLOSET	WSF 2	RB 1	P1	P1	P1	P1	P8	X	X	
C144	CORRIDOR	WSF 2	RB 1	P4	X	P4	P4	AT1	X	X	
C145	CORRIDOR	WSF 2	RB 1	P1/RV1	P1	P1/RV1	X	AT1	X	X	
C146	CORRIDOR	WSF 2,3	RB 1	X	P1/RV1	X	P1/RV1	AT1,P8	X	X	P4 AT EAST & WEST ALCOVE WALL, RV1 TO 36" AFF

ROOM FINISH SCHEDULE

ROOM NO	ROOM NAME	FINISHES									REMARKS
		FLOOR	BASE	WALLS				CLG	CSWK TOP	CSWK FACE	
				NORTH	EAST	SOUTH	WEST				
C147	CORRIDOR	WSF 2	RB 1	P1/RV1	P1/RV1	P1	P1/RV1	AT1,P8	X	X	P4 AT EAST & WEST ALCOVE WALL, RV1 TO 36" AFF
C148	CORRIDOR	WSF 2,3	RB 1	X	P1/RV1	P1/RV1	P1/RV1	AT1,P8	X	X	P4 AT EAST & WEST ALCOVE WALL, RV1 TO 36" AFF
C149	VESTIBULE	WLK 1	RB 1	P2	P2	P2	P2	AT1	X	X	
CS01	STAIR 1	RST 1	RB 1	P3	P3	P3	P3	X	X	X	
CS02	STAIR 2	RST 1	RB 1	P3	P3	P3	P3	X	X	X	
	ELEVATOR CAB	TT 1									
SECOND FLOOR											
C201	PROGRAM MANAGER	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C202	STORAGE	WSF 2	RB 1	P1	P1	P1	P1	X	X	X	
C203	PROGRAM MANAGER	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C204	PROGRAM MANAGER	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C205	CLINICAL COORDINATOR	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C206	EXPOSURE THERAPY RM	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C207	CLOSET	WSF 2	RB 1	P1	P1	P1	P1	X	X	X	
C208	CHAPLAIN INTERN	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C209	CHAPLAIN OFFICE	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C210	SOCIAL WORKER	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C211	RESTROOM	PT 2	PT 1	CT1/PT1	CT1/PT1	CT1/PT1	CT1/PT1	P8	X	X	CT1: 6" ACCENT STRIP AT 60" AFF
C212	SOCIAL WORKER	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C213	SOCIAL WORKER	WSF 2	RB 1	P3	P3	P3	P3	AT1	X	X	
C214	CORRIDOR	WSF 2	RB 1	P1	P1	P1	P1	AT1	X	X	
C215	ALCOVE	WSF 2	RB 1	P1	P1	P1	P1	P8	X	X	
CS01	STAIR 1	RST 1	RB 1	P3	P3	P3	P3	P8	X	X	
CS02	STAIR 2	RST 1	RB 1	P3	P3	P3	P3	P8	X	X	

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies steel studs wall systems, shaft 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, 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 spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. 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 shaft wall assembly
4. 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)

A123-09.....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products

A653/A653M-09.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire

C11-09.....Terminology Relating to Gypsum and Related Building Materials and Systems

C635-07.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

C636-08.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C645-08.....Non-Structural Steel Framing Members

C754-08.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C841-03(R2008).....Installation of Interior Lathing and Furring

C954-07.....Steel 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

C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

E580-08.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

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 G-60 minimum, per ASTM 123.

2.2 STEEL STUDS AND RUNNERS (TRACK)

A. ASTM C645, modified for thickness specified and sizes as shown.
   1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
   2. Runners same thickness as studs.

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.

E. Shaft Wall Framing:
   1. Conform to rated wall construction.
   2. C-H Studs.
   3. E Studs.
   4. J Runners.
   5. Steel Jamb-Strut.

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. "Z" Furring Channels:
   1. Not less than 0.45 mm (0.0179-inch)-thick bare metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
   2. Web furring depth to suit thickness of insulation with slotted perforations.

D. 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 610 mm (24 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 when extended to underside of structure overhead.

D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.

E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated.

F. 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.

G. 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.

H. 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).

I. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.

J. 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 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 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.

C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:
   1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
   2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
   3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
   4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
   5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
   6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

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 SHAFT WALL SYSTEM

A. Conform to UL Design No. U438 for two-hour fire rating.

B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 600 mm (24 inches) on center.

C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.

D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.

E. Suitably frame all openings to maintain structural support for wall:
   1. Provide necessary liner fillers and shims to conform to label frame requirements.
   2. Frame openings cut within a liner panel with E studs around perimeter.
   3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

F. Elevator Shafts:
   1. Frame elevator door frames with 0.87 mm (0.0341-inch) thick J strut or J stud jambs having 75 mm (three-inch) long legs on the shaft side.
   2. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
   3. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

3.6 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 400 mm (16-inch) centers for metal lath anchorage.
   2. Space framing at 600 mm (24-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. 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.

F. 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 over head 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. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

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. Section 06 10 00, ROUGH CARPENTRY.

B. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

C. Sound deadening board: Section 07 21 13, THERMAL INSULATION.

D. 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. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "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 sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
3. Typical shaft wall assembly.
4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:

1. Cornerbead.
2. Edge trim.

3. Control joints.

E. Test Results:

1. Fire rating test, each fire rating required for each assembly.

2. Sound rating test.

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):

C11-08.....Terminology Relating to Gypsum and Related Building Materials and Systems

C475-02.....Joint Compound and Joint Tape for Finishing Gypsum Board

C840-08.....Application and Finishing of Gypsum Board

C919-08.....Sealants in Acoustical Applications

C954-07.....Steel 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

C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1047-05.....Accessories for Gypsum Wallboard and Gypsum Veneer Base

C1177-06.....Glass Mat Gypsum Substrate for Use as Sheathing

C1658-06.....Glass Mat Gypsum Panels

C1396-06.....Gypsum Board

E84-08.....Surface Burning Characteristics of Building Materials

C. Underwriters Laboratories Inc. (UL):

Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):

Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.

B. Coreboard or Shaft Wall Liner Panels.

1. ASTM C1396, Type X.
2. ASTM C1658: Glass Mat Gypsum Panels,
3. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.

C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.

D. Gypsum cores shall contain a minimum of 95 percent post industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.

B. ASTM C1177, Type X.

2.3 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.

2.4 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

A. 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 on following partitions and furring:
   1. Two sides of partitions:
      a. Fire rated partitions.
      b. Smoke partitions.
      c. Sound rated partitions.
      d. Full height partitions shown (FHP).
      e. Corridor partitions.
   2. One side of partitions or furring:
      a. Inside of exterior wall furring or stud construction.
      b. Room side of room without suspended ceilings.
      c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
   3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

B. In locations other than those specified, extend gypsum board from floor to heights as follows:
   1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
   2. At ceiling of suspended gypsum board ceilings.
   3. At existing ceilings.

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 C1658 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.
   2. For two-ply assembles:
      a. Use perpendicular application.

b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

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. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
8. Installing Two Layer Assembly Over Sound Deadening Board:
   a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.
   b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
9. 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. Acoustical or Sound Rated Partitions, 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.
   3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

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 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.

B. Use screws of sufficient length to secure sheathing to framing.

C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.

D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.

E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.4 CAVITY SHAFT WALL

A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.

B. Conform to UL Design No. U438. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.

C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
   1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
   2. Stagger joints top and bottom in adjacent panels.

D. Gypsum Board:
   1. Two hour wall:
      a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
      b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
      c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
   2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.
   3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.

E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

3.5 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 5 finish for al finished areas open to public view.

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 non decorated smoke barrier and 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 non decorated surfaces.

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 non decorated surface to provide smoke tight construction and fire protection equivalent to the fire rated construction.

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SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies ceramic and porcelain tile, and marble thresholds, crack isolation membranes, tile backer board.

1.2 RELATED WORK

A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.

B. Color, texture and pattern of field tile and trim shapes, size of field tile and trim shapes and color of grout: See Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES

C. Metal and resilient edge strips at joints with new resilient flooring, – Section 09 65 19, RESILIENT TILE FLOORING AND PLANK FLOORING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. Base tile, each type, each color, each size.

2. Porcelain tile, each type, color, patterns and size.

3. Wall (or wainscot) tile, each color, size and pattern.

4. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.

C. Product Data:

1. Ceramic and porcelain tile, marked to show each type, size, and shape required.

2. Dry-set Portland cement mortar and grout.

3. Reinforcing tape, crack isolation membranes.

4. Leveling compound.

5. Latex-Portland cement mortar and grout.

6. Commercial Portland cement grout.

7. Organic adhesive.

8. Fasteners.

D. Certification:

1. Master grade, ANSI A137.1.

2. Manufacturer's certificates indicating that the following materials comply with specification requirements:

a. Commercial Portland cement grout.

b. Dry-set Portland cement mortar and grout.

c. Reinforcing tape, crack isolation membrane.

d. Latex-Portland cement mortar and grout.

e. Leveling compound.

f. Organic adhesive.

g. Factory mounted tile suitability for application in wet area specified under 2.1, A, 3 with list of successful in-service performance locations.

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. American National Standards Institute (ANSI):

A10.20-05.....Safety Requirements for Ceramic Tile, Terrazzo, and Marble Works

A108.1A-05.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar

A108.1B-05.....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar

A108.1C-05.....Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

A108.4-05.....Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives

A108.5-05.....Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar

A108.10-05.....Installation of Grout in Tilework

A118.1-05.....Dry-Set Portland Cement Mortar

A118.4-05.....Latex-Portland Cement Mortar

A118.6-05.....Standard Cement Grouts for Tile Installation

A118.9-05.....Cementitious Backer Units

A136.1-05.....Organic Adhesives for Installation of Ceramic Tile

A137.1-88.....Ceramic Tile

C. American Society For Testing And Materials (ASTM):

C627-93(R2007).....Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester

C954-07.....Steel 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

C1027-99(R2004).....Determining “Visible Abrasion Resistance on Glazed Ceramic Tile”

C1028-07.....Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method

D. Tile Council of America, Inc. (TCA):

2007.....Handbook for Ceramic Tile Installation

PART 2 - PRODUCTS

2.1 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 C 1027.

b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms

c. Class IV, 6000 revolutions for remaining areas.

3. Slip Resistant Tile for Floors:

a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:

1) Not less than 0.7 (wet condition) for bathing areas.

2) Not less than 0.8 on ramps for wet and dry conditions.

3) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.

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 package show the same range in colors as those taken from other packages and match approved samples.

B. Glazed Wall Tile: Cushion edges, glazing, see 09 60 00 Schedule for Finishes.

C. Glass Wall Feature Tile: See 09 06 00 Schedule for Finishes.

D. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method shall be made of approximately 50% feldspar; the remaining 50% shall be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5% or less and a breaking strength of between 390 to 400 pounds. See 09 06 00 Schedule for Finishes.

E. Trim Shapes:

1. Conform to applicable requirements of adjoining floor and wall tile.

2. Use trim shapes sizes conforming to size of adjoining field wall tile.

3. Internal and External Corners:

a. Square internal and external corner joints are not acceptable.

b. External corners including edges: Use bullnose shapes.

c. Internal corners: Use cove shapes.

d. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.

e. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.

f. For unglazed ceramic mosaic and glazed wall tile installed in Portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.

g. For unglazed ceramic mosaic and glazed wall tile installed in dry-set Portland cement mortar, latex-Portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.

4. ASTM C1002 for steel framing less than 0.0329 inch thick.

2.2 GLASS MAT WATER RESISTANT GYPSUM BACKER BOARD

A. Confirm to ASTM C1178/C1178M, Optional System for Cementious Backer Units.

2.3 SETTING MATERIALS OR BOND COATS

A. Conform to TCA Handbook for Ceramic Tile Installation.

B. Portland Cement Mortar: ANSI A108.1.

C. 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.

D. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.

E. Organic Adhesives: ANSI A136.1, Type 1.

2.4 GROUTING MATERIALS

A. Coloring Pigments:

1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.

2. Add coloring pigments to grout by the manufacturer.

3. Job colored grout is not acceptable.

4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.

B. Commercial Portland Cement Grout: ANSI A118.6 color as specified.

C. Dry-Set Grout: ANSI A118.6 color as specified.

D. Latex-Portland Cement Grout: ANSI A118.6 color as specified.

1. Unsanded grout mixture for joints 3.2 mm (1/8 inch) and narrower.

2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.

2.5 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. Shall have minimum following 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 - 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 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled 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.

2.6 MARBLE

A. Soundness Classification in accordance with MIA Design Manual III Groups.

B. Thresholds:

1. Group A, Minimum abrasive hardness (Ha) of 10.0 per ASTM C241.

2. Honed finish on exposed faces.

3. Thickness and contour as shown.

4. Fabricate from one piece without holes, cracks, or open seams; full depth of wall or frame opening by full width of wall or frame opening; 19 mm (3/4-inch) minimum thickness and 6 mm (1/4-inch) minimum thickness at beveled edge.

5. Set not more than 13 mm (1/2-inch) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2. On existing floor slabs provide 13 mm (1/2-inch) above ceramic tile surface with bevel edge joint top flush with adjacent floor.

6. One piece full width of door opening. Notch thresholds to match profile of door jambs.

2.7 METAL DIVIDER STRIPS

A. Terrazzo type divider strips.

B. Heavy top type strip with 5 mm (3/16 inch) wide top and 38 mm (1-1/2 inch) long leg.

C. Embedded leg perforated and deformed for keying to mortar.

D. Aluminum, brushed finish.

2.8 WATER

A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.9 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 not acceptable.

C. Selected Product needs to be resistant to all types of cleaning agents used by the VA. Contact COTR for material safety data sheets and methods of cleaning to ensure product compatibility.

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 installation and not less than three 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 fourth day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:

1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.

2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.

B. Variation in Plane of Wall Surfaces:

1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.

2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials 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.

b. Float finish.

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. Mortar Bed for Slopes to Drains:

1. Slope compound to drain where drains are shown.

2. Install mortar bed in depressed slab sloped to drains not less than 1 in 200 (1/16 inch per foot).

3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.

4. Screed for slope to drain and float finish.

5. Cure mortar bed for not less than seven days. Do not use curing compounds or coatings.

D. Additional preparation of concrete floors for tile set with epoxy, or furan-resin shall be in accordance with the manufacturer's printed instructions.

E. 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.

3. Apply metal lath to framing in accordance with ANSI A108.1:

a. Use fasteners specified in paragraph "Fasteners." Use washers when lath opening is larger than screw head.

b. Apply scratch and leveling coats to metal lath in accordance with ANSI A108.1.C.

c. Total thickness of scratch and leveling coats:

1) Apply 9 mm to 16 mm (3/8 inch to 5/8 inch) thick over solid backing.

2) 16 mm to 19 mm (5/8 to 3/4 inch) thick on metal lath over studs.

3) Where wainscots are required to finish flush with wall surface above, adjust thickness required for flush finish.

d. Apply scratch and leveling coats more than 19 mm (3/4 inch) thick in two coats.

3.4 GLASS MAT WATER-RESISTANT GYPSUM BACKER BOARD

A. Install in accordance with manufacturer’s instructions. TCA Systems W245-01.

B. Treat joints with tape and latex-Portland cement mortar or adhesive.

3.5 MARBLE

A. Secure thresholds in position with minimum of two stainless steel dowels.

B. Set in dry-set Portland cement mortar or latex-Portland cement mortar bond coat.

C. Set threshold to finish 12mm (1/2 inch) above ceramic tile floor unless shown otherwise, with bevel edge joint top flush with adjacent floor similar to TCA detail TR611-02.

3.6 CERAMIC TILE - GENERAL

A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.

B. Comply with TCA Installation Guidelines:

C. Installing Mortar Beds for Floors:

1. Install mortar bed to not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.

2. Install floor mortar bed reinforcing centered in mortar fill.
3. Screed finish to level plane or slope to drains where shown, float finish.
4. For thin set systems cure mortar bed not less than seven days. Do not use curing compounds or coatings.
5. For tile set with Portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.

D. 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.
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 shall 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. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
   b. In areas where floor drains occur, slope to drains where shown.
   c. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.

d. In areas where cracks occur and where tile bridges new and existing floors, install crack suppression membrane.

9. Walls:

a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.

b. Finish reveals of openings with tile, except where other finish materials are shown or specified.

c. 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.

b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.

c. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.

3.7 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR

A. Mortar Mixes for Floor, Wall And Base Tile: ANSI A108.1.except specified otherwise.

B. Installing Wall and Base Tile: ANSI A108.1, except specified otherwise.

C. Installing Floor Tile: ANSI A108.1, except as specified otherwise. Slope mortar beds to floor drains a minimum of 1 in 100 (1/8 inch per foot).

3.8 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDONG MORTAR

A. Due to the denseness of porcelain tile use latex Portland cement bonding mortar that meets the requirements of ANSI A118.4.Bonding mortars shall be mixed in accordance with manufacturer’s instructions. Improper liquid ratios and dwell time before placement of bonding mortar and tile shall affect bond.

3.9 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR

A. Installation of Tile: ANSI A108.5, except as specified otherwise.

B. Slope tile work to drains not less than 1 in 100 (1/8 inch per foot).

3.10 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH ORGANIC ADHESIVE

A. Installation of Tile: ANSI A108.4.

3.11 GROUTING

A. Grout Type and Location:

1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile Portland cement grout, latex-Portland cement grout, dry-set grout, or commercial Portland cement grout.

B. Workmanship:

1. Install and cure grout in accordance with the applicable standard.

2. Portland Cement grout: ANSI A108.10.

3. Epoxy Grout: ANSI A108.6.

4. Furan and Commercial Portland Cement Grout: ANSI A108.8 and in accordance with the manufacturer's printed instructions.

5. Dry-set grout: ANSI A108.5.

3.12 MOVEMENT JOINTS

A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.

B. TCA details EJ 171-02.

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, not less than 6 mm (1/4 inch) deep.

3.13 CLEANING

A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.

B. Methods and materials used shall not damage or impair appearance of tile surfaces.

C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.

D. Clean tile grouted with epoxy, furan and commercial Portland cement grout as recommended by the manufacturer of the grout.

3.14 PROTECTION

A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.

B. Where traffic occurs over tile floor, 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.

3.15 TESTING FINISH FLOOR

A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

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SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1- GENERAL

1.1 DESCRIPTION

A. Metal ceiling suspension system for acoustical ceilings.

B. Acoustical units.

C. Adhesive application.

1.2 RELATED WORK

A. Door and Frames: Section 08 31 13, ACCESS DOORS AND FRAMES.

B. Color, pattern, and location of each type of acoustical unit: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Framing: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

1.3 SUBMITTAL

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. Acoustical units, each type, with label indicating conformance to specification requirements.
2. Colored markers for units providing access.

C. Manufacturer's Literature and Data:

1. Ceiling suspension system, each type, showing complete details of.
2. Acoustical units, each type

D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

1.4 DEFINITIONS

A. Standard definitions as defined in ASTM C634.

B. Terminology as defined in ASTM E1264.

1.5 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 Society for Testing and Materials (ASTM):

A641/A641M-03.....Zinc-coated (Galvanized) Carbon Steel Wire

A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process

C423-07.....Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

C634-02 (E2007).....Standard Terminology Relating to Environmental Acoustics
C635-04.....Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
C636-06.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-07.....Surface Burning Characteristics of Building Materials
E119-07.....Fire Tests of Building Construction and Materials
E413-04.....Classification for Rating Sound Insulation.
E580-06.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-(R2005).....Classification for Acoustical Ceiling Products

PART 2- PRODUCTS

2.1 METAL SUSPENSION SYSTEM

A. ASTM C635, heavy-duty system, except as otherwise specified.
   1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
      a. Galvanized cold-rolled steel, bonderized.
      b. Extruded aluminum.
      c. Fire resistant plastic (glass fiber) having a flame spread and smoke developed rating of not more than 25 when tested in accordance with ASTM E84.
   2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
   3. Use aluminum suspension in kitchens and aluminum or fire resistant plastic in toilets adjacent to shower areas, hydrotherapy, and swimming pools.

B. Exposed grid suspension system for support of lay-in panels:
   1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (5/16 inch) panel bearing surface.
   2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
   3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

2.2 PERIMETER SEAL

A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.

B. Thickness as required to fill voids between back of wall molding and finish wall.

C. Not less than 9 mm (3/8 inch) wide strip.

2.3 WIRE

A. ASTM A641.

B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).

C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

2.4 ANCHORS AND INSERTS

A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.

B. Hanger Inserts:

1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
2. Nailing type option for wood forms:
   a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
   b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.
3. Flush ceiling insert type:
   a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
   b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
   c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

C. Clips:

1. Galvanized steel.
2. Designed to clamp to steel beam or bar joists, or secure framing member together.
3. Designed to rigidly secure framing members together.
4. Designed to sustain twice the loads imposed by hangers or items supported.

D. Tile Splines: ASTM C635.

2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.

B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

2.6 ADHESIVE

A. ASTM D1779, having flame spread index of 25 or less when tested in accordance with ASTM E84.

B. Developing minimum strength of 7 kg/m^2 (one psi) of contact surface 48 hours after installation in temperature of 21 °C (70 °F).

2.7 ACOUSTICAL UNITS

A. General Acoustic Panels:

1. ASTM E1264, weighing 3.6 kg/m^2 (3/4 psf) minimum for mineral fiber panels or tile.
2. Class A Flame Spread: ASTM 84
3. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
4. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
5. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces.
6. Lay-in panels: Sizes as shown, with square edges.

B. Scrubbable Panels:

1. ASTM E1264, Type XX (high density ceramic-like composition with scrubbable finish), Pattern G, Fire Class A.
2. ASTM E84, Flame Spread Index 25 or less, smoke Developed Index 50 or less.
3. Minimum CAC (Ceiling Attenuation Class): 40
4. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces.
6. Lay-in panels: Sizes as shown, with square edges.

2.8 ACCESS IDENTIFICATION

A. Markers:

1. Use colored markers with pressure sensitive adhesive on one side.

2. Make colored markers of paper of plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.

B. Use markers of the same diameter throughout building.

C. Color Code: Use 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
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 EXECUTION

3.1 CEILING TREATMENT

A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.

B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.

C. 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.

D. 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.

3.2 CEILING SUSPENSION SYSTEM INSTALLATION

A. General:

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m^2 (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.

5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Anchorage to Structure:

2. Steel and Wood:
   a. When steel/ wood framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
      (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
      (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/ wood trusses spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
   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.

C. Direct Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. 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.

D. Indirect Hung Suspension System:

1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels

not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) or center so as to insure that specified requirements are not exceeded.

3. Support main runners by specially designed clips attached to carrying channels.

3.3 ACOUSTICAL UNIT INSTALLATION

A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.

B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.

1. Install tile to lay level and in full contact with exposed grid.
2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.

C. Markers:

1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
2. Attach colored markers to exposed grid on opposite sides of the units providing access.
3. Attach marker on exposed ceiling surface of upward access acoustical unit.

3.4 CLEAN-UP AND COMPLETION

A. Replace damaged, discolored, dirty, cracked and broken acoustical units.

B. Leave finished work free from defects.

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SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the installation of vinyl or rubber base and resilient stair treads and risers with sheet rubber flooring on landings.

1.2 RELATED WORK

A. Color and texture: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Flooring: Section 09 65 16, RESILIENT SHEET FLOORING.

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.
2. Base and stair material manufacturer's recommendations for adhesives.
3. Application and installation instructions.

C. Samples:

1. Base: 150 mm (6 inches) long, each type and color.
2. Resilient Stair Treads and Risers: 150 mm (6 inches) long.
3. Sheet Rubber Flooring: 300 mm (12 inches) square.
4. Adhesive: Literature indicating each type.

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 will be rejected.

1.5 STORAGE

A. Store materials in weather tight and dry storage facility.

B. Protect material from damage by handling and construction operations before, during, and after installation.

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

F1344-04.....Rubber Floor Tile

F1859-04.....Rubber Sheet Floor Covering without Backing

F1861-02.....Resilient Wall Base

C. Federal Specifications (Fed. Spec.):
RR-T-650E.....Treads, Metallic and Non-Metallic, Nonskid

PART 2 - PRODUCTS

2.1 GENERAL

A. Use only products by the same manufacturer and from the same production run.

2.2 RESILIENT BASE

A. ASTM F1861, 3 mm (1/8 inch) thick, 100 mm (6 inches) high, Type TP Rubber, Thermoplastics, Group 2-layered with molded top. Style B-cove.

B. Use only one type of base throughout.

2.3 RESILIENT TREADS AND RISERS

A. Fed. Spec. RR-T-650, Composition A, Type 2, 5 mm (3/16 inch) thick on wear surface tapering to 3 mm (1/8 inch) thick at riser end.

B. Nosing shape to conform to sub-tread nosing shape.

2.4 SHEET RUBBER FLOORING

A. ASTM F1344, F1859 or F1860, 900 mm (36 inches) wide, 3 mm (1/8 inch) thick, smooth face, material by the same manufacturer as the rubber treads, color and pattern to match treads.

B. Use for stair landings.

C. Use rubber flooring made with a minimum of 90% consumer rubber where possible.

2.5 PRIMER (FOR CONCRETE FLOORS)

A. As recommended by the adhesive and tile manufacturer.

2.6 LEVELING COMPOUND (FOR CONCRETE FLOORS)

A. Provide products with latex or polyvinyl acetate resins in the mix.

2.7 ADHESIVES

A. Use products recommended by the material manufacturer for the conditions of use.

B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

2.8 CLEANING

A. Selected Product needs to be resistant to all types of cleaning agents used by the VA. Contact Contracting Officer’s Technical Representative (COTR) for material safety data sheets and methods of cleaning to ensure product compatibility.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.

B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.

C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

3.2 INSTALLATION REQUIREMENTS

A. The respective manufacturer's instructions for application and installation will be considered for use when approved by COTR.

B. Submit proposed installation deviation from this specification to the COTR indicating the differences in the method of installation.

C. The COTR reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

3.3 PREPARATION

A. Examine surfaces on which material is to be installed.

B. Fill cracks, pits, and dents with leveling compound.

C. Level to 3 mm (1/8 inch) maximum variations.

D. Do not use adhesive for leveling or filling.

E. Grind, sand, or cut away protrusions; grind high spots.

F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.

G. Substrate area dry and cured. Perform manufacturer’s recommended bond and moisture test.

H. Preparation of existing installation:

1. Remove existing base and stair treads including adhesive.
2. Do not use solvents to remove adhesives.
3. Prepare substrate as specified.

3.4 BASE INSTALLATION

A. Location:

1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.

B. Application:
   1. Apply adhesive uniformly with no bare spots.
   2. Set base with joints aligned and butted to touch for entire height.
   3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
      a. Short pieces to save material will not be permitted.
      b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.

C. Form corners and end stops as follows:
   1. Score back of outside corner.
   2. Score face of inside corner and notch cove.

D. Roll base for complete adhesion.

3.5 STAIR TREAD AND RISER INSTALLATION

A. Prepare surfaces to receive the treads and risers in accordance with applicable portions of paragraph, preparation.

B. Layout of Treads and Risers.
   1. No joints will be accepted in treads or risers.
   2. Set full treads on intermediate and floor landings.

C. Application:
   1. Apply adhesive uniformly with no bare spots.
   2. Roll and pound treads to assure adhesion.

3.6 SHEET RUBBER INSTALLATION.

A. Prepare surfaces to receive sheet rubber in accordance with applicable portions of paragraph, preparation.

B. Layout of Sheet Rubber:
   1. Use minimum number of joints compatible with material direction and symmetrical joint location.
   2. Where sheet rubber intersect vertical stair members, other sheets, stair treads, and other resilient materials at the floor landings, material shall touch for the entire length within 5 mils (0.005 inch).
   3. Install sheet rubber on floors and intermediate landings where resilient stair treads are installed; center joint with other flooring material under doors.

C. Application:
   1. Apply adhesive uniformly with no bare spots.
   2. Roll sheet rubber to assure adhesion.

3.7 CLEANING AND PROTECTION

A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.

B. Keep traffic off resilient material for at least 72 hours after installation.

C. Clean and polish materials in the following order:

1. After two weeks, scrub resilient base, sheet rubber, tread, and riser materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.

2. Do not polish tread, riser, and sheet rubber materials.

D. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the COTR.

E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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SECTION 09 65 16
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the installation of homogenous sheet flooring and integral cove base.

B. Grades of resilient sheet vinyl floor covering without backing having vinyl plastic wearlayer with backing.

C. Installation of sheet flooring including following:

1. Heat welded seams.
2. Integral cove base: Installed at intersection of floor and vertical surfaces.

1.2 RELATED WORK

A. Section 03 30 00, CAST-IN-PLACE CONCRETE for concrete floors.

b. Section 03 54 13, CEMENTITIOUS SELF-LEVELING FLOOR UNDERLAYMENT.

C. Section 09 06 00, SCHEDULE FOR FINISHES for color, pattern and texture.

D. Section 09 65 13, RESILIENT BASE AND ACCESSORIES, for resilient base over base of lockers, equipment and casework.

1.3 QUALITY CONTROL-QUALIFICATIONS:

A. The Contracting Officer’s Technical Representative (COTR) shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:

1. Heat welded seaming is manufacturer's prescribed method of installation.
2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
3. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.

B. The sheet vinyl floor coverings shall meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
2. Smoke Density: Less than 450 per ASTM E662.

C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

1.4 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, submit following:

B. Manufacturer's Literature and Data:

1. Description of resilient material and accessories to be provided.
2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
3. Application and installation instructions.

C. Samples:

1. Sheet material, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding.
2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.
3. 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.
4. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
5. Edge strips: 150 mm (6 inches) long each type.
6. Adhesive, underlayment and primer: Pint container, each type.

1.5 PROJECT CONDITIONS

A. Maintain temperature of floor materials and room, where work occurs, above 18 ° C (65 °F) and below 38 °C (100 °F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13 °C (55 °F).

B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.

C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.

B. Deliver sheet flooring full width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.

C. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before, during and after installation. Store sheet flooring on end with ambient temperatures maintained as recommended by manufacturer.

D. Store sheet flooring on end.

E. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

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 Society For Testing Materials (ASTM):

E648-06.....Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source.

E662-06.....Specific Optical Density of Smoke Generated by Solid Materials.

E1907-06.....Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings

F710-05.....Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.

F1303-04.....Sheet Vinyl Floor Covering with Backing.

F1913-04.....Sheet Vinyl Flooring without Backing

C. Resilient Floor Covering Institute (RFCI):

Recommended Work Practices for Removal of Resilient Floor Coverings.

1.8 SCHEDULING

A. Interior finish work such as plastering, drywall finishing, concrete, terrazzo, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.9 CERTIFICATIONS AND APPROVALS:

A. Manufacturer's certification of material and substrate compliance with specification.

B. Manufacturer's approval of installer.

C. Contractor's certificate of compliance with Quality Assurance requirements.

D. Manufacturer’s approval of the use of the following floor maintenance products for future maintenance by VA facility staff: Husky 705 Extra Heavy-Duty Stripper, Husky 1022 Ultra Versatile Premium Floor Stripper, 3M HB Quat Disinfectant Cleaner and Floor Science Spray Buff.

1.10 WARRANTY:

A. Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include two (2) years.

PART 2 - PRODUCTS

2.1 SHEET VINYL FLOOR COVERINGS

A. Sheet Vinyl Floor Coverings: Smooth face, minimum thickness nominal 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F1913 and material requirements specified in ASTM F1303, Type II, Grade 1, backing classification not applicable. Foam backed sheet flooring is not acceptable.

B. Size: Provide maximum size sheet vinyl material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable - 1200 mm (48 inches).

C. Each color and pattern of sheet flooring shall be of same production run.

2.2 WELDING ROD:

A. Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

2.3 APPLICATION MATERIALS AND ACCESSORIES

A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.

B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use.

C. Base Accessories:

1. Fillet Strip: 19 mm (3/4 inch) radius fillet strip compatible with resilient sheet material.
2. Cap Strip: Extruded flanged zero edge vinyl reducer strip approximately 25 mm (one inch) exposed height with 13 mm (1/2 inch) flange.

2.4 SHEET FLOORING

A. ASTM F1303, Type II, Grade 1, except for backing requirements. Foam backed sheet flooring is not acceptable.

B. Minimum nominal thickness 2 mm (0.08 inch); 1800 mm (6 ft) minimum width.

C. Critical Radiant Flux: 0.45 watts per sq.cm or more, Class I, per ASTM E648.

D. Smoke density: less than 450 per ASTM E662.

E. Color and pattern of sheet flooring of the same production run.

2.5 ADHESIVES

A. Water resistant type recommended by the sheet flooring manufacturer for the conditions of use.

2.6 BASE CAP STRIP AND COVE STRIP

A. Extruded vinyl compatible with the sheet flooring.

B. Cap strip "J" shape with feathered edge flange approximately 25 mm (one inch) wide; top designed to receive sheet flooring with 13 mm (1/2 inch) flange lapping top of flooring

C. Cove strip 70 mm (2-3/4 inch) radius.

2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)

A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

2.8 PRIMER (FOR CONCRETE SUBFLOORS)

A. As recommended by the adhesive or sheet flooring manufacturer.

2.9 EDGE STRIPS

A. Extruded aluminum, mill finish, mechanically cleaned.

B. 28 mm (1-l/8 inch) wide, 6 mm (1/4 inch) thick, bevel one edge to 3 mm (1/8 inch) thick.

C. Drill and counter sink edge strips for flat head screws. Space holes near ends and approximately 225 mm (9 inches) on center in between.

2.10 SEALANT

A. As specified in Section 07 92 00, JOINT SEALANTS.

B. Compatible with sheet flooring.

2.11 CLEANING

A. Selected Product needs to be resistant to all types of cleaning agents used by the VA. Contact COTR for material safety data sheets and methods of cleaning to ensure product compatibility.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of sheet flooring above 36 °C (65 °F), for 48 hours before installation.

B. Maintain temperature of rooms where sheet flooring work occurs above 36 °C (65 °F), for 48 hours, before installation and during installation.

C. After installation, maintain temperature at or above 36 °C (65 °F.)

D. Building is permanently enclosed.

E. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.

1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.

2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.

B. Broom or vacuum clean substrates to be covered by sheet vinyl floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.

C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer’s directions.

D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.

E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.

1. Do not use adhesive for filling or leveling purposes.

2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.

3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.

F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.

G. Concrete Subfloor Testing:
Determine adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MPR.

3.3 INSTALLATION OF FLOORING

A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.

B. Maintain uniformity of sheet vinyl floor covering direction and avoid cross seams.

C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 150 mm (6 inches) away from parallel joints in flooring substrates.

D. Match edges of resilient floor coverings for color shading and pattern at seams.

E. Where resilient sheet flooring abuts other flooring material floors shall finish level.

F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.

G. Inform the COTR of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.

H. Install sheet in full coverage adhesives.

1. Air pockets or loose edges will not be accepted.
2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.

I. Keep joints to a minimum; avoid small filler pieces or strips.

J. Follow manufacturer’s recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.

K. Follow manufacturer’s recommendations regarding pattern match, if applicable.

L. Installation of Edge Strips:

1. Locate edge strips under center lines of doors unless otherwise indicated.
2. Set aluminum strips in adhesive, anchor with lead anchors and stainless steel Phillips screws.

M. Integral Cove Base Installation:
   1. Set preformed fillet strip to receive base.
   2. Install the base with adhesive, terminate expose edge with the cap strip.
   3. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.
   4. Solvent weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
   5. Unless otherwise specified or shown where sheet flooring is scheduled, provide integral base at intersection of floor and vertical surfaces. Provide sheet flooring and base scheduled for room on floors and walls under and behind areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

3.4 INSTALLATION OF INTEGRAL COVED BASE

A. Set preformed cove to receive base. Install base material with adhesive and terminate exposed edge with cap strip. Integral base shall be 150 mm (6 inches)high.

B. Internal and external corners shall be formed to geometric shape generated by cove at either square or radius corners.

3.5 WELDING

A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.

B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.

C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.

D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

3.6 CLEANING

A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.

B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.

C. Clean and polish materials per flooring manufacturer’s written recommendations.

D. Vacuum floor thoroughly.

E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer’s recommendations.

F. Upon completion, COTR shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.

G. Perform initial maintenance according to flooring manufacturer’s written recommendations.

3.7 PROTECTION:

A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.

B. Keep traffic off sheet flooring for 24 hours after installation.

C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the COTR.

D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

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SECTION 09 65 19
RESILIENT TILE AND PLANK FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the installation of vinyl composition tile flooring, vinyl plank flooring, and accessories.

1.2 RELATED WORK

A. Color and pattern and location in room finish schedule: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Tiling: Section 09 30 13, CERAMIC/PORCELAIN TILING.

B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

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.
2. Resilient material manufacturers recommendations for adhesives, underlayment, primers and polish.
3. Application and installation instructions.

C. Samples:

1. Tile: 300 mm by 300 mm (12 inches by 12 inches) for each type, pattern and color.
2. Plank: (1) full size plank.
3. Edge Strips: 150 mm (6 inches) long, each type.
4. Feature Strips: 150 mm (6 inches) long.

D. Shop Drawings:

1. Locations as shown on Sheet AS602.
2. Edge strip locations showing types and detail cross sections.

E. Test Reports:

1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory.

2. Tested per ASTM F510.

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 will be rejected.

1.5 STORAGE

A. Store materials in weathertight and dry storage facility.

B. Protect from damage from handling, water, and temperature.

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):

D4078-02.....Water Emulsion Floor Finish

E648-08.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source

E662-06.....Specific Optical Density of Smoke Generated by Solid Materials

E1155-96 (R2008).....Determining Floor Flatness and Floor Levelness Numbers

F510-93 (R 2004).....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method

F710-08.....Preparing Concrete Floors to Receive Resilient Flooring

F1066-04.....Vinyl Composition Floor Tile

F1344-04.....Rubber Floor Tile

F1700-04.....Solid Vinyl Floor Tile

C. Resilient Floor Covering Institute (RFCI):

IP #2.....Installation Practice for Vinyl Composition Tile (VCT)

D. Federal Specifications (Fed. Spec.):

SS-T-312.....Tile Floor: Asphalt, Rubber, Vinyl and Vinyl Composition

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish product type, materials of the same production run and meeting following criteria.

B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.

C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E 648.

D. Smoke density: Less than 450 per ASTM E662.

2.2 RUBBER TILE (MOLDED FROM RECYCLED RUBBER TIRES)

A. Size: 24 inch square, 1/4 inch thick.

B. Color and pattern uniformly distributed throughout thickness.

C. ASTM D2047 Slip Resistance.

D. ASTM D2240 Hardness: 78-Shore A.

E. ASTM F970 static Load Limit: 0.0% Residual indentation at 250-lb load.

F. ASTM D3389 Abrasion: .0 Gram/1000 Cycle.

2.3 ADHESIVES

A. Comply with applicable regulations regarding toxic and hazardous materials Green Seal (GS-36) for commercial adhesive.

B. Use low-VOC adhesive during installation. Water based is preferred over solvent based adhesives.

2.4 PRIMER (FOR CONCRETE SUBFLOORS)

A. As recommended by the adhesive and tile manufacturer.

2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)

A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

B. Determine the type of underlayment selected for use by the condition to be corrected.

2.6 POLISH AND CLEANERS

A. Cleaners RFCI CL-1.

B. Polish: ASTM D4078.

C. Selected Product needs to be resistant to all types of cleaning agents used by the VA. Contact the Contracting Officer’s Technical Representative (COTR) for material safety data sheets and methods of cleaning to ensure product compatibility.

2.8 EDGE STRIPS

A. 28 mm (1-1/8 inch) wide unless shown otherwise.

B. Bevel from maximum thickness to minimum thickness for flush joint unless shown otherwise.

C. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.

B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.

C. 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 PREPARATION

A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:

FF30/FL20

B. Correct conditions which will impair proper installation.

C. Fill cracks, joints and other irregularities in concrete with leveling compound:

1. Do not use adhesive for filling or leveling purposes.

2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.

3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.

D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.

E. Concrete Subfloor Testing: Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.

F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.

G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.

H. Preparation of existing installation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives.

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 will not be accepted.

C. Tile Layout:

1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.

2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.

3. Place tile pattern in the same direction; do not alternate tiles.

D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.

E. Application:

1. Apply adhesive uniformly with no bare spots.

a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner intersection.

b. More than 5 percent of the joints not touching will not be accepted.

2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.

3. The COTR may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.

F. Installation of Edge Strips:

1. Locate edge strips under center line of doors unless otherwise shown.

2. Set resilient edge strips in adhesive.

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 and polish materials in the following order:

1. For the first two weeks sweep and damp mopped only.

2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.

3. Apply polish to vinyl composition tile floors in accordance with the polish manufacturer's instructions. (DO NOT apply polish to vinyl plank flooring.)

D. When construction traffic occurs over tile or plank, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by COTR. 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 COTR.

E. When protective materials are removed and immediately prior to acceptance, replace any damage tile, re-clean resilient materials, lightly re-apply polish and buff floors.

3.5 LOCATION

A. Unless otherwise specified or shown, install tile and plank flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

B. Extend tile flooring for room into adjacent closets and alcoves.

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SECTION 09 66 16
TERRAZZO FLOOR TILE

PART 1 - GENERAL

1.1 DESCRIPTION

Resilient marble and granite terrazzo tile for installation over elevator cab floors.

1.2 RELATED WORK

A. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

B. Concrete floors: Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. Wood Subfloors: Section 06 10 00, ROUGH CARPENTRY.

D. Color and Pattern: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 MANUFACTURER'S QUALIFICATIONS

A. Approval by the Contracting Officer’s Technical Representative (COTR) is required of products or service, or proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:

1. Manufacturer regularly and presently manufactures terrazzo tile as one of his principal products.
2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items. Approval will not be given, however, where experience record is one of unsatisfactory performance.
3. Manufacturer's product submitted has been in satisfactory and efficient operation on three installations similar or equivalent to this project for three years. Submit list of installations. List shall include name of project, and owner and location of project.

1.4 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

B. Flooring Manufacturer's Literature and Data: Printed installation instructions for conditions indicated.

C. Certificates: Indicating materials conform to specified requirements. Indicating flooring manufacturer's approval of underlayment, adhesive and cleaners.

D. Samples: Terrazzo Tile (each color and pattern to be used) adhesive.

1.5 DELIVERY

Deliver materials to job in manufacturer's original unopened containers, free of damage, with manufacturer's brand name marked thereon.

1.6 STORAGE

Store materials in a protected area. Storage area shall be kept dry and temperature of storage area shall not be lower than 10 degrees C (50 degrees F) or higher than 32 degrees C (90 degrees F).

1.7 PROJECT CONDITIONS

Tiles shall not be installed until all other work that could cause damage to the finish flooring has been completed. Maintain a temperature of not less than 21 degrees C (70 degrees F) in spaces where tile is to be installed for at least 48 hours before, during and after the laying of tiles. Bring tile into such spaces and allow it to condition at not less than 21 degrees C (70 degrees F) at least 48 hours before installing. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter.

1.8 WARRANTY

Terrazzo tile is subject to terms of "Warranty of Construction" FAR clause 52.246-21, except that warranty period is two years in lieu of one year.

1.9 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 basic designation only.

B. American Society for Testing And Materials (ASTM):

C109-05.....Compressive Strength of Hydraulic Cement Mortars

D2047-04.....Static Coefficient of Friction of Polish Coated Floor Surfaces as Measured by the James Machine

E648-06.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

C. Military Specifications (Mil. Spec.):

MIL-D-3134J.....Deck Covering Materials

PART 2 - PRODUCTS

2.1 TERRAZZO TILE

Terrazzo tile shall consist of marble and granite chips embedded in a flexible thermo-set resin matrix. Tiles shall be 5 mm (3/16-inch) thick, and nominal 300 x 300 mm (12 inches by 12 inches) square. Tiles shall have a smooth polished finish with uniform color distribution of chips. Marble chips and granite chips shall be manufacturer's standard gradation. Tile shall have the following properties.

TABLE I - MARBLE TERRAZZO TILE		
PROPERTY	TEST METHOD	VALUE
Compressive strength Water absorption Hardness	ASTM 109 Mil.Spec.MIL-D-3134 Barcol Hardness	51.7 Mpa (7500 psi) minimum 0.4 percent maximum Resin 78, Marble at 25 degrees C 55-85
Coefficient of Friction Flame Resistance	ASTM D2047 ASTM E645	0.70 0.45 watt/cm square minimum

TABLE II GRANITE TERRAZZO TILE		
Compressive strength Water absorption Hardness at 25 degrees C	ASTM C109 Mil. Spec. MIL-D-3134 Barcol Hardness	35.8 MPa (5,200 psi) 0.4 percent maximum Resin 70, 55-85
Coefficient of Friction Flame Resistance minimum//	ASTM D2047 ASTM E648	0.70 0.45 watt/cm square

2.2 ADHESIVE

Shall be terrazzo tile manufacturer's standard product or a product recommended by the terrazzo tile manufacturer.

2.3 WALL BASE

See Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

2.4 METAL EDGE STRIPS

Extruded aluminum, butt-type, approximately 38 mm (1-1/2 inches) wide with thickness to set top surface flush with top of tile and with bevel at exposed edge. Edge strips shall have countersunk holes, near each end and spaced at no more than 300 mm (8 inches) on center for securement.

PART 3 - EXECUTION

3.1 GENERAL

Provide flooring and base on floor surfaces and walls where shown on the drawings. Provide resilient base as scheduled for room or space, for freestanding columns, pilasters, furred spaces convectors and where shown. Resilient base required over metal base of casework is specified in other sections. Except as necessary to install new tile, keep all traffic off new tile for at least 24 hours after installation.

3.2 SUBSTRATE PREPARATION

A. Elevator Cab Floor: Fill holes and cracks with approved mortar. Floor shall be free of curing compounds, grease, dirt, loose particles and other foreign matter that would prevent adhesion. Remove projecting irregularities by chipping or grinding smooth. Fill depressions and level uneven surfaces with underlayment. Then rinse subfloors and allow them to dry thoroughly before applying adhesive.

3.3 INSTALLATION

A. Install tile in accordance with the tile manufacturer's approved installation instructions, except as specified herein. Lay design symmetrical about center lines of rooms. Joints shall be tight, and inconspicuous as possible, and in true alignment. Cut tile to fit snugly at pipes and other fixed vertical surfaces. Seal joints at pipes with adhesive. Remove spots or smears of adhesive immediately. Make entire surfaces of finished tile floors smooth, straight, and free from bleeding adhesive, buckles, waves or projecting tile edges upon completion. Remove any surface film on back of base due to mold release agents as recommended by base manufacturer, before applying base adhesive.
   1. Where metal edge strip is required, install as detailed.
   2. Bleeding of adhesive on finished floors is considered cause for rejection. Replace damaged tiles.

B. Metal Edge Strips: Secure strips with No. 10 aluminum alloy, counter sunk flathead machine screws with expansion sleeves. Provide metal edge strips, in one piece, at any exposed edges of tile.

C. Transition Strips: Apply transition strips with adhesive continuous, between ceramic tile finish floors and resilient tile finish floors as shown.

D. Premolded Base: Install as specified in Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

3.4 CLEANING

Upon completion of the installation, and after adhesive has cured, clean flooring in accordance with manufacturer's recommendations.

3.5 PROTECTION

From the time of laying until acceptance, protect the flooring from damage. Replace damaged, loose, broken, or curled tiles.

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SECTION 09 67 23.60
RESINOUS FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies Resinous (Resinous urethane and epoxy mortars) flooring with integral cove:
   1. High Abuse Climatic Troweled and Sealed Urethane Mortar Flooring System.
   2. High Abuse Non-Climatic Troweled and Sealed Epoxy Mortar Flooring System.

1.2 RELATED WORK

A. Concrete and Moisture Vapor Barrier: Section 03 30 00, CAST-IN-PLACE CONCRETE.
B. Color and location of each type of resinous (urethane and epoxy mortar) flooring: As indicated in 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.
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. 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.

F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
   1. Patterns.
   2. Edge configurations.

G. Certifications and Approvals:
   1. Manufacturer's certification of material and substrate compliance with specification.
   2. Manufacturer's approval of installer.
   3. Contractor's certificate of compliance with Quality Assurance requirements.
   4. Manufacturer’s approval of the use of the following floor maintenance products for future maintenance by VA facility staff: Husky 705 Extra Heavy-Duty Stripper, Husky 1022 Ultra Versatile Premium Floor Stripper, 3M HB Quat Disinfectant Cleaner and Floor Science Spray Buff.

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 five (5) 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 five (5) 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 the Contracting Officer’s Technical Representative (COTR).
      a. If applicable include 48 inch (1200 mm)length of integral cove base.
   3. Approved mockups not damaged during the testing may become part of the completed work if undisturbed at time of Substantial Completion.
   4. Sign off from COTR on texture for slip resistance and clean ability must be complete before installation of flooring system.

E. Pre-Installation Conference:
   1. Convene a meeting not less than thirty days prior to starting work.
   2. Attendance:
      a. Contractor
      b. COTR
      c. Manufacturer and Installer's Representative
   3. Review the following:
      a. Environmental requirements
         i) Air and surface temperature
         ii) Relative humidity
         iii) Ventilation
         iv) Dust and contaminates
      b. Protection of surfaces not scheduled to be coated
      c. Inspect and discus 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 (urethane and epoxy mortar/cement) 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

F. Manufacturer’s Field Services: Manufacturer’s representative shall provide technical assistance and guidance for surface preparation and application of resinous flooring systems.

G. 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.

H. Volatile Organic Compound content to remain under 100g/liter.

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.

F. 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.

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.

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.

D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

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 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.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION FOR ‘EPY 3’ (HEAVY DUTY CLIMATIC)

A. System Descriptions:

1. Monolithic, multi-component urethane chemistry resinous flooring system, Screed and steel finish trowel applied, chemical and thermal cycling and shock resistant. Self priming multiple component polyurethane mortar, quartz aggregates for texture and associated high performance urethane sealer. Temperature resistance to 250 degrees F (121 degrees C) where required.

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 mortar base product, build up layers of broadcast systems will not be accepted. Verify compatibility with substrate. Use manufacturer’s standard components, compatible with each other and as follows:

2. Mortar (Body coat):

a. Resin: Urethane.

b. Formulation Description: Multiple component high solids.

c. Application Method: Screed and steel finish trowel.

d. Thickness of coat(s): Verify thickness as systems vary by manufacturer; Nominal thickness 3/16 to 1/4 inch (4.76 to 6.35mm).

e. Number of Coats: One.

f. Aggregates: Quartz texture broadcast into wet urethane mortar base.

3. Seal Coat(s):

a. Resin: Urethane.

b. Formulation Description: Pigmented Two-component, high solids.

c. Application Method: Squeegee and Back roll.

d. Number of Coats: One.

E. Physical Properties:

1. Physical Properties of flooring system when tested as follows:

Property	Test	Value
Compressive Strength	ASTM C579	5,000 psi after 7 days
Tensile Strength	ASTM C307	1,000 psi
Flexural Strength	ASTM C580	2,400 psi
Water Absorption	ASTM C413	0.056%
Coefficient of friction dry/slip index wet	ASTM D2047	>1.0 dry >1.0 wet
Impact Resistance	ASTM D4226	> 160 in. lbs
Abrasion Resistance	ASTM D4060	0.05 gm maximum weight loss
Thermal Coefficient of Linear Expansion	ASTM C531	1.1×10^{-5} mm/ ^{o}C mm
Hardness Shore D	ASTM D2240	80 to 84
Bond Strength	ASTM D7234	>300 psi 100% concrete failure
Chemical Resistance of the following:	ASTM D1308	No Effect
Acetic acid	5 percent	
Ammonium hydroxide	10 percent	
Citric Acid	50 percent	
Fatty acid Motor Oil, 20W		
Hydrochloric acid	10 percent	
Salt water		
Sodium Hydroxide	10 percent	
Sulfuric acid	10 percent	
Trisodium phosphate	5 percent	
Urine		
Feces		
Hydrogen peroxide	28 percent	
Distilled Water		
Sodium Hypochloride	5.28 percent	

2.2 SYSTEM DESCRIPTION FOR 'EPY 1'

A. System Description:

1. Resinous liquid applied waterproof coating includes: concrete epoxy primers, 2 component, high solids urethane resin water proof membrane, and associated 100% solids general service epoxy sealer. Optional: Texture dependent on use of areas.

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 compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:
   1. Primer (Bond Coat): Verify inclusion of primer in manufacturer's system.
      a. Resin: Epoxy.
      b. Formulation Description: 100 percent solids.
      c. Application Method: Apply by Squeegee and back roller.
         1) Coats: Single (one).
   2. Membrane:
      a. Resin: Urethane.
      b. Formulation Description: high solids elastomeric.
      c. Application Method: Verify specific requirements as systems vary by manufacturer.
         1) notched squeegee application:
            a) Thickness of coats: Nominal 30mil.
            b) Number of coats: One.
   3. Topcoat:
      a. Resin: Epoxy.
      b. Formulation Description: 100 percent solids.
      c. Application Method: Squeegee and finish roll.
         1) Thickness of coats: 3-5 mils.
         2) Number of Coats: one (aggressive texture profiles may require more than one coat)
      d. Aggregates: For added slip resistance dependant on area.
         1) Dry silica sand (30 Mesh or larger).
         2) Aluminum oxide.

D. System Characteristics:
   1. Color and Pattern: Refer to 09 0 600 Schedule for Finishes.
   2. Integral cove base: 1 inch (25.4 mm) radius epoxy mortar cove keyed into concrete substrate and or resinous flooring mortar system. No fillers integral cove base must be troweled in place with specified resinous mortar base.
   3. Overall System Thickness: Nominal 30 to 40 mil.
   4. Finish: texture 2 finish.
   5. Temperature Range: Systems vary by manufacturer; approximate range from a minimum of 45 to 150 degrees F.

2.3 SYSTEM DESCRIPTION FOR 'EPY 2'

A. SYSTEM DESCRIPTION:

1. Resinous liquid applied nuisance static floor coating: concrete epoxy primers, 3 components, 100% solids general service bisphenol (F) epoxy conductive topcoat sealer.

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 compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:

1. Primer (Bond Coat): Verify inclusion of primer in manufacturer's system.

a. Resin: Epoxy.

b. Formulation Description: 100 percent solids.

c. Application Method: Apply by Squeegee and back roller.

1) Coats: Single (one).

2. Topcoat:

a. Resin: Bisphenol (F) Epoxy.

b. Formulation Description: 100 percent solids with conductive elements.

c. Application Method: Squeegee and finish roll.

1) Thickness of coats: 3-5 mils.

2) Number of Coats: one.

D. System Characteristics:

1. Color and Pattern: Refer to 09 0 600 Schedule for Finishes

3. Overall System Thickness: Nominal 5 to 10 mil.

4. Finish: standard finish.

5. Temperature Range: Systems vary by manufacturer; approximate range from a minimum of 45 to 150 degrees F.

2.4 SYSTEM DESCRIPTION FOR SHOWER FLOOR

A. System Description:

1. Resinous liquid applied waterproof coating includes: 2 component, high solids urethane resin water proof membrane. Optional: Texture dependent on use of areas.

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 compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:
   1. Membrane:
   a. Resin: Urethane.
   b. Formulation Description: high solids elastomeric.
   c. Application Method: Verify specific requirements as systems vary by manufacturer.
      1) notched squeegee application:
         a) Thickness of coats: Nominal 30mil.
         b) Number of coats: One.

D. System Characteristics:
   1. Color and Pattern: Refer to 09 0 600 Schedule for Finishes.
   2. Integral cove base: 1 inch (25.4 mm) radius epoxy mortar cove keyed into concrete substrate and or resinous flooring mortar system. No fillers integral cove base must be troweled in place with specified resinous mortar base.
   3. Overall System Thickness: Nominal 30 to 40 mil.
   4. Finish: texture 2 finish.
   5. Temperature Range: Systems vary by manufacturer; approximate range from a minimum of 45 to 150 degrees

2.5 SUPPLEMENTAL MATERIALS

A. Textured Top Coat: Type recommended or produced by manufacturer of seamless resinous flooring system for desired final finish.

B. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service or joint conditioned indicated.

C. Patching and Fill Material: Resinous product of or approved by resinous coating manufacturer for application indicated. Resinous based materials only. Cementitious or single component product are not acceptable.

2.6 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: NAAMM 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 (urethane and epoxy mortar) flooring system with integral base is to be installed with the COTR.

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.

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 COTR for the seamless resinous (urethane and epoxy mortar) flooring system with integral cove base.

B. Substrate 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. Prepare concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and re circulates the shot by vacuum pickup.

b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent. Use of acids is never allowed.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates are dry.
   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of **5 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** in 24 hours.
   b. MVT threshold for monolithic resinous Non - climatic flooring shall not exceed 5 lbs/1000 square feet (0.0001437 kPa) in a 24 hour period. MVT threshold for monolithic resinous climatic flooring shall not exceed 6 lbs/1000 square feet (0.0002155 kPa) over a 24 hour period.
   c. 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.
   d. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75-80 percent.
   e. Provide a written report showing test placement and results.
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.

F. 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. A. **General**: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, 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.

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. Trowel mortar base: Mix mortar material according to manufacturer's recommended procedures. Climatic and non-climatic resinous flooring systems may vary slightly on mode of application. Application should be based upon the following: Uniformly spread mortar over substrate using a specially designed screed box adjusted to manufacturer's recommended height. Metal trowel (hand or power) single mortar coat in thickness indicated for flooring system, grout to fill substrate voids. When cured, sand to remove trowel marks and roughness

E. Topcoat: Mix and roller apply the topcoat(s) with strict adherence to manufacturer's installation procedures and coverage rates.

3.6 Tolerance

A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring and base.

B. From radius of cove: Maximum of 1/8 inch (3.18 mm) plus or 1/16-inch (1.59 mm) minus.

3.7 CURING, PROTECTION AND CLEANING

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 91 00
PAINTING

PART 1-GENERAL

1.1 DESCRIPTION

A. Section specifies field painting.

B. Section specifies prime coats which may be applied in shop under other sections.

C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 12 - FURNISHINGS, 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 sections.

B. Contractor option: Prefinished flush doors with transparent finishes: Section 08 14 00, WOOD DOORS.

C. Color and location in room finish schedule: 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:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

C. 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 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).

3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.
4. Attach labels to panel stating the following:
   a. Federal Specification Number or manufacturers name and product number of paints used.
   b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   c. Product type and color.
   d. Name of project.
5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

D. Sample of identity markers if used.

E. Manufacturers' Certificates indicating compliance with specified requirements:
1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. Intumescent clear coating or fire retardant paint.
5. Plastic floor coating.

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. If paint or other coating, state coat types; prime, body or finish.

C. Maintain space for storage, and handling of painting materials and equipment in a 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 18 and 30 degrees C (65 and 85 degrees F).

1.5 MOCK-UP PANEL

A. Before starting application of water paint mixtures, apply paint as specified to an area, not to exceed 9 m^2 (100 ft^2), selected by Contracting Officer's Technical Representative (COTR).

B. Finish and texture approved by the COTR will be used as a standard of quality for remainder of work.

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 basic designation only.

B. American Conference of Governmental Industrial Hygienists (ACGIH):

ACGIH TLV-BKLT-2008.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC-2008......Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. American National Standards Institute (ANSI):

A13.1-07.....Scheme for the Identification of Piping Systems

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

D260-86.....Boiled Linseed Oil

E. Commercial Item Description (CID):

A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)

A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)

F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

No. 1-07.....Aluminum Paint (AP)

No. 4-07.....Interior/ Exterior Latex Block Filler

No. 5-07.....Exterior Alkyd Wood Primer

No. 7-07.....Exterior Oil Wood Primer

No. 8-07.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)

No. 9-07.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)

No. 10-07.....Exterior Latex, Flat (AE)

No. 11-07.....Exterior Latex, Semi-Gloss (AE)

No. 18-07.....Organic Zinc Rich Primer

No. 22-07.....Aluminum Paint, High Heat (up to 590% - 1100F) (HR)
No. 26-07.....Cementitious Galvanized Metal Primer
No. 27-07.....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)
No. 31-07.....Polyurethane, Moisture Cured, Clear Gloss (PV)
No. 36-07.....Knot Sealer
No. 43-07.....Interior Satin Latex, MPI Gloss Level 4
No. 44-07.....Interior Low Sheen Latex, MPI Gloss Level 2
No. 45-07.....Interior Primer Sealer
No. 46-07.....Interior Enamel Undercoat
No. 47-07.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
No. 48-07.....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
No. 49-07.....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)
No. 50-07.....Interior Latex Primer Sealer
No. 51-07.....Interior Alkyd, Eggshell, MPI Gloss Level 3
No. 52-07.....Interior Latex, MPI Gloss Level 3 (LE)
No. 53-07.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
No. 54-07.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
No. 59-07.....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss (FE)
No. 60-07.....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
No. 66-07.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved) (FC)
No. 67-07.....Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR)
No. 68-07.....Interior/ Exterior Latex Porch & Floor Paint, Gloss
No. 71-07.....Polyurethane, Moisture Cured, Clear, Flat (PV)
No. 74-07.....Interior Alkyd Varnish, Semi-Gloss
No. 77-07.....Epoxy Cold Cured, Gloss (EC)
No. 79-07.....Marine Alkyd Metal Primer
No. 90-07.....Interior Wood Stain, Semi-Transparent (WS)
No. 91-07.....Wood Filler Paste
No. 94-07.....Exterior Alkyd, Semi-Gloss (EO)
No. 95-07.....Fast Drying Metal Primer
No. 98-07.....High Build Epoxy Coating
No. 101-07.....Epoxy Anti-Corrosive Metal Primer
No. 108-07.....High Build Epoxy Coating, Low Gloss (EC)
No. 114-07.....Interior Latex, Gloss (LE) and (LG)

No. 119-07.....Exterior Latex, High Gloss (acrylic) (AE)
No. 135-07.....Non-Cementitious Galvanized Primer
No. 138-07.....Interior High Performance Latex, MPI Gloss Level 2 (LF)
No. 139-07.....Interior High Performance Latex, MPI Gloss Level 3 (LL)
No. 140-07.....Interior High Performance Latex, MPI Gloss Level 4
No. 141-07.....Interior High Performance Latex (SG) MPI Gloss Level 5

H. Steel Structures Painting Council (SSPC):
SSPC SP 1-04 (R2004)....Solvent Cleaning
SSPC SP 2-04 (R2004)....Hand Tool Cleaning
SSPC SP 3-04 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood Sealer: MPI 31 (gloss) or MPI 71 (flat) thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.

B. Plastic Tape:
1. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
2. Pressure sensitive adhesive back.
3. Widths as shown.

C. Identity markers options:
1. Pressure sensitive vinyl markers.
2. Snap-on coil plastic markers.

D. Exterior Alkyd Enamel (EO): MPI 9.

E. Exterior Latex, Flat (AE): MPI 10.

F. Exterior Latex, Semi-Gloss (AE): MPI 11.

G. Organic Zinc rich Coating (HR): MPI 22.

H. High Heat Resistant Coating (HR): MPI 22.

I. Cementitious Galvanized Metal Primer: MPI 26.

J. Interior Satin Latex: MPI 43.

K. Interior Low Sheen Latex: MPI 44.

L. Interior Primer Sealer: MPI 45.

M. Interior Enamel Undercoat: MPI 47.

N. Interior Latex Primer Sealer: MPI 50.

O. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.

P. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.

Q. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.

R. Interior Wood Stain, Semi-Transparent (WS): MPI 90.
S. Fast Drying Metal Primer, Zinc-Chromate metal Primer: MPI 95.
T. Interior latex, Gloss (LE) and (LG): MPI 114.
U. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.
V. Waterborne Galvanized Primer: MPI 134.
W. Non-Cementitious Galvanized Primer: MPI 135.
X. Bituminous Paint: MPI 35.
Y. Aluminum Paint: MPI 1.

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.

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
   1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
   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 Projectial structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
   3. Asbestos: Materials shall not contain asbestos.
   4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
   5. Human Carcinogens: Materials shall 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, where possible.
   7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

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 days 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 COTR and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
   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 soon 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 where allowed by manufacturer's printed instructions.
      b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
   6. Varnishing:
      a. Apply in clean areas and in still air.
      b. Before varnishing vacuum and dust area.
      c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 SURFACE PREPARATION

A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.

B. General:
   1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.

2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting 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.

C. Wood:
1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

D. 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). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.

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. This includes 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.

E. 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.

F. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
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. Remove loose mortar in masonry work.
4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING. Do not fill weep holes. Finish to match adjacent surfaces.
5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three days and brush thoroughly free of crystals.
6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

G. Gypsum Plaster and 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 [Plaster, Gypsum (Spackling Compound) 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.

3.3 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 component and two 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.

3.4 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 coats; prime, body, and finish. When two 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 the COTR.
E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
F. Apply by brush, roller or spray, except as otherwise specified.
G. Do not spray paint in existing occupied spaces unless approved by the COTR, except in spaces sealed from existing occupied spaces.
   1. Apply painting materials specifically required by manufacturer to be applied by spraying.

2. In areas, 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 WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

H. 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.

3.5 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 rebates for stop and face glazing of wood, and for face glazing of steel.

E. Wood:

1. Use same kind of primer specified for exposed face surface.
   a. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
   b. Transparent finishes as specified under Transparent Finishes on Wood.
2. Apply two coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one coat of primer MPI 7 (Exterior Oil Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
5. Apply MPI 67 (Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR) to wood for fire retardant finish.

F. 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), 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 (EO)).
   6. Asphalt coated metal: MPI 1 (Aluminum Paint (AP)).
   7. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).

G. Gypsum Board:
   1. Surfaces scheduled to have MPI 11 (Exterior Latex, Semi-Gloss (AE)), MPI 53 (Interior Latex, Flat), MPI 54 (Interior Latex, and Semi-Gloss, MPI Gloss Level 5 (LE).
   2. Primer: MPI 50 (Interior Latex Primer Sealer).

3.6 EXTERIOR FINISHES

A. Apply the following finish coats:

B. Steel and Ferrous Metal:
   1. Two coats of MPI 9 (Exterior Alkyd Enamel (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).
   2. One coat of MPI 22 (High Heat Resistant Coating (HR)) on surfaces over 94 degrees K (200 degrees F) and on surfaces of engine exhaust pipes.

C. Machinery without factory finish except for primer: One coat MPI 94 (Exterior Alkyd, Semi-Gloss (EO)).

D. Concrete Masonry Units and Concrete:
   1. General:
      a. Where specified in Section 09 06 00, SCHEDULE FOR FINISHES or shown.
      b. Mix as specified in manufacturer's printed directions.
      c. Do not mix more paint at one time than can be used within four hours after mixing. Discard paint that has started to set.
      d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
      e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.
   2. Use two coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious (CEP)), unless specified otherwise.

3.7 INTERIOR FINISHES

A. Apply following finish coats:

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. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
      b. Two coats of MPI 51 (Interior Alkyd, Eggshell (AK)).
      c. One coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
      e. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
      f. Asphalt Coated Metal: One coat MPI 1 (Aluminum Paint (AP)).
      g. Ferrous Metal over 94 degrees K (200 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One coat MPI 22 (High Heat Resistant Coating (HR).

C. Gypsum Board:
   1. One coat of MPI 45 (Interior Primer Sealer), MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)).

D. Wood:
   1. Sanding:
      a. Use 220-grit sandpaper.
      b. Sand sealers and varnish between coats.
      c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
   2. Sealers:
      a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
      b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
      c. Sand as specified.
   3. Paint Finish:
      a. One coat of MPI 45 (Interior Primer Sealer), MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) (SG).

E. Miscellaneous:
   1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   2. MPI 1 (Aluminum Paint): Two coats of aluminum paint.

3.8 PAINT COLOR

A. Color and location 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.

3.9 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 under paragraph H, colors.

C. Paint various systems specified in 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. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.

H. Color:

1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES, to match surrounding surfaces.

2. Paint colors as indicated 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.
   f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:
   1. Exterior Locations:
      a. Apply two coats of MPI 9 (Exterior Alkyd Enamel (EO)) to the following ferrous metal items:
         Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
      b. Apply two coats of MPI 11 (Exterior Latex, Semi Gloss (AE)) to the following metal items:
         Galvanized and zinc-copper alloy metal.
      c. Apply one coat of MPI 22 (High Heat Resistant Coating (HR)), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
   2. Interior Locations:
      a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
         1) Metal under 94 degrees C (200 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 coats of MPI 9 (Exterior Alkyd Enamel (EO) 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 coats of MPI 1 (Aluminum Paint (AP)).

b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 11 (Exterior Latex Semi-Gloss (AE).

3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING

A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.

1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
3. Painting of ferrous metal and galvanized metal.
4. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:

a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.

b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.

2. Finished surfaces:

a. Hardware except ferrous metal.

b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.

c. Signs, fixtures, and other similar items integrally finished.

3. Concealed surfaces:
   a. Inside shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
   b. Inside walls or other spaces behind access doors or panels.
   c. Surfaces concealed behind permanently installed casework and equipment.
4. Moving and operating parts:
   a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
   b. Tracks for overhead or coiling doors, shutters, and grilles.
5. Labels:
   a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
   b. Identification plates, instruction plates, performance rating, and nomenclature.
6. Galvanized metal:
   a. Except where specifically specified to be painted.
7. Metal safety treads and nosings.
8. Gaskets.
9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.

3.11 IDENTITY PAINTING SCHEDULE

A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
   1. Legend may be identified using 2.1 G options or by 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 12 000 mm (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.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
   a. High Pressure - 414 kPa (60 psig) and above.
   b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
   c. Low Pressure - 103 kPa (14 psig) and below.
   d. 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 BBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	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		Yellow	Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret ____*
Medium Pressure Steam		Yellow	Black	M. P. Stm ____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low Pressure Steam		Yellow	Black	L.P. Stm _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Green	White	Fuel Oil-Grade __*
Boiler Water Sampling		Yellow	Black	Sample

Chemical Feed		Yellow	Black	Chem Feed
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	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		Yellow	Black	Acid Waste
Vent		Yellow	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	White	Auto Spr
Standpipe		Red	White	Stand
Sprinkler		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 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000, 15000, 25000, or as applicable.

8. See Sections for methods of identification, legends, and abbreviations of the following:
   a. 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 / Section 28 05 33, RACEWAYS AND BOXES 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 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
   4. Use semigloss 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 shown.
   2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
   3. Apply on four 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.

3.12 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 - - -

APPENDIX

Coordinate the following abbreviations used in Section 09 91 00, PAINTING, with other Sections, especially Section 09 06 00, SCHEDULE FOR FINISHES and other COATING SECTIONS listed. Use the same abbreviation and terms consistently.

Paint or coating	Abbreviation
Acrylic Emulsion	AE (MPI 10 – flat/MPI 11 – semigloss/MPI 119 - gloss)
Alkyd Flat	Ak (MPI 49)
Alkyd Gloss Enamel	G (MPI 48)
Alkyd Semigloss Enamel	SG (MPI 47)
Aluminum Paint	AP (MPI 1)
Cementitious Paint	CEP (TT-P-1411)
Exterior Latex	EL (MPI 10 / 11 / 119)??
Exterior Oil	EO (MPI 9 – gloss/MPI 8 – flat/MPI 94 – semigloss)
Epoxy Coating	EC (MPI 77 – walls, floors/MPI 108 – CMU, concrete)
Fire Retardant Paint	FR (MPI 67)
Fire Retardant Coating (Clear)	FC (MPI 66, intumescent type)
Floor Enamel	FE (MPI 27 – gloss/MPI 59 – eggshell)
Heat Resistant Paint	HR (MPI 22)
Latex Emulsion	LE (MPI 53, flat/MPI 52, eggshell/MPI 54, semigloss/MPI 114, gloss Level 6
Latex Flat	LF (MPI 138)
Latex Gloss	LG (MPI 114)
Latex Semigloss	SG (MPI 141)
Latex Low Luster	LL (MPI 139)
Plastic Floor Coating	PL
Polyurethane Varnish	PV (MPI 31 – gloss/MPI 71 - flat)
Rubber Paint	RF (CID-A-A-3120 - Paint for Swimming Pools (RF)).
Water Paint, Cement	WPC (CID-A-A-1555 - Water Paint, Powder).
Wood Stain	WS (MPI 90)

Verify abbreviations used in the following coating sections:

- - - E N D OF A P P E N D I X- - -

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior signage for room numbers, directional signs, code required signs, telephone identification signs and temporary interior signs.

B. This section also specifies exterior medical center identification signs, building identification signs.

C. Installation of Government furnished dedication plaque and VA seal.

1.2 RELATED WORK

A. Electrical: Related Electrical Specification Sections.

B. Lighted EXIT signs for egress purposes are specified under Division 26, ELECTRICAL.

C. Color Finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 MANUFACTURER'S QUALIFICATIONS

Sign manufacturer shall provide evidence that they regularly and presently manufacture signs similar to those specified in this section as one of their principal products.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Samples: Sign panels and frames, with letters and symbols, each type. Submit 2 sets. One set of samples will be retained by the Contracting Officer’s Technical Representative (COTR), other returned to Contractor.

1. Sign Panel, 200 mm x 250 mm (8 inches x 10 inches), with letters.
2. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches. Show anticipated range of color and texture.
3. Sample of typeface, arrow and symbols in a typical full size layout.

C. Manufacturer's Literature:

1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
2. Manufacturer’s printed specifications, anchorage details, installation and maintenance instructions.

D. Samples: Sign location plan, showing location, type and total number of signs required.

E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.

F. Full size layout patterns for dimensional letters.

1.5 DELIVERY AND STORAGE

A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.

B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.

C. Deliver signs only when the site and mounting services are ready for installation work to proceed.

D. Store products in dry condition inside enclosed facilities.

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):

B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and tubes.

C. Federal Specifications (Fed Spec):

MIL-PRF-8184F.....Plastic Sheet, Acrylic, Modified.

MIL-P-46144C.....Plastic Sheet, Polycarbonate

1.7 MINIMUM SIGN REQUIREMENTS

A. Permanent Rooms and Spaces:

1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.
2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
6. Mounting Location and Height: As shown. Mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.

B. Overhead Signs:
   1. Type Styles: As shown. Characters shall have a width-to-height ratio between 3:5 and 1:1. Characters shall have a stroke width-to-height ratio of between 1:5 and 1:10.
   2. Character Height: minimum 75 mm (3 in) high for overhead signs. As shown, for directional signs.
   3. Finish and Contrast: Same as for signs of permanent rooms and spaces.
   4. Mounting Location and Height: As shown.

1.8 COLORS AND FINISHES:

Section 09 06 00, SCHEDULE FOR FINSIHES.

PART 2 - PRODUCTS

2.1 GENERAL

A. Signs of type, size and design shown on the drawings and as specified.
B. Signs complete with lettering, framing and related components for a complete installation.
C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. COTR to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

2.2 PRODUCTS

A. Aluminum:
   1. Sheet and Plate: ASTM B209.
   2. Extrusions and Tubing: ASTM B221.
B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.
C. Polycarbonate: MIL-P-46144C; Type I, class 1.
D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.

E. Electrical Signs:

1. General: Furnish and install all lighting, electrical components, fixtures and lamps ready for use in accordance with the sign type drawings, details and specifications.
2. Refer to Electrical Specifications Section, Division 26, ELECTRICAL, to verify line voltages for sign locations that require electrical signs.
3. Quality Control: Installed electrical components and sign installations are to bear the label and certification of Underwriter's Laboratories, Inc., and are to comply with National Electrical Code as well as applicable federal, state and local codes for installation techniques, fabrication methods and general product safety.
4. Ballast and Lighting Fixtures: See Electrical Specifications.

2.3 SIGN STANDARDS

A. Typography:

1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps as indicated in Sign Message Schedule.
2. Arrow: See graphic standards in drawings.
3. Letter spacing: See graphic standards on drawings.
4. Letter spacing: See graphic standards on drawings.
5. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings is for layout purposes only; final text for signs is listed in Sign Message Schedule.

B. Project Colors and Finishes: See Section 09 06 00, SCHEDULE FOR FINISHES.

2.4 SIGN TYPES

A. General:

1. The interior sign system is comprised of sign type families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.

a. IN indicates a component construction based sign.

1. The exterior sign system shall be comprised of sign type families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
2. EI designation indicates exterior internally illuminated sign.

3. EN designation indicates exterior non-illuminated sign.

B. Interchangeable Component System:

1. Sign Type Families: 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16 and 17.
2. Interior sign system capable of being arranged in a variety of configurations with a minimum of attachments, devices and connectors.
   a. Interchangeable nature of the system shall allow for changes of graphic components of the installed sign, without changing sign in its entirety.
   b. Component Sign System is comprised of the following primary components:
      1) Rail Back utilizing horizontal rails, spaced to allow for uniform, modular sizing of sign types.
      2) Rail Insert mounted to back of Copy Panels to allow for attachment to Rail Back.
      3) Copy Panels, made of a variety of materials to allow for different graphic needs.
      4) End Caps which interlock to Rail Back to enclose and secure changeable Copy Panels.
      5) Joiners and Accent Joiners connect separate Rail Backs together.
      6) Top Accent Bars which provide decorative trim cap that encloses the top of sign or can connect the sign to a Type 03 Room Number Sign.
   c. Rail Back, Rail Insert and End Caps in anodized extruded aluminum to allow for tight tolerances and consistent quality of fit and finish.
   d. Signs in system shall be convertible in the field to allow for enlargement from one size to another in height and width through use of Joiners or Accent Joiners, which connect Rail Back panels together blindly, providing a butt joint between Copy Panels. Accent Joiners shall connect Rail Backs together with a visible 3 mm (1/8") horizontal rib, flush to the adjacent copy insert surfaces.
   e. Sign configurations shall vary in width from 225 mm (9 inches) to 2050 mm (80 inches), and have height dimensions of 50 mm (2 inches), 75 mm (3 inches), 150 mm (6 inches), 225 mm (9 inches) and 300 mm (12 inches). Height shall be increased beyond 300 mm (12 inches), by repeating height module in full or in part.

3. Rail Back functions as internal structural member of sign using 6063T5 extruded aluminum and anodized black.
   a. Shall accept an extruded aluminum or plastic insert on one sign or on both sides, depending upon sign type.
   b. Shall be convertible in field to allow for connection to other Rail Back panels, so that additive changes can be made to sign unit.
   c. Rail shall allow for a variety of mounting devices including wall mounting for screw-on applications, using pressure sensitive tape, freestanding mount, ceiling mount and other mounting devices as needed.
4. Rail Insert functions as a mounting device for Copy Panels on to the Rail Back. The Rail Insert mounts to the back of the Copy Panel with adhesive suitable for use with the particular copy insert material.
   a. Shall allow Copy Panels to slide or snap into the horizontal Rail Back for ease of changeability.
   b. Shall mount to the back of the Copy Panel with adhesive suitable for use with particular Copy Panel material.
5. Copy Panels shall accept various forms of copy and graphics, and attaches to the Rail Back with the Rail Insert. Copy Panels shall be either ABS plastic with integral color or an acrylic lacquer finish; photo polymer; or, acrylic.
   a. Interchangeable by sliding horizontally from either side of sign, and to other signs in system of equal or greater width or height.
   b. Cleanable without use of special chemicals or cleaning solutions.
   c. Copy Insert Materials.
      1) ABS Inserts - 2.3 mm (.090 inches) extruded ABS plastic core with .07 mm (.003 inches) acrylic cap bonded during extrusion/texturing process. Pressure bonded to extruded Rail Insert using adhesive. Background color is either integral or painted in acrylic lacquer. ABS inserts finished in a chromium industries #HM335RA texture pattern to prevent glare.
      2) Photo polymer Inserts - 3 mm (.125 inches) phenolic photo polymer with raised copy etched to 2.3 mm (.0937 inches), bonded to an ABS plastic or extruded aluminum insert with adhesive. Background color is painted in acrylic enamel.
      3) Changeable Paper/ Insert Holder - Extruded insert holder with integral Rail Insert for connection with structural back panel in 6063T5 aluminum with a black anodized finish. Inserts into

holder are paper with a clear 0.7 mm (.030 inches) textured cover. Background color is painted in acrylic lacquer.

4) Acrylic - 2 mm (.080 inches) non-glare acrylic. Pressure bonded to extruded Rail Insert using adhesive. Background color is painted in acrylic lacquer or acrylic enamel.
5) Extruded 6063T5 aluminum with a black anodized finish Insert Holder with integral Rail Insert for connection with Structural Back Panel to hold a 0.7 mm (.030 inches) textured polycarbonate insert and a Sliding Tile which mounts in the Inset Holder and slides horizontally.
6) End Caps - Extruded using 6063T5 aluminum with a black anodized. End Caps interlock with Rail Back with clips to form an integral unit, enclosing and securing the changeable Copy Panels, without requiring tools for assembly.
   a) Shall be interchangeable to either end of sign and to other signs in the system of equal height.
   b) Mechanical fasteners can be added to the End Caps that will secure it to Rail Back to make sign tamper resistant.
7) Joiners - Extruded using 6063T5 aluminum with a black anodized finish. Rail Joiners connect Rail Backs together blindly, providing a butt joint between Copy Inserts.
8) Accent Joiners - Extruded using 6063T5 aluminum with a mirror polished finish. Joiner shall connect Rail Backs together with a visible 3 mm (.125 inches) horizontal rib, flush to the adjacent Copy Panel surfaces.
9) Top Accent Rail - Extruded using 6063T5 aluminum with a mirror polished finish. Rail shall provide 3 mm (.125 inches) high decorative trim cap, which butts flush to adjacent Copy Panel and encloses top of Rail Back and Copy Panel.
10) Typography
   a) Vinyl First Surface Copy (non-tactile) - Applied Vinyl copy.
   b) Subsurface Copy Inserts - Textured 1 mm (.030 inches) clear polycarbonate face with subsurface applied Vinyl copy. Face shall be back sprayed with paint and laminated to an extruded aluminum carrier insert.
   c) Integral Tactile Copy Inserts - phenolic photo polymer etched with 2.3 mm (.0937 inches) raised copy.
   d) Silk-screened First Surface Copy (non-tactile) - Injection molded or extruded ABS plastic or aluminum insert with first surface applied enamel silk-screened copy.

C. Sign Type Family 08 and 09:
   1. All text and graphics are to be first surface silk-screened.
   2. IN-08: Preparation of artwork for reproduction of "fire and emergency evacuation maps" is by manufacturer.

D. Sign Type Families 03:
   1. Tactile sign is to be made from a material that provides for letters, numbers and Braille to be integral with sign plaque material such as: photosensitive polyamide resin, etched metal, sandblasted phenolic or embossed material. Do not apply letters, numbers and Braille with adhesive.
   2. Numbers, letters and Braille to be raised 0.793 mm (.0312 inches) from the background surface. The draft of the letters, numbers and Braille to be tapered, vertical and clean.
   3. Braille dots are to conform with standard dimensions for literary Braille; (a) Dot base diameter: 1.5 mm (.059 inches) (b) Inter-dot spacing: 2.3 mm (.090 inches) (c) Horizontal separation between cells: 6.0 mm (.241 inches) (d) Vertical separation between cells: 10.0 mm (.395 inches)
   4. Entire assembly is painted in specified color. After painting, apply white or other specified color to surface of the numbers and letters. Entire sign is to have a protective clear coat sealant applied.
   5. Complete sign is to have an eggshell finish (11 to 19 degree on a 60 degree glossmeter).

E. Sign Type Family 04:
   1. All text and graphics are to be first surface applied vinyl letters.
   2. IN-04: When a Type IN-04 is to be mounted under a Type IN03, a connecting Accent Joiner is to be used to create a singular integrated sign.

F. Sign Type Family 06 and 07:
   1. A11 text and graphics are to be first surface applied vinyl letters except for under sliding tile.
   2. Protect text, which is covered by sliding tile, so tile does not wear away letters.

G. Sign Type Family 17:
   1. A11 text and graphics are to be first surface applied vinyl letters.
   2. IN-17: Directory constructed using elements of the Component System.

H. Sign Type Family 18:
   1. A11 text and graphics are to be first surface applied stylus cut vinyl letters.

2. Provide in specified typeface, color and spacing, with each message or message group on a single quick release backing sheet.

I. Sign Type Family 19:

1. Dimensional letters are mill or laser cut acrylic in the size and thickness noted in the drawings.
2. Draft of letters is perpendicular to letters face.
3. All corners such as where a letter stem and bar intersect are to be square so the letter form is accurately reproduced.
4. Paint letters with acrylic polyurethane in specified color and finish.

J. Temporary Interior Signs:

1. Fabricated from 50 kg (110 pound) matte finished white paper cut to 100 mm (4 inch) wide by 300 mm (12 inch) long. Punched 3 mm (.125 inch) hole with edge of hole spaced 13 mm (.5 inch) in from edge and centered on 100 mm (4 inch) side. Reinforce hole on both sides with suitable material that prevents tie form pulling through hole. Ties are steel wire 0.3 mm (0.120 inch) thick attached to tag with twist leaving 150 mm (6 inch) long free ends.
2. Mark architectural room number on sign, with broad felt marker in clearly legible numbers or letters that identify room, corridor or space as shown on floor plans.
3. Install temporary signs to all rooms that have a room, corridor or space number. Attach to door frame, door knob or door pull.
   a. Doors that do not require signs are: corridor doors in corridor with same number, folding doors or partitions, toilet doors, bathroom doors within and between rooms, closet doors within rooms, communicating doors in partitions between rooms with corridor entrance doors.
   b. Replace and missing damaged or illegible signs.

2.5 FABRICATION

A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.

B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.

C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.

D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth su1rfaces.
G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
K. Movable parts, including hardware, are be cleaned and adjusted to operate as designed without binding of deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
M. No signs are to be manufactured until final sign message schedule and location review has been completed by the COTR & forwarded to contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.

B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact COTR for clarification.
C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
D. Remove or correct signs or installation work COTR determines as unsafe or as an unsafe condition.
E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
F. Locate signs as shown on the Sign Location Plans.
G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

- - - END - - -

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INTERIOR SIGN SCHEDULE

Room No	Sign No	Sign Type	Room Name	Header Text	Message Text	Symbol	Remarks
Community Building							
C100	C100	EN-06.05	VESTIBULE		BUILDING NAME & NUMBER		EXTERIOR BUILDING SIGN
FIRST FLOOR							
C100	1A01A	IN-17.01	VESTIBULE		BLDG NAME, DEPT NAMES		DIRECTORY
C101	1A01	IN-19.01	RECEPTION	1A01	1234		DIMENSIONAL LETTERS
C102			WAITING				
C103			VESTIBULE				
C104	1A05	IN-09.01	RESTROOM	1A05	RESTROOM	PICTO/ACCESS	
C105	1A03	IN-09.01	RESTROOM	1A03	RESTROOM	PICTO	
C106	1A09	IN-03.01 / IN-04.01	HOUSE KEEPING	1A09	HOUSEKEEPING		
C107	1A11	IN-03.01 / IN-04.01	TRASH RECYCLE	1A11	RECYCLE / TRASH		
C110	1A02	IN-03.01 / IN-04.01	RESOURCE CENTER	1A02	RESOURCE CENTER		
	1A02-1	IN-03.01 / IN-04.01	RESOURCE CENTER	1A02	RESOURCE CENTER		
C112	1A07	IN-03.01 / IN-04.01	STAFF LOUNGE	1A07	STAFF LOUNGE		
C113			MECHANICAL ROOM				
C114	1A04	IN-03.01 / IN-04.01	SOILED LINEN	1A04	SOILED LINEN		
C115	1A06	IN-03.01 / IN-04.01	CLEAN LINEN	1A06	CLEAN LINEN		
C116	1A13	IN-03.01 / IN-04.01	MULTI-PURPOSE ROOM	1A13	MULTI-PURPOSE ROOM		
C117	1A13A	IN-03.01 / IN-04.01	STORAGE	1A13A	STORAGE		
C118	1A08	IN-03.01	TELECOM ROOM	1A08	NO TEXT		
C119	1A10	IN-03.01	ELECTRICAL ROOM	1A10	NO TEXT		
C120	1B02	IN-03.01 / IN-04.01	PATIENT LNG REC THER	1B02	PATIENT LOUNGE		
C121	1B02A	IN-03.01 / IN-04.01	STORAGE	1B02A	STORAGE		
C122	1B02B	IN-03.01 / IN-04.01	REC THERAPY OFFICE	1B02B	RECREATION THERAPY		
C123	1B05B	IN-03.01 / IN-04.01	DINING ROOM	1B05B	DINING ROOM		
C123A	1B07	IN-03.01 / IN-04.01	KITCHEN	1B07	KITCHEN		
C124	1B01	IN-03.01 / IN-07.01	GROUP ROOM	1B01	GROUP ROOM A		
	1B01-1	IN-03.01 / IN-07.01	GROUP ROOM	1B01	GROUP ROOM A		
C125	1B05	IN-03.01 / IN-07.01	GROUP ROOM	1B05	GROUP ROOM B		
C126	1B05A	IN-03.01 / IN-07.01	GROUP ROOM	1B05A	GROUP ROOM C		
C127	1B04	IN-03.01 / IN-04.01	PHYSICAL THERAPY	1B04	PHYSICAL THERAPY		
C127A	1B04A	IN-09.01	TOILET/SHOWER	1B04A	RESTROOM	PICTO	
C127B	1B04B	IN-09.01	TOILET/SHOWER	1B04B	RESTROOM	PICTO/ACCESS	
C128	1B03	IN-03.01 / IN-04.01	STORAGE	1B03	STORAGE		
C129	1C01A	IN-03.01	MACHINE ROOM	1C01A	NO TEXT		

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INTERIOR SIGN SCHEDULE

Room No	Sign No	Sign Type	Room Name	Header Text	Message Text	Symbol	Remarks
Community Building							
FIRST FLOOR CONTINUED							
C130	1C01	IN-03.01 / IN-04.01	CLOTH STORAGE	1C01	CLOTHING STORAGE		
C131	1C03	IN-03.01 / IN-04.01	PHARMACIST OFFICE	1C03	PHARMACIST		
C132	1C03A	IN-03.01 / IN-04.01	MEDS ROOM	1C03A	MEDICATIONS		
C133	1C05	IN-03.01 / IN-04.01	NURSE MANAGER	1C05	NURSE MANAGER		
C134	1C07	IN-03.01 / IN-04.01	PSYCH TECH OFFICE	1C07	PSYCHOLOGIST		
C135	1C09	IN-03.01 / IN-04.01	PSYCH OFFICE	1C09	PSYCHOLOGIST		
C136	1C11	IN-03.01	CLOSET	1C11	NO TEXT		
C137	1C14	IN-03.01 / IN-04.01	EXAM / PHYSICIAN ASST	1C14	EXAM ROOM		
C138	1C12	IN-03.01 / IN-04.01	PSYCH OFFICE	1C12	PSYCHOLOGIST		
C139	1C10	IN-03.01 / IN-04.01	PSYCH OFFICE	1C10	PSYCHOLOGIST		
C140	1C06	IN-09.01	RESTROOM	1C06	RESTROOM	PICTO/ACCESS	
C141	1C04	IN-03.01 / IN-04.01	OFFICE	1C04	CONSULT		
C142	1C02	IN-03.01 / IN-04.01	CONSULT	1C02	CONSULT		
C143	B1-1	IN-08	CORRIDOR		IN CASE OF FIRE DO NOT USE ELEVATOR USE STAIR	PICTOGRAM	
C143A	1C08	IN-03.01	CLOSET	1C08	NO TEXT		
C144			CORRIDOR				
C145			CORRIDOR				
C146			CORRIDOR				
C147			CORRIDOR				
C148			CORRIDOR				
C149			VESTIBULE				
CS01	CS01-1	IN-04.01	STAIR 1		STAIR 1		
CS02	CS02-1	IN-04.01	STAIR 2		STAIR 2		

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INTERIOR SIGN SCHEDULE

Room No	Sign No	Sign Type	Room Name	Header Text	Message Text	Symbol	Remarks
Community Building							
SECOND FLOOR							
C201	2C01	IN-03.01 / IN-04.01	PROGRAM MANAGER	2C01	PROGRAM MANAGER		
C202	2C01A	IN-03.01 / IN-04.01	STORAGE	2C01A	STORAGE		
C203	2C09	IN-03.01 / IN-04.01	PROGRAM MANAGER	2C09	PROGRAM MANAGER		
C204	2C05	IN-03.01 / IN-04.01	PROGRAM MANAGER	2C05	PROGRAM MANAGER		
C205	2C07	IN-03.01 / IN-04.01	CLINICAL COORDINATOR	2C07	CLINICAL COORDINATOR		
C206	2C03	IN-03.01 / IN-04.01	EXPOSURE THERAPY RM	2C03	EXPOSURE THERAPY		
C207	2C11	IN-03.01	CLOSET	2C11	NO TEXT		
C208	2C14	IN-03.01 / IN-04.01	CHAPLAIN INTERN	2C14	CHAPLAIN		
C209	2C12	IN-03.01 / IN-04.01	CHAPLAIN OFFICE	2C12	CHAPLAIN		
C210	2C10	IN-03.01 / IN-04.01	SOCIAL WORKER	2C10	SOCIAL WORKER		
C211	2C06	IN-09.01	RESTROOM	2C06	RESTROOM	PICTO/ACCESS	
C212	2C04	IN-03.01 / IN-04.01	SOCIAL WORKER	2C04	SOCIAL WORKER		
C213	2C02	IN-03.01 / IN-04.01	SOCIAL WORKER	2C02	SOCIAL WORKER		
C214	B2-1	IN-08	CORRIDOR		IN CASE OF FIRE DO NOT USE ELEVATOR USE STAIR	PICTOGRAM	
C215	2C08	IN-03.01	CLOS		NO TEXT		
CS01	CS01-2	IN-03.01 / IN-04.01	STAIR 1		STAIR 1		
CS02	CS02-2	IN-03.01 / IN-04.01	STAIR 2		STAIR 2		

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies wall guards (crash rails or bumper guards), handrail/wall guard combinations, corner guards and high impact wall covering.

1.2 RELATED WORK

A. Structural steel corner guards: Section 05 50 00, METAL FABRICATIONS.

B. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.

C. Color and texture of resilient material: 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. Shop Drawings: Show design and installation details.

C. Manufacturer's Literature and Data:

1. Handrail/Wall Guard Combinations.
2. Wall Guards.
3. Corner Guards.
4. High Impact Wall covering.

D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

1.4 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° C (70 degrees F) for at least 48 hours prior to installation.

1.5 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 Society for Testing and Materials (ASTM):

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B221-07.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
D256-06.....Impact Resistance of Plastics
D635-06.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
E84-07.....Surface Burning Characteristics of Building Materials

C. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
D. National Fire Protection Association (NFPA):
80-06.....Standard for Fire Doors and Windows
E. Underwriters Laboratories Inc. (UL):
Annual Issue.....Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A167, Type 302B.
B. Aluminum Extruded: ASTM B221, Alloy 6063, Temper T5 or T6
C. Resilient Material:
1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).
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. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
f. Same finish on exposed surfaces.

2.2 CORNER GUARDS

A. Resilient, Shock-Absorbing Corner Guards: Surface mounted type of 30 mm (1-1/4 inch radius formed to profile shown.
1. Full height snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. Provide appropriate mounting hardware, cushions and base plates as required.

2. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.
3. Provide ‘attic stock’ equal to 20% of corner guard total indicated on finish plans.

2.3 WALL GUARDS AND HANDRAILS

A. Resilient Wall Guards and Handrails:

1. Handrail/Wall Guard Combination: Snap-on covers of resilient material, minimum 2 mm (0.078-inch) thick, shall be free-floated on a continuous, extruded aluminum retainer, minimum 1.8 mm (0.072-inch) thick, anchored to wall at maximum 760 mm (30 inches) on center.
2. Wall Guards (Crash Rails): Snap-on covers of resilient material, minimum 2.8 mm (0.110-inch) thick, shall be free-floated over 50 mm (two-inch) wide aluminum retainer clips, minimum 2.3 mm (0.090-inch) thick, anchored to wall at maximum 600 mm (24 inches) on center, supporting a continuous aluminum retainer, minimum 1.6 mm (0.062-inch) thick; or, shall be free-floated over a continuous extruded aluminum retainer, minimum 2.3 (0.090-inch) thick anchored to wall at maximum 600 mm (24 inches) on center.
3. Provide handrails and wall guards (crash rails) with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards (crash rails). Screw or bolt closure

2.4 HIGH IMPACT WALL COVERING

A. Fabricate from vinyl acrylic or polyvinyl chloride resilient material minimum .040 inch thick designed specially for interior use.
B. Coordinate with door guard rail protection material and supplier for proper fit, installation and color.
C. Provide adhesive as recommended by the wall covering manufacturer.

2.5 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, submit shop drawings showing proposed installation details.

2.6 FINISH

A. In accordance with NAAMM AMP 500 series.
B. Resilient Material: Embossed texture and color in accordance with SAE J 545 and as specified on Sheet AS602.

PART 3 - INSTALLATION

3.1 RESILIENT CORNER GUARDS

A. Install corner guards on walls in accordance with manufacturer's instructions.

3.2 RESILIENT HANDRAIL AND RESILIENT WALL GUARDS (CRASH RAIL)

A. Secure guards to walls with brackets and fasteners in accordance with manufacturer's details and instructions.

3.3 HIGH IMPACT WALL COVERING

A. Surfaces to receive protection shall be clean, smooth and free of obstructions.

B. Apply with adhesive in controlled environment according to manufacture’s recommendations.

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SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies manufactured items usually used in dressing rooms, toilets, baths, locker rooms and at sinks in related spaces.

B. Items Specified:

1. Paper towel dispenser.
2. Combination paper towel dispenser and disposal unit.
3. Waste receptacles.
4. Toilet tissue dispenser.
5. Grab Bars.
6. Clothes hooks, robe or coat.
7. Metal framed mirror.
8. Mop racks.
9. Stainless steel shelves, Type 45.

1.2 RELATED SECTIONS

A. Glazing: Section 08 80 00, GLAZING.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Each product specified.
2. Paper towel dispenser and combination dispenser and disposal units.
3. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
4. Grab bars, showing design and each different type of anchorage.
5. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.

C. Samples:

1. One of each type of accessory specified.
2. After approval, samples may be used in the work.

D. Manufacturer's Literature and Data:

1. All accessories specified.
2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
3. Show working operations of spindle for toilet tissue dispensers.
4. Mop racks.

E. Manufacturer's Certificates:
   1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, Phisohex and solutions containing hexachlorophene.
   2. Anodized finish as specified.

1.4 QUALITY ASSURANCE

A. Each 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 accessory type shall be the same and be made by the same manufacturer.
C. Each accessory shall be assembled 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 PACKAGING AND DELIVERY

A. Pack accessories individually to protect finish.
B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
C. Deliver inserts and rough-in frames to site at appropriate time for building-in.
D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

1.6 STORAGE

A. Store products in weathertight and dry storage facility.
B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

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

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
A176-99(R2004).....Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
A269-07.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A312/A312M-06.....Seamless and Welded Austenitic Stainless Steel Pipes
A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
B456-03.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
C1036-06.....Flat Glass
C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass
D635-06.....Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position
F446-85 (R2004).....Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.
A269-07.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
D3453-01.....Flexible Cellular Materials - Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications
D3690-02.....Vinyl-Coated and Urethane-Coated Upholstery Fabrics

C. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
AMP 500-505-88.....Metal Finishes Manual and Finishes for Stainless Steel

D. American Welding Society (AWS):
D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing

E. Federal Specifications (Fed. Specs.):
A-A-3002.....Mirrors, Glass
FF-S-107C (2).....Screw, Tapping and Drive
FF-S-107C.....Screw, Tapping and Drive.
WW-P-541E(1).....Plumbing Fixtures (Accessories, Land Use) Detail Specification

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.

B. Stainless Steel:

1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.

C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.

D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.

E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.

F. Glass:

1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
3. ASTM C1048, Kind FT, Condition A, Type 1, Class 1 (use in Mental Health and Behavior Nursing Unit Psychiatric Patient Areas and Security Examination Rooms where mirrors and glass are specified).

G. Foam Rubber: ASTM D3453, Grade BD, Type 2.

H. Vinyl Covering: ASTM D3690, Vinyl coated fabric, Class A.

I. Plywood: PS1, Grade CD.

2.2 FASTENERS

A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.

B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).

C. Toggle Bolts: For use in hollow masonry or frame construction.

D. Hex bolts: For through bolting on thin panels.

E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.

F. Screws:

1. ASME B18.6.4.
2. Fed Spec. FF-S-107, Stainless steel Type A.

G. Adhesive: As recommended by manufacturer for products to be joined.

2.3 FINISH

A. In accordance with NAAMM AMP 500 series.

B. Anodized Aluminum:
   1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
   2. AA-C22A44 Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish. Dyes will not be accepted.

C. AA-M32 Mechanical finish, medium satin.
   1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
   2. Stainless Steel: NAAMM AMP 503, finish number 4.
   3. Ferrous Metal:
      a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
      b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.
   4. Nylon Coated Steel: Nylon coating powder formulated for a fluidized bonding process to steel to provide a hard smooth, medium gloss finish, not less than 0.3 mm (0.012-inch) thick, rated as self-extinguishing when tested in accordance with ASTM D635.

2.4 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, except stainless steel, anchors and fastening devices.

H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.

I. Key items alike.

J. Provide templates and rough-in measurements as required.

K. Round and deburr edges of sheets to remove sharp edges.

2.5 PAPER TOWEL DISPENSERS

A. VA supplied; Contractor installed.

2.6 TOILET TISSUE DISPENSERS

A. VA supplied; Contractor installed.

2.7 GRAB BARS

A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.

B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:

1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.

C. Concealed mount.

D. Bars:

1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
   a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
   b. Finish: Horizontal: smooth satin. Vertical: Peened satin.
2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around three sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
3. Continuous weld intermediate support to the grab bar.

E. Flange for Concealed Mounting:

1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.

F. Back Plates:

1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
3. Furnish spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on metal partitions.

2.8 CLOTHES HOOKS-ROBE OR COAT

A. Fabricate hook units either of chromium plated brass with a satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to the thickness of the 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 the wall flange, provided with concealed fastenings.

2.9 METAL FRAMED MIRRORS WITH SHELF

A. Fed. Spec. A-A-3002 metal frame; stainless steel, type 302 or 304.

B. Size: 16″W x 20″H, standard. 24″W x 36″H, handicapped accessible.

C. Mirror Glass:

1. Minimum 6 mm (1/4 inch) thick.
2. Set mirror in a protective vinyl glazing tape.
3. Use tempered glass for mirrors in Mental Health and Behavioral Nursing units.

D. Frames:

1. Channel or angle shaped section with face of frame not less than 9 mm (3/8 inch) wide. Fabricate with square corners.
2. Use either 0.9 mm (0.0359 inch) thick stainless steel, chrome finished steel, or extruded aluminum, with clear anodized finish 0.4 mils thick.
3. Filler:
   a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
   b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.
4. Attached Shelf for Mirrors:
   a. Fabricate shelf of the same material and finish as the mirror frame.
   b. Make shelf approximately 125 mm (five inches) in depth, and extend full width of the mirror.
   c. Close the ends and the front edge of the shelf to the same thickness as the mirror frame width.
   d. Form shelf for aluminum framed mirror as an integral part of the bottom frame member. Form stainless steel shelf with concealed brackets to attach to mirror frame.

E. Back Plate:

1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

F. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

lip. Plastic soap trays or tray inserts are not acceptable.

2.10 MOP RACKS

A. Minimum 1.0M (40 inches) long with five holders.

B. Clamps:

1. Minimum of 1.3 mm (0.050-inch) thick stainless steel bracket retaining channel with a hard rubber serrated cam; pivot mounted to channel.
2. Clamps to hold handles from 13 mm (1/2-inch) minimum to 32 mm (1-1/4 inch) maximum diameter.

C. Support:

1. Minimum of 1 mm (0.0375 inch) thick stainless steel hat shape channel to hold clamps away from wall as shown.
2. Drill wall flange for 3 mm (1/8 inch) fasteners above and below clamp locations.

D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.

E. Finish on stainless Steel: AMP 503-No. 4.

2.11 STAINLESS STEEL SHELVES

A. Fabricate shelves and brackets to design shown of 1.2 mm (0.0478-inch) thick stainless steel.

B. Round and finish smooth projecting corners of shelves and edge corners of brackets. Drill brackets for 6 mm (1/4-inch) anchor bolts.

C. Screw or weld brackets to shelves.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before starting work notify the Contracting Officer’s Technical Representative (COTR) in writing of any conflicts detrimental to installation or operation of units.

B. Verify with the COTR the exact location of accessories.

3.2 INSTALLATION

A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry. Expansion bolt to concrete or solid masonry.

C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.

D. Install accessories plumb and level and securely anchor to substrate.

E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the 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 as needed.

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.

I. Install wall mirrors in Mental Health and Behavioral Units with tamper resistant screws that are flush mounted so that they will not support a rope or material for hanging.

3.3 SCHEDULE OF ACCESSORIES

A. Single-Use Toilet (Patient And Staff):

1. Paper Towel Dispenser
2. Toilet Tissue Dispenser
3. Grab Bars
4. Clothes Hook - Coat
5. Metal Framed Mirror w/Shelf

B. EMS Closet:

1. Mop Rack
2. Stainless Steel Shelf, 36 inches long

C. Dressing / Changing Room:

1. Clothes Hook – Coat
2. Clothes Hook – Robe

D. Scrub Sink:

1. Stainless Steel Shelf, 60 inches long

3.4 CLEANING

A. After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

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SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section covers semi-recessed fire extinguisher cabinets.

1.2 RELATED WORK

A. Acrylic glazing: Section 08 80 00, GLAZING.

B. Field Painting: Section 09 91 00, PAINTING.

C. Fire extinguisher provided by Government and Contractor installed.

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):
D4802-02.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

A. Recessed type with flat trim.

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.

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.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.

B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

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SECTION 12 32 00
MANUFACTURED WOOD CASEWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies plastic laminate casework as detailed on the drawings, including related components and accessories required to form integral units. Wood casework items shown on the drawings, but not specified below shall be included as part of the work under this section, and applicable portions of the specification shall apply to these items. Each like item of casework shall be of the same design and by one manufacturer.

B. Where shown, provide plastic laminate casework items as follows:
   1. Plastic laminate covered countertops for casework.
   2. Solid polymer material countertops with sinks, and where indicated.

1.2 RELATED WORK

A. Custom Casework: Section 06 20 00, FINISH CARPENTRY.

B. Countertops: Section 12 36 00, COUNTERTOPS.

C. Color and Finish of Plastic Laminate: Section 09 06 00, SCHEDULE FOR FINISHES.

D. Lavatories and Plumbing in Casework: Section 22 40 00, PLUMBING FIXTURES.

1.3 MANUFACTURER'S QUALIFICATIONS

A. The fabrication of casework shall be by a manufacturer who produces casework similar to the casework specified and shown.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
   Sinks, trim and fittings.
   Locks for doors and drawers
   Adhesive cements

C. Samples:
   Counter top, plastic laminate, 150 mm (six inch) square
   Wood Face Veneer or Hardwood Plywood

D. Shop Drawings (1/2 full size):
   1. All casework, showing details of construction, including materials, hardware and accessories.

2. Cabinets and counters showing faucets in connection with sink bowls, and electrical fixtures and receptacles which are mounted on cabinets and counters.
3. Fastenings and method of installation.

E. Mock-Up: Where required for special casework and where four or more similar units are involved, submit a mock-up of a typical unit for approval by the Contracting Officer’s Technical Representative (COTR).

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 basic designation only.

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

A167-99 (R2004).....Stainless and Heat-Resisting chromium-Nickel Steel Plate, Sheet and Strip
A1008-07.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy
C1036-06.....Flat Glass

C. Composite Panel Association (CPA):

A208.1-99.....Particleboard

D. U.S. Department of Commerce Product Standards (Prod. Std):

PS1-95.....Construction And Industrial Plywood

E. Hardwood, Plywood and Veneer Association (HPVA):

HP.1-04.....Hardwood and Decorative Plywood

F. Architectural Woodwork Institute (AWI):

Architectural Woodwork Quality Standards, Guide Specifications Quality Certification Program - 1999

G. American Society of Mechanical Engineers (ASME):

A112.18.1-05.....Plumbing Fixture Fittings

H. National Electrical Manufacturers Association (NEMA):

LD3-05.....High Pressure Decorative Laminates
LD3.1-95.....Performance, Application Fabrication and Installations of High-Pressure Decorative Laminates

I. Hardwood Plywood and Veneer Association

HP-1.....Hardwood and Decorative Plywood

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE:

A. NEMA LD-3.

B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General purpose Type HGL.

C. Cabinet Interiors Including Shelving: Both of following options to comply with NEMA, LD3.1 as a minimum.

1. Plastic laminate clad plywood or particle board.

2. Resin impregnated decorative paper thermally fused to particle board.

D. Backing sheet on bottom of plastic laminate covered wood tops. Backer Type BKL.

E. Post Forming Fabrication, Decorative Surface: Post forming Type HGP.

2.2 PLYWOOD

A. Prod. Std. PS1, five ply construction from 13 mm to 28 mm (1/2 inch to 1-1/8 inch) thickness, and seven ply for 31 mm (1 1/4 inch) thickness.

2.3 RUBBER OR VINYL BASE

A. Straight (for carpet), cove (for resilient floor); 100 mm (4 inch) high, 3 mm (1/8 inch) thick, flexible to conform to irregularities in walls, partitions and floors.

2.4 PLUMBING FIXTURES

A. ASME A112.18.1, except die-cast zinc-alloy material is not acceptable.

2.5 GLASS: ASTM C1036

A. For Doors: Type I, Class 1, Quality q4.

2.6 SOLID WOOD

A. Wood required for edge banding and moldings shall be of same species as wood face veneer.

2.7 SHEET STEEL

A. ASTM A1008.

2.8 STAINLESS STEEL

A. ASTM A167, with No. 4 finish.

2.9 HARDWARE

A. Where pin tumbler locks are specified, disc tumbler lock "Duo A", with brass working parts and case, as manufactured by the Illinois Lock Company will be an acceptable substitute. Locks for each type casework, shall be keyed differently and shall be master-keyed for each type service, such as Nurses, Psychiatric, and Administration. Provide two keys for each lock. Exposed hardware, except as otherwise specified, shall be satin finished chromium plated brass or nickel plated brass.

B. Marking of Locks and Keys:

1. The name of the manufacturer, or trademark by which manufacturer can readily be identified, legibly marked on each lock.

2. The key change number marked on the exposed face of lock, and also stamped on each key.
3. Key change numbers shall provide sufficient information for replacement of the key by the manufacturer.

C. Hinged Doors:
1. Doors 900 mm (36 inches) and more in height shall have three hinges and doors less than 900 mm (36 inches) in height shall have two hinges. Each door shall close against two rubber bumpers.
2. Hinges: Fabricate hinges with minimum 2 mm (0.072 inch) thick chromium plated steel leaves, and with minimum 3.5 mm (0.139 inch) diameter stainless steel pin. Hinges shall be five knuckle design with 63 mm (2-1/2 inch) high leaves and hospital type tips.
3. Fasteners: Provide full thread wood screws to fasten hinge leaves to door and cabinet frame. Finish screws to match finish of hinges.

D. Door Catches:
1. Friction or Magnetic type, fabricated with metal housing.
2. Provide one catch for cabinet doors 1200 mm (48 inches) high and under, and two for doors over 1200 mm (48 inches) high.

E. Locks:
1. Cylinder type pin tumbler.
2. Equip doors and drawers where shown with locks.

F. Drawer and Door Pulls:
Doors and drawers shall have flush pulls, fabricated of either chromium plated brass, chromium plated steel, stainless steel, or anodized aluminum.

G. Drawer Slides:
1. Full extension steel slides with nylon ball-bearing rollers.
2. Slides shall have positive stop.
3. Equip drawers with rubber bumpers.

H. Sliding Doors:
1. Each door shall be supported by two ball bearing bronze or nylon rollers, or sheaves riding on a stainless steel track at top or bottom, and shall be restrained by a nylon or stainless steel guide at the opposite end.
2. Plastic guides are not acceptable.
3. Each door shall have rubber silencers set near top and bottom of each jamb.

I. Shelf Standards (Except For Fixed Shelves):
Bright zinc-plated steel for recessed mounting with screws, 16 mm (5/8 inch) wide by 5 mm (3/16 inch) high providing 13 mm (1/2 inch) adjustment, complete with shelf supports.

2.10 FABRICATION

A. Casework shall be of the flush overlay design and, except as otherwise specified, be of premium grade construction and of component thickness in conformance with AWI Quality Standards.
B. Fabricate casework of plastic laminated covered plywood as follows:
   1. Where shown, doors, drawers, shelves and all semi-concealed surfaces shall be plastic laminated.
C. Electrical fixtures, receptacles, wiring and junction boxes required for fixtures and receptacles:
   1. Factory installed in casework.
   2. For electrical lighting fixtures, see drawings.
   3. For electric receptacles and lighting fixtures installed below or adjacent to wall cabinets or above counter tops, see electrical sections or specifications.
   4. Install wiring in built-in raceways and terminate at junction box mounted on rear of cabinet and counter.
   5. For final hook-up at junction box see electrical sections of specifications.
D. Provide 18 gage sheet steel sloping tops for casework where shown. Fasten sloping tops with oval-head screws inserted from interior. Exposed ends of sloping tops shall have flush closures fastened as recommended by manufacturer.
E. Base:
   1. Provide rubber or vinyl base with close, flush joints; set with adhesive.
   2. Remove adhesive from exposed surfaces.
   3. Install base at floor line after casework has been accurately leveled.
   4. Rub base to glossy finish.
F. Countertops:
   1. Countertops, splashbacks and end splashes shall be solid polymer material.
   2. Countertops shall be 100mm (3/4 inch) thick.
   3. Splashbacks and end splashes shall be coved and integral to countertops.

4. Provide cut-outs for plumbing trim where shown.

G. Sink bowls:
1. 18 gage stainless steel, of size and design shown.
2. All interior corners of bowls shall be formed to manufacturer's standard radii.
3. Sinks shall have rims with flanged edges overlapping tops to provide tight joints.
4. Secure sink bowls with concealed fastenings.
5. For service lines from service fixtures, see other sections of specifications.

H. Provide the following plumbing trim and fittings:
1. Faucets: ASME A112.18.1 Type I, compression type, countertop mounted, chromium plated brass, having two valves and with gooseneck as shown, elevated to clear handles.
2. Fittings shall have an elongated escutcheon for spout and handles, replaceable valve seats and four arm or lever style indexed chromium plated brass or stainless steel handles; handles either with or without hood.

I. Faucets:
1. ASME A112.18.1 Type I, compression type, splashback mounted, chromium plated brass, having two valves and with gooseneck spout as indicated.
2. Fittings shall have exposed body union inlets and adjustable flanges.
3. Valves shall have indexed chromium plated brass or stainless steel lever handles and replaceable valves seats; handles either with or without hood.

J. Drain:
1. Cast or wrought brass or stainless steel with flat strainer.
2. Surfaces of drains exposed from above shall have a chromium plated finish.

K. Traps: Cast brass.

L. Spray Hose:
1. Hose shall drop below counter top when not in use and be of sufficient length to reach the entire length of the countertop.
2. Concealed trim may be rough brass.

M. Support Members for Tops of Tables:
1. Construct as detailed.
2. Provide miscellaneous steel members and anchor as shown.

N. Legs For Counters:
   1. Fabricate legs for counters of 1.6 mm (0.0635 inch) thick, 38 mm (1-1/2 inch) square tubular steel where shown.
   2. Secure legs to counter tops and provide legs at bottom with shoes not less than 25 mm (one inch) in height.
   3. Fabricate shoes of either stainless steel, aluminum or chromium plated brass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set casework in place; level, plumb and accurately scribe and secure to walls, and/or floors.

B. The installation shall be complete including all trim and hardware. Leave the casework clean and free from defects.

3.2 FASTENINGS

A. Fastenings for securing casework to adjoining construction shall be as detailed on the drawings or approved shop drawings.

B. See Section 05 50 00, METAL FABRICATIONS for reinforcement of walls and partitions for casework anchorage.

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SECTION 12 36 00
COUNTERTOPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies casework countertops with integral accessories.

B. Integral accessories include:

1. Sinks with traps and drains.

1.2 RELATED WORK

A. Section 06 20 00, FINISH CARPENTRY.

A. Color and patterns of plastic laminate: Section 09 06 00, SCHEDULE FOR FINISHES.

B. DIVISION 22 - PLUMBING.

C. DIVISION 26 - ELECTRICAL.

1.3 SUBMITTALS

A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings

1. Show dimensions of section and method of assembly.
2. Show details of construction at 1/2 scale.

C. Samples:

1. 150 mm (6 inch) square samples each top.
2. Front edge, back splash, end splash and core with surface material and booking.

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. American Hardboard Association (AHA):

A135.4-04.....Basic Hardboard

C. Composite Panel Association (CPA):

A208.1-99.....Particleboard

D. American Society of Mechanical Engineers (ASME):

A112.18.1-05.....Plumbing Fixture Fittings

A112.1.2-04.....Air Gaps in Plumbing System

A112.19.3-00(R2004).....Stainless Steel Plumbing Fixtures (Designed for Residential Use)

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

A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A1008-07.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength, Low Alloy
D256-06.....Pendulum Impact Resistance of Plastic
D570-98(R2005).....Water Absorption of Plastics
D638-03.....Tensile Properties of Plastics
D785-03.....Rockwell Hardness of Plastics and Electrical Insulating Materials
D790-07.....Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D4690-99(2005).....Urea-Formaldehyde Resin Adhesives
G21-96 (R2002).....Determining Resistance of Synthetic Polymeric Materials to Fungi

F. Federal Specifications (FS):
A-A-1936.....Adhesive, Contact, Neoprene Rubber

G. U.S. Department of Commerce, Product Standards (PS):
PS 1-95.....Construction and Industrial Plywood

H. National Electrical Manufacturers Association (NEMA):
LD 3-05.....High Pressure Decorative Laminates
LD 3.1-95.....Performance, Application, Fabrication, and Installation of High Pressure Decorative Laminates

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solid Polymer Material:
1. Filled Methyl Methacrylic Polymer.
2. Performance properties required:

Property	Result	Test
Elongation	0.3% min.	ASTM D638
Hardness	90 Rockwell M	ASTM D785
Gloss (60^0 Gordon)	5-20	NEMA LD3.1
Color stability	No change	NEMA LD3 except 200 hour
Abrasion resistance	No loss of pattern Max wear depth 0.0762 mm (0.003 in) - 10000 cycles	NEMA LD3
Water absorption weight (5 max)	24 hours 0.9	ASTM D-570
Izod impact	14 N·m/m (0.25 ft-lb/in)	ASTM D256 (Method A)

Property	Result	Test
Impact resistance	No fracture	NEMA LD-3 900 mm (36") drop 1 kg (2 lb.) ball
Boiling water surface resistance	No visible change	NEMA LD3
High temperature resistance	Slight surface dulling	NEMA LD3

3. Cast into sheet form.
4. Color throughout with subtle veining through thickness.
5. Dupont "Corian" is acceptable if meeting the above properties.
6. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.

B. Fasteners:

1. Metals used for welding same metal as materials joined.
2. Use studs, bolts, spaces, threaded rods with nuts or screws suitable for materials being joined with metal splice plates, channels or other supporting shape.

2.2 SINKS

A. Material as specified in DIVISION 22 - PLUMBING

2.3 TRAPS AND FITTINGS

A. Material as specified in DIVISION 22 - PLUMBING.

2.4 WATER FAUCETS

A. Material as specified in DIVISION 22 - PLUMBING.

2.5 FIXTURE IDENTIFICATION

A. Code fixtures with full view plastic index buttons.

B. Use following colors and codes:

SERVICE	COLOR	CODE	COLOR OF LETTERS
Cold Water	Dark Green	CW	White
Hot Water	Red	HW	White
Laboratory Air	Orange	AIR	Black
Fuel Gas	Dark Blue	GAS	White
Laboratory Vacuum	Yellow	VAC	Black
Distilled Water	White	DW	Black
Deionized Water	White	DI	Black
Oxygen	Light Green	OXY	White
Hydrogen	Pink	H	Black
Nitrogen	Gray	N	Black

SERVICE	COLOR	CODE	COLOR OF LETTERS
All Other Gases	Light Blue	CHEM.SYM.	Black

2.6 COUNTERTOPS

A. Fabricate in largest sections practicable.
B. Fabricate with joints flush on top surface.
C. Fabricate countertops to overhang front of cabinets and end of assemblies 25 mm (one inch) except where against walls or cabinets.
D. Provide 1 mm (0.039 inch) thick metal plate connectors or fastening devices (except epoxy resin tops).
E. Join edges in a chemical resistant waterproof cement or epoxy cement, except weld metal tops.
F. Fabricate with end splashes where against walls or cabinets.
G. Splash Backs and End Splashes:
   1. Not less than 19 mm (3/4 inch) thick.
   2. Height 100 mm (4 inches) unless noted otherwise.
   3. Fabricate solid polymer material splash back in maximum lengths practical of the same material.
H. Drill or cutout for sinks, and penetrations.
   1. Accurately cut for size of penetration.
   2. Cutout for VL 81 photographic enlarger cabinet.
      a. Finish cutout to fit flush with vertical side of cabinet, allowing adjustable shelf to fit into cutout space of cabinet at counter top level. Finish cutout surface as an exposed edge.
      b. Provide braces under enlarger space to support not less than 45 kg (100 pounds) centered on opening side along backsplash.
I. Solid Polymer Material Tops:
   1. Fabricate countertop of solid polymer material sheet, 19 mm (3/4 inch) thick.
   2. Splashbacks and end splashes shall be solid polymer material.
   3. Splashbacks and end splashes shall be coved and integral to countertops.
   3. Fabricate skirt to depth shown.
   5. Fabricate in one piece for full length from corner to corner up to 3600 mm (12 feet).
   6. Join pieces with adhesive sealant.
   7. Cut out countertop for lavatories, plumbing trim.
   8. Provide concealed fasteners and epoxy cement for anchorage of sinks to countertop.

J. Pegboards: Fabricate of solid polymer material and equip with polypropylene pegs and/or stainless steel accessories.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installing countertops verify that wall surfaces have been finished as specified and that mechanical and electrical service locations are as required.

B. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.
   1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.
   2. Use round head bolts or screws.
   3. Use epoxy or silicone to fasten the epoxy resin countertops to the cabinets.
   4. Use wood or sheet metal screws for wood or plastic laminate tops; minimum penetration into top 16 mm (5/8 inch), screw size No 8, or 10.

C. Rubber Moldings:
   1. Where shown install molding with butt joints in horizontal runs and mitered joints at corners where ceramic tile occurs omit molding.
   2. Fasten molding to wall and to splashbacks and splashends with adhesive.

D. Sinks
   1. Install stainless steel sink in countertops with epoxy compound to form watertight seal under shelf rim.
      a. Install faucets and fittings on sink ledges with watertight seals where shown.

E. Faucets, Fixtures, and Outlets:
   1. Seal opening between fixture and top.
   2. Secure to top with manufacturers standard fittings.

3.2 PROTECTION AND CLEANING

A. Tightly cover and protect against dirt, water, and chemical or mechanical injury.

B. Clean at completion of work.

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SECTION 14 24 00
HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the, engineering, furnishing and installation of the complete electro-hydraulic elevator system as described herein and shown on the drawings.

B. The electric passenger elevator shall be oil hydraulic type with microprocessor based control, two stop collective automatic, operation with car leveling device, signal system, power-operated single-speed, side opening car and hoistway doors. Elevators shall have Class “A” loading.

1.2 QUALITY CONTROL

A. Qualifications:

1. Approval by the Contractor’s Technical Representative (COTR) is required of products or services of proposed manufacturer, suppliers, and installers and will be contingent upon submission by Contractor of a certificate stating the following:
   a. Manufacturer is currently and regularly engaged in manufacturing of elevator equipment as one of his principal products.
   b. Installer has technical qualifications of at least three years of successful experience, trained supervisory and installation personnel, and facilities to install elevator equipment specified herein.
   c. Contractor shall submit a list of two or more prior hospital installations where all the elevator equipment the contractor proposes to furnish on this project has performed satisfactorily together under conditions of normal use. The list shall include projects that have been in operation for a period of not less than two years preceding the date of these specifications; include the name and addresses of the Medical Center and the Medical Center Administrators.
2. All hydraulic elevators shall be the product of the same manufacturer.
3. Approval of manufacturer's equipment will be contingent upon his having a permanent and satisfactory maintenance service branch which shall render services within four hours of receipt of notification. Manufacturer shall submit the names and address of his authorized branch or service department which will render service to this

installation, together with certification that the quantity and quality of replacement parts stock on hand is sufficient to warranty continued operation of the elevator installation.

4. Approval will not be given to any Elevator Contractor and/or manufacturer who has established on prior projects, either Government, municipal, or commercial, a record for unsatisfactory elevator installations, or has repeatedly failed to complete contracts awarded to him within the contract time, or has not the requisite record of satisfactorily performing elevator installations of similar type and magnitude.

1.3 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. Federal Specifications (Fed. Spec.):

J-C-30B(l).....Cable and Wire, Electrical (Power, Fixed Installation)

J-C-580B(l).....Cord, Electrical and Wire, Electrical (O to 600-Volt Service)

W-C-596/12F.....Connector, Receptacle, Electrical, General Purpose, Duplex, Hospital Grade Grounding, 2 Pole, 3 Wire, 15 Amperes, 125 Volts, 50/60 Hertz

W-F-406D.....Fittings for Cable, Power, Electrical and Conduit, Metal Flexible

W-F-408E.....Fittings for Conduit, Metal, Rigid (Thick-Wall and Thin-Wall (EMT) Type)

W-S-610E.....Splice Connectors

FF-S-325.....Shield, Expansion; Nail Expansion; and Nail, Drive

QQ-S-766D.....Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip

L-P-508H.....Plastic Sheet, Laminated, Decorative and Non-Decorative (Style "D" Type I Class 25 Plastic Laminate)

TT-E-489.....Enamel, Alkyd, Gloss, Low Voc Content

WW-C-566C.....Conduit, Metal, Flexible

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

A1008/A1008M-02.....Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formation

C612-00a.....Mineral Fiber Block and Board Thermal Insulation
E1042-92(1997)e1.....Acoustically Absorptive Materials Applied by Trowel or Spray

D. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):
SP-58-1993.....Pipe Hangers and Supports

E. American Society of Mechanical Engineers (ASME):
A17.1-2000.....Safety Code for Elevators and Escalators
A17.2-2001.....Inspectors Manual for Elevators and Escalators

F. National Fire Protection Association (NFPA):
70-2002 or current code. National Electric Code
252-2003.....Fire Test of Door Assemblies

G. Society of Automotive Engineers, Inc. (SAE)
J517-91.....Hydraulic Hose, Standard; April 1991

H. Gages:
For Sheet and Plate: U.S. Standard (USS)
For Wires: American Wire Gauge (AWG)

I. American Welding Society (AWS):
D1.1-2002.....Structured Welding Code - Steel

J. National Electrical Manufacturers' Association (NEMA):
LD3-2000.....High-Pressure Decorative Laminates

K. Underwriter's Laboratories (UL):
486A-97 Ninth Edition...Wire Connectors and Soldering Lugs for Use with Copper Conductors
797-83.....High Safety Electrical Metallic Tubing

L. Regulatory Standards:
A Specification 16721 Fire Alarm - Local Building System
VA Barrier Free Design Handbook (H-08-13)
Uniform Federal Accessibility Standards - 1988
Americans with Disabilities Act - 1991

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Complete scaled and dimensioned layout of each elevator installation in plan, elevation, and section.

C. Complete layout showing location of storage tank; pump; controller; selectors and supervisory panels; outside diameter of cylinder; plunger; piping layout and working pressure; clearance of car at top and bottom of hoistway when car makes normal stops at terminals, and clearance of car at bottom of hoistway when buffers are fully compressed; car

platform; size of car frame members; support assembly and weights of principal parts.

D. Complete drawings of hoistway entrances and doors showing details of construction, and method of fastening to structural members of building.
   1. If dry-wall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.

E. Drawing showing methods of fastening conduit or duct systems, fixture boxes, fascia plates, intermediate supports, rail brackets, and hoistway construction.

F. Complete drawings of elevator car enclosure, showing dimensioned details of construction, location of car equipment, fastenings to platform, car lighting, ventilation, ceiling framing and top exit:
   1. Dimensioned drawings showing details of guide shoes.

G. Dimensioned drawings showing details of all signal and car equipment and fixtures.

H. Complete drawings showing details of jack unit.

I. Dimensioned drawings and description of power door operator and photo-electric devices.

J. Dimensioned drawings and description of hoistway door hangers.

K. Cuts of drawings of hydraulic fluid scavenger pump system.

L. Complete dimensioned hydraulic fluid storage tank and jack unit.

M. Samples (One each):
   1. Stainless steel plate, 75 mm by 125 mm (3-inches by 5-inches.)
   2. Baked enamel plate, 75 mm by 125 mm (3-inches by 5-inches.)
   3. Color vinyl floor tile, .31 mm (12-inch square.)
   4. Protection pads, 75 mm by 125 mm (3-inches by 5-inches.)
   5. No other samples of materials specified shall be submitted unless specifically requested after submission of manufacturer's name.

N. Materials Data: Submit the name of manufacturer and type or style designation of the following for approval:
   1. Controllers.
   2. Size of hydraulic power unit.
   3. H.P. and R.P.M. of hydraulic power unit motor.
   4. Electric control valves, including capacity range.
   5. Electric power and power door operator.
   6. Hoistway door interlocks and electric contacts.
   7. Stroke, certified maximum and minimum loads and maximum striking speed of car buffers.
   8. HP and CFM rating on cab ventilation unit.

1.5 WIRING DIAGRAMS

A. Provide three (3) sets field wiring and straight line wiring diagrams showing all electrical circuits of all elevator equipment in the hoistway, as well as the machine room. One (1) set of diagrams shall be framed under plastic or on pivoted hardboards coated with an approved plastic sealer, and mounted in each elevator machine room as directed by the COTR. In the event field modifications are found necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection.

B. Diagrams shall be delivered to the COTR within 30 days of final acceptance.

1.6 ADDITIONAL EQUIPMENT

A. Furnish and install any additional equipment required to operate specified equipment manufactured or contemplated for this installation.

B. Special equipment not required by specification, but manufactured by elevator contractor, which would improve the operation as a whole, may be installed on or in conjunction with the specified equipment by the contractor at his option at no additional cost to the Government, provided prior approval is obtained from the COTR.

1.7 TOOL CABINET

A. Provide a metal tool cabinet, having two shelves and a hinged door. cabinet size shall be approximately 1200 mm (48 inches) high, 450 mm (18 inches) wide, 375 mm (15 inches) deep and shall contain not less than 213.4 cubic cm (7 cubic feet) of storage.

1.8 PERFORMANCE STANDARDS

A. The elevators shall be capable of meeting the highest standards of the industry and specifically the following:

1. Contract speed shall mean speed in the UP direction with full capacity load in the car. Speed variation under any load condition, regardless of direction, shall be no more than ten (10) percent.
2. Starting, stopping, and leveling shall be smooth and comfortable without appreciable steps of acceleration and deceleration.

B. The door opening time:

1. Door opening shall be not more than 4.0 seconds maximum for the Elevator.
2. Door closing time shall be 4.0 seconds minimum for Elevator.

C. Cycle time shall be measured from the time the doors starts to close until the car has reached the next floor level, with the car stopped within the level allowance of plus or minus 3 mm (1/8 inch).

D. Pressure: Fluid system components shall be designed and factory tested for 500 p.s.i. maximum operating pressure shall be 500 p.s.i.

E. Floor Accuracy

1. Accuracy shall be maximum 3 mm (1/8 inch) above or below the floor, regardless of load condition.

1.9 WARRANTY

A. Submit all labor and materials furnished in connection with elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. Warranty shall commence upon final inspection and completion of performance test and upon full acceptance of the installation and shall concur with the length of the maintenance contract.

B. If it becomes evident during warranty period that any device is not functioning properly or in accordance with specification requirements, or if in the opinion of the COTR, excessive maintenance and attention must be employed to keep device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where stainless steel is specified, it shall be corrosion resisting steel complying with Fed. Spec. QQ-S-766, Class 302 or 304, Condition A with Number 4 finish (150 grit) on exposed surfaces. Stainless steel shall have the grain of belting in the direction of the longest dimension and surfaces shall be smooth and without waves. During erection, protect all stainless steel surfaces with a suitable material.

B. Where cold rolled steel is specified, it shall be low-carbon steel rolled to stretcher leveled standard flatness, complying with ASTM A109.

2.2 MANUFACTURED PRODUCTS

A. Materials, devices and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items.

B. When two or more units of same class of materials, devices or equipment are required, these units shall be products of one manufacturer.

C. Manufacturers of equipment assemblies which include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit shall be products of same manufacturer.
2. Parts which are alike shall be the product of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for the intended service.

D. Welding: Welding at the project site shall be made by welders and welding operators who have previously qualified by test as prescribed in American Welding Society Publication AWS D1.1 to perform type of work required.

E. Motor nameplates shall state manufacturer's name, rated horsepower, speed, volts, amperes and other characteristics required by NEMA standards, and shall be securely attached to the item of equipment in a conspicuous location.

F. Where key-operated switches or key-operated cylinder locks are furnished in conjunction with any component of the elevator installation, four keys for each individual switch or lock shall be furnished. Barrel keys are not acceptable. Attach each key to a tag bearing a stamped or etched legend identifying its purpose. Engrave tags and imprint "Property of U.S. Government" on reverse side.

2.3 CAPACITY, SPEED AND TRAVEL

A. Each direct-plunger elevator shall have the capacity to lift the live load exclusive of the weight of entire car and plunger, as specified in the following schedule.

ELEVATOR SCHEDULE	
Elevator Number	1
Overall Platform Size	6′-8″ by 4′3″ Car interior dimensions
Rated Load - pounds	2500
Rated Speed - fpm	125 ft./min.
Total Travel	12′-4″
Number of Stops	2
Number of Openings	1
Entrance Type & Size	3′-6″ by 7′-0″

B. Actual elevator speed shall not vary more than 10 percent above nor more than 10 percent below specified speed.

2.4 POWER SUPPLY

A. For power supply in each machine room see specification Division 26, ELECTRICAL and electrical drawings.

B. It shall be the electrical contractor's responsibility to supply the labor and materials for the installation of the following:

1. A feeder from the power source indicated on the drawings to each hydraulic controller.

2. Shunt Trip Circuit Breaker for each controller located at the strike side of the machine room door. Shall be lockable in the “Off” position.

3. Auxiliary circuits for hydraulic signal and control systems as indicated on the drawings, from the indicated source to each hydraulic controller. The hydraulic controller, the elevator contractor shall supply and install motor and power and signal wiring from the controller to the machine.

2.5 CONDUIT PER NEC

A. All conduit terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushing. Install a steel locknut under the bushing if they are constructed completely of insulating materials. Protect the conductors at ends of conduits not terminating in steel cabinets or boxes by terminal fittings having an insulated opening for the conductors.

B. Do not use set screws or indentations as a means of attachment or connection. Use compression fittings.

C. Conduit size: 19mm (1/2”) minimum.

D. Flexible metal conduit not less than 9.5 mm(3/8-inch) electrical trade size may be used, not exceeding 457 mm (18 inches) in length, for short connections between risers and limit switches, interlocks, and for other applications permitted by the NEC. Flexible heavy-duty service cord, type S.O., may be used between fixed car wiring and switches on car doors for safety edges and light ray devices.

E. Provide terminal boxes for the conduit and wiring connections to the pump motor.

2.6 CONDUCTORS

A. Unless otherwise specified, conductors, exclusive of traveling cables, shall be stranded or solid coated annealed copper in accordance with Fed. Spec. J-C-30 for either Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, either single conductor cable in accordance with Fed. Spec. J-C-580 for Type TF, or multiple conductor cable, may be used

provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable shall have color coding or other suitable identification for each conductor. Conductors for control boards shall be in accordance with NEC. Permit no joints or splices in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

B. All wiring must test free from short circuits or grounds. Insulation resistance between individual external conductors and between conductors and ground shall be not less than one megohm.

C. Where size of conductors is not given, capacity shall be such that maximum current shall not exceed limits prescribed by NEC.

D. Provide equipment grounding. Ground conduits, supports, controller enclosures, motors, platform and car frames, and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, green, insulated and sized as required by NEC. Bond the grounding wires to all junction boxes, cabinets, and wire raceways.

E. Terminal connections for all conductors used for external wiring between various items of elevator equipment shall be solderless pressure wire connectors in accordance with Fed. Spec. W-S-610. The Contractor may, at his option, make these terminal connections on No. 10 or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

2.7 TRAVELING CABLES

A. Traveling cables from junction box on car to junction box in hoistway or directly to controller shall consist of flexible traveling cables conforming with requirements of NEC. Equip junction boxes in hoistway and on car with terminal blocks. Provide all connections to terminal blocks with either terminal eyelet connections or pressure wire connectors of the clamp type that meet UL 486A requirements from stranded wire. Terminal blocks shall have permanent indelible identifying numbers for each connection. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending or twisting producing distortion of cable shall not be allowed.

B. Provide 10 percent, but not less than 5 spare conductors in each traveling cable.

C. Provide shielded traveling cable wires for the auto dial phone system in each elevator car. Cable shall extend from auto dial phone system in car directly to controller or from junction box in hoistway to controller.

D. For type and location of hoistway lighting and intercom junction boxes, see contract drawings.

2.8 CONTROLLERS

A. Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self supporting steel frame. Completely enclose equipment with covers. Provide means to prevent overheating.

B. Wiring: Controller wiring shall be neatly arranged, readily accessible, easily traced and securely fastened in place. Identify all spare conductors to controller.

C. Identify each device and fuse (ampere rating) on panels by name, letter, or standard symbol, in an approved indelible and legible manner on device or panel. Coordinate identification markings with identical markings or wiring diagrams.

D. Provide solid state components and printed circuit boards to control the hydraulic machine or signal functions. If this option is exercised, complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval prior to manufacture. Incorporate the following features into the design:

1. The electrical connections between the printed circuit boards (modules) and the circuit connectors incorporated in the mounting racks shall be made through individual tabs which shall be an integral part of each module. The tabs shall be nickel-gold plated or other approved metal of equal electrical characteristics. Notch modules so as to prevent insertion of the modules in the inverted position.
2. Light emitting diode (LEDS) may be used for visual monitoring of individual modules.
3. Components shall have interlocking circuits to assure fail-safe operation and to prevent unwarranted elevator movement in case any component fails to function properly.
4. Submit method of wire wrappings for point to point wire connections on the mounting racks for approval.
5. Modules shall be of the type that plug into pre-wired mounting racks. No field wiring or alteration shall be necessary in order to replace defective modules.

6. Any field wiring changes required during construction shall be made only to the mounting rack connection points and not to the individual module circuitry or components. Any changes to individual modules shall be performed at the factory.
7. Fabricate module boards from non-conductive, non-corrosive material which is of sufficient strength so as to support all components mounted thereon without warping. Space mounting racks sufficiently apart to prevent accidental contact between individual modules.
8. All logic symbols and circuitry designations shall be in accordance with ASME Standards.
9. Design solid state components to operate at a maximum of 40 degrees C (104 degrees F).
10. Bring wiring connections for operating circuits and for external control circuits to terminal blocks mounted in an accessible location within the controller cabinet. Terminal blocks using pierce-through serrated washers shall not be acceptable.

2.9 MICROPROCESSOR CONTROL SYSTEM

A. The Contractor shall, provide solid state components and printed circuit boards to control the hoisting machine and signal functions in accordance with these specifications. Complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval.

2.10 HYDRAULIC JACK UNIT

A. Design cylinder and plunger in accordance with ASME A17.1. It shall be of sufficient size to lift gross load the height specified. Factory test at a pressure equal to twice the calculated working pressure, for strength and to insure freedom from leakage. Provide bottom of cylinder head with internal guide bearing and top of cylinder head with removable packing gland. Packing gland shall permit ready replacement of packing. Victualic type packing gland head will not be permitted.
   1. Provide a bleeder valve located below the cylinder flange on the jack unit to release air or other gases from the system.
   2. Equip cylinder with drip ring below the packing gland to collect leakage of hydraulic fluid.
   3. Bolt the jack unit mounting brackets to continuous footing channels that also support the rails and buffers.

B. Install a copper tubing scavenger line with a electrically operated pump between the piston drip ring and oil storage tank. Scavenger line, pump and strainers shall operate independently of hydraulic fluid pressure. Equip scavenger pump with a water float designed to prevent operation of

the pump, should the pit flood. Also, design to be manually reset. Strap the pump and reservoir to the pit floor.

C. Plunger shall be heavy seamless steel tubing, turned smooth and true to within plus or minus .38 mm (0.015-inches) tolerance and no diameter change greater than .07 mm (0.003-inches per-inch) of length. Ground the plunger surface to a fine polish finish, 12 micro-inches or finer. Where plunger is multi-piece construction, machine turn the joints to assure perfectly matching surfaces. No tool marks shall be visible.
   1. Secure plunger to underside of platform supporting beams with fastenings capable of supporting four times the weight of the plunger. The platen shall incorporate piston car vibration isolator as, hereinafter, specified.
   2. Provide a stop ring electrically welded or screwed to the bottom of plunger to positively prevent plunger from leaving its cylinder. 3. Isolate plunger head from the platen to prevent corrosion or electrolysis.
   4. Carefully protect plunger and replace if gouged, nicked or scored.
   5. If conditions beneath the pit floor are not adequate to support the total loading of the elevator, install reinforcing members in the pit floor.

D. Before installation, clean entire cylinder wall of all traces of oil, grease, moisture, dirt and scale.

2.11 HYDRAULIC JACK UNIT CASING

A. The casing shall be iron or steel not less than 0.375-inch thick, at least 15.2 mm (six-inches) larger in diameter than the cylinder. The Elevator Contractor shall demonstrate to the COTR that the casing has been accurately set, positioned, and plumbed to accept jack unit. Close the bottom with a minimum of 15.2 mm (6-inches) of concrete. Fill space between casing and cylinder and tamp with washed, dry sand after cylinder has been accurately located. After setting, the top of the casing shall be sealed.

B. Provide PVC casing liner to fit inside steel casing. Fabricate from schedule 80 PVC pipe with watertight bottom and a top flange gasketed to seal to plunger flange and to form a complete, watertight, electrically non-conductive encasement of the entire unit. Provide two one-inch diameter PVC filler elbows and caps at the top of the casing liner. Fill space between jack unit and casing liner with a petroleum-based corrosion preventive by pouring into one filler (both caps removed) until oil is visible in both fillers. Cap both tubes.

C. Provide suitable well hole to accommodate casing. Coordinate the drilling of jack hole and setting cylinder with construction of concrete pit. Provide watertight joint between the casing and the pit floor at bottom of pit.

D. Base bid on drilling hole in dirt, sand, rock, gravel, loam, boulders, hardpan, water, or other obstacles. Include the removal of all dirt and debris.

2.12 PUMP UNIT ASSEMBLY

A. Completely integrate the pump unit for the control of the elevator and self-contain in a unit fabricated of structural steel. The unit shall consist of a hydraulic fluid pump driven by an induction motor together with oil control valves, piping, etc. Do not install hydraulic equipment within the storage tank. Completely enclose unit on four open sides of the power unit frame with not less than 16 gauge steel removable panel sections. Fully line panel sections on the interior with one-inch rigid board, mineral or glass fiber, or equivalent acoustical insulation.

B. Design hydraulic system so that working pressure does not exceed 400 p.s.i. under any loading condition.

C. Pump shall be positive-displacement, rotary screw type, specially designed for hydraulic elevator service, having a steady discharge without pulsation to give smooth and quiet operation. Pump output shall be capable of lifting elevator car with rated capacity, with a speed variation of no more than ten percent between no load and full load. Pump shall operate under flooded suction in an accurately machined case with the clearance required to assure maximum efficiency. Hydraulic fluid by-pass shall discharge directly into storage tank.

D. Submersible pump unit not acceptable.

E. Motor shall be squirrel-cage, drip proof, ball bearing, induction type, with a synchronous speed not in excess of 1800 RPM. Design motor specifically for elevator service, not to exceed nameplate full load current by more than 10% and be continuously rated 80 starts per hour without exceeding a rise of 40 degrees C. Include closed transition SCR soft start.

F. Connect motor and pump with multiple V-belt. Size belts and sheaves for duty involved and design to prevent any metallic contact between motor and pump shaft. Provide isolation units of rubber in shear to prevent transmission of pump and motor vibration to the building. Install expanded metal sheave guard that can be easily removed for servicing and inspection.

2.13 HYDRAULIC SYSTEM

A. Construct the storage tank of sheet steel, welded construction, and a steel cover. Suitable means for filling, a minimum one-inch protected vent opening, an overflow connection, and a valved drain connection. Tank shall act as a storage tank only, and sized to pass through machine room door as shown on drawings. Provide marked gauge to meter hydraulic fluid level. Tank shall be of capacity to hold volume of hydraulic fluid required to lift elevator to top terminal landing, plus a reserve of not less than ten gallons. Provide a baffle in the bottom of the tank to prevent entry of any sediment or foreign particles into hydraulic system. Baffle shall also minimize aeration of hydraulic fluid. Permissible minimum hydraulic fluid level shall be clearly indicated. Hydraulic fluid shall be of good grade to assure free flow when cool, and have minimum flash point of 400 degrees F. Provide initial supply of hydraulic fluid for operation of elevator.

1. Thermostatically control the viscosity of the hydraulic fluid with thermal cooling unit and temperature thermostat to maintain the fluid temperature in the reservoir, pump and valves at a constant operating viscosity.
2. Provide a data plate on the tank framing indicating the characteristics of the hydraulic fluid used.

B. Furnish and install connections between the storage tank, pump, muffler, operating valves, and cylinder complete with necessary valves, pipe supports, and fittings. All connections between the discharge side of the pump, check valve, muffler, cylinder, lowering valves shall be of schedule 40 steel with screw, flanged, welded, or approved flexible or mechanical couplings. Size of pipe and couplings between cylinder and pumping unit shall be such that fluid pressure loss is limited to 10 percent.

C. Do not subject valves, piping, and fittings to working pressure greater than those recommended by the manufacturer.

D. Support all horizontal piping. Place hangers or supports within 3 mm (12 inches) on each side of every change of direction of pipe line and space supports not over 3.0 meters (10 feet) apart. Secure vertical runs properly with iron clamps at sufficiently close intervals to carry weight of pipe and contents. Provide supports under pipe to floor.

1. Provide all piping from remote machine room to hoistway, including necessary supports or hangers. If remote piping is underground or in damp, inaccessible areas, install hydraulic piping thru PVC sleeve pipe.

E. Install pipe sleeves where pipes pass through walls or floors. Set sleeves during construction. After installation of piping, equip the sleeves with snug fitting inner liner of either glass or mineral wool insulation.

F. Install blowout-proof, non-hammering, oil-hydraulic muffler in the hydraulic fluid supply pressure line near power unit in machine room. Design muffler to reduce to a minimum any pulsation or noises that may be transmitted through the hydraulic fluid into the hoistway.

G. Solenoid operate and arrange control valves so hydraulic fluid flow will be controlled in positive and gradual manner to insure smooth starting and stopping of elevator.

H. Provide safety check valve between cylinder and flexible pump connection which will hold elevator with specified load at any point when pump stops or pressure drops below minimum operating levels.

I. Provide an automatic shut-off valve in the oil supply line at the cylinder inlet. Weld pipe protruding from cylinder at inlet and thread to receive shut-off valve. Activate the automatic shut-off valve when there is a ten percent drop in no-load operating pressure. When activated, this device shall immediately stop the descent of the elevator, and hold the elevator until it is lowered by use of the manual lowering feature of the valve. Arrange the manual lowering feature of the automatic shut-off valve to limit the maximum descending speed of the elevator to 15 FPM. The exposed adjustments of the automatic shut-off valve shall have their means of adjustment sealed after being set to their correct position.

J. Provide external tank shut-off valve to isolate hydraulic fluid during maintenance operations.

K. Provide all pump relief and other auxiliary valves to comply with the requirements of the Code and to insure smooth, safe, and satisfactory operation of elevator.

L. Furnish and adjust by-pass and relief valve in accordance with Rule 3.19.4.2 of ASME A17.1.

M. Install check valve to hold the elevator car with rated load at any point when the pump stops.

N. Provide a shut-off valve in the pit near the jack and in the machine room capable of withstanding 150 percent of design operating pressure. Manual valve shall have handle attached to the valve.

0. Conveniently locate the manual lowering valve, easily accessible, and properly identified with a red arrow and not concealed within the storage tank. Mark the operating handle in red.

P. Provide a low oil control feature which shall shut off the motor and pump and return the elevator to the lowest landing. Upon reaching the lowest landing, doors will open automatically allowing passengers to leave the car. Then doors shall close. All control buttons, except the door open button, shall be made ineffective.

Q. Provide oil-tight drip pan for assembled pumping unit, including storage tank. Pan shall be not less than 16 gauge sheet steel, with one-inch sides.

R. The entire hydraulic system, including muffler, shall be tested to withstand a pressure equal to twice the calculated working pressure. Submit certification that test has been performed.

2.14 GUIDE RAILS

A. Guide rails shall be planed steel, standard T-Section, securely fastened to building structure with steel brackets by means of bolts and heavy duty steel rail clips. Rails shall weigh not less than 15 pounds per foot and have suitable size and weight for the application. Rails shall conform with ASME A17.1, and located so that the entire car assembly is in true balance with the guide rails.

B. Support guide rails by brackets at each floor. Where fastenings are over 4.3 meters (14 feet) apart, reinforce rails with 2.3 mm (9 inch) channel backing, or approved equal, to secure the rigidity required for elevator capacity, platform size and method of loading.

C. Locate all joints so as not to interfere with supporting clamps and brackets. Design shims used to secure rail alignment so that they remain in position, even though the fastening bolts may be loosened.

D. Extend guide rails from channels on pit floor to within three-inches of the underside of the concrete slab at the top of the hoistway with a maximum deviation of 1/8 inch from plumb in all directions. Provide a minimum of 3/4-inch clearance between bottom of rails and top of channels.

E. Guide rail anchorages in pit shall be made in a manner that will not reduce the effectiveness of the pit waterproofing.

F. Clean guide rails of any signs of rust or abrasion, and file to remove all rough edges prior to final inspection. File all guide rail joints to assure perfectly matching surfaces.

G. For attachment of guide rails in concrete or brick, where steel framing is not available, install approved inserts or bond blocks.

2.15 CAR GUIDES

A. Install on car frame four adjustable roller guides, each assembled on a substantial metal base, to permit individual self-alignment to the guide rails.

B. Roller Guides

1. Each guide shall be of an approved type consisting of not less than three (3) wheels, each with a durable, resilient oil-resistant material tire rotating on ball bearings having sealed-in lubrication. Assemble rollers on a substantial metal base and mount to provide continuous spring pressure contact of all wheels with the corresponding rail surfaces under all conditions of loading and operation. The wheels shall be of ample diameter and shall run on three-machine finished dry rail surfaces. Secure the roller guides at top and bottom on each side of car frame and counterweight frame. All mounting bolts shall be fitted with nuts, flat washers, split lock washers and if required, beveled washers.
2. Provide sheet metal guards to protect wheels on top of car.
3. Minimum diameter of car rollers shall not be less than 152 mm (6 inches). The entire elevator car shall be properly balanced to equalize pressure on all guide rollers. Cars shall be balanced in post-wise and front-to-back directions. Test for this balanced condition shall be witnessed at time of final inspection.
2. Flexible guide shoes of approved design, other than swivel type, may be used provided they are self-aligning on all three faces of the guide rails.
3. Provide spring take-up in car guide shoes for side play between rails.

2.16 CROSSHEAD DATA PLATE

A. Permanently attach a non-corrosive metal data plate to car crosshead. Data plate shall bear information required by Rule 2.16.3 and 2.20.2.1 of ASME A17.1. Etch or stamp such information on plate.

2.17 CAR BUFFERS

A. Provide a minimum of two spring buffers for each car, in accordance with Rule 3.22 of ASME A17.1. Securely fasten buffers and supports to the pit channels, and in the alignment with striker plates on car. Permanently fasten to each buffer a metal plate showing stroke and loading rating. Buffer anchorage shall not puncture pit waterproofing.

B. Design and install buffers to provide minimum car runby required by Rule 3.4.2 of ASME A17.1.

C. Furnish pipe stanchions and struts, as required, to properly support the buffer.

2.18 NORMAL AND FINAL TERMINAL STOPPING DEVICES

A. Mount normal stopping switch on car or in hoistway to slow speed of car and bring it to an automatic stop level with the terminal landings.
   1. Switch shall function with any load up to and including 125 percent of rated elevator capacity at any speed obtained in normal operation.
   2. Switch, when opened, shall permit operation of car in reverse direction.
   3. No normal stopping device, other than one mounted on car and activated by cams in hoistway, or mounted in hoistway and activated by cams on car, shall be permitted.

B. Mount final terminal stopping switches in the hoistway.
   1. Switches shall be positively opened by car, should the car travel beyond the normal stopping switches.
   2. Switches shall be independent of other stopping devices.
   3. Switches, when opened, shall remove power from hoist motor, apply hoist machine brake, and prevent operation of car in either direction.

C. After final stopping switches have been adjusted, through bolt switches to guide rail.

2.19 TOP-OF-CAR OPERATING DEVICE

A. The device shall conform to ASME A17.1 and the following:
   1. Activate the device by a toggle switch mounted in the device. The switch shall have the "ON" and "OFF" positions permanently marked on the faceplate with 1/4-inch letters.
   2. Accomplish movement of the elevator by the continuous pressure on a direction button and a safety button.
   3. Provide an emergency stop toggle type switch as per ASME.
   4. Provide permanent identifications for the operation of all components in the device.
   5. Permanently attach the device to the elevator crosshead, on the side of the elevator which is nearest to the hoistway door opening.

2.20 WORKMAN’S LIGHTS AND OUTLETS

A. Provide duplex GFCI protected type receptacles and lamp, with wire guards on top of elevator car and beneath platform.

B. The receptacles shall be in accordance with Fed. Spec. W-C-596/12D for Type D7, 2-pole, 3-wire grounded type rated for 15 amperes and 125 volts.

2.21 CAR LEVELING DEVICE

A. Provide car leveling device for elevator which shall automatically bring car to within 3 mm (1/8-inch) of exact level with floor landing regardless of load in car or direction of travel.

B. When the car is traveling in the up direction, the car shall level up to the floor; and when the car is traveling in the down direction, the car shall level down to the floor. The car shall at all times level into the floor and shall not stop above or below the floor and level back.

C. One-way leveling, augmented with an anti-creep device, shall not be acceptable.

2.22 EMERGENCY STOP SWITCHES

A. Provide each top-of-car device, pit, etc., with emergency stop toggle switches. Mount stop switch on top-of-car in a common fixture with the top-of-car operating device and stop switch in the pit adjacent to pit access door or at top of pit ladder.

B. Each stop switch shall be red in color and shall have its "Identity" and "STOP" and "RUN" positions legibly and indelibly identified.

2.23 OPERATING DEVICE FACEPLATES

A. Fabricate faceplates for all elevator operating and signal devices from not less than 3 mm (1/8-inch) thick flat stainless steel, with all edges beveled at least 15 degrees. Install all faceplates flush with surface upon which they are mounted.

B. Corridor push button faceplates shall be at least 65 mm (2 1/2-inches) wide by 200 mm (8 inches) high. The centerline of all corridor pushbutton fixtures shall be 1 meter (3 feet 6 inches) above the corridor floor.

C. Fasten all car and corridor operating device and signal device faceplates with non-corrosive white metal spanner head or bristol head tamperproof screws.

D. Design car and corridor pushbutton faceplates so that pressure on pushbuttons are independent of pressure on pushbutton contacts.

E. Engraved legends or raised numerals in faceplates shall have lettering ¼ inch high filled with black paint.

2.24 OPERATING DEVICES AT HOISTWAY LANDINGS

A. Each button shall contain an integral registration light, which shall illuminate upon registration of a car call, and extinguish when that call is answered.

2.25 ELEVATOR CAR OPERATING PANELS

A. Locate main car operating panel in car enclosure so that the highest passenger use device shall be no more than 1200 mm (4 feet) above the

finished floor. Locate the alarm bell button at the bottom of the panel with the centerline no less than 875 mm (35 inches) above the finished floor.

1. All terminology on main car operating panel and auxiliary panel shall be engraved. Use 6 mm (1/4 inch) or larger letters for all passengers use devices in main and auxiliary car operating panels. Use 3 mm (1/8 inch) letters to identify all other devices in lower section of the main car operating panel.
   a. Phase II firefighters’ operating instructions
   b. Unique car number
   c. “No Smoking”
   d. Car capacity in pounds
   e. Medical emergency operation

B. Main car operating panel with faceplate mounted behind stationary.
   1. The control panel shall contain:
      a. A complete set of raised or flush illuminated pushbuttons with a minimum diameter of 25.4 mm (1 inch). Buttons shall have the floor designation indelibly marked on their face using 13 mm (1/2 inch) characters. The button illumination shall extinguish when the car reverses its travel. As the car stops for a floor, that corresponding button shall be extinguished.
      b. Emergency stop key switch (red in color) with markings to show “RUN” and “STOP”. Emergency stop switch shall be key operated.
         1) Connect emergency signal alarm bell button to a 150 mm (6 inch) vibrating bell located on top of car. Furnish and install bell including the necessary wiring and auxiliary devices.
      c. Emergency signal alarm bell button (red in color). Illuminate button when actuated.
      d. Two position key operated independent service transfer switch marked "INDEPENDENT SERVICE" with two positions marked "ON" and "OFF".
      e. A three position key operated fire service switch marked "FIRE OPERATION" with three positions marked "OFF, HOLD and ON".
      g. A red translucent light jewel with a visual graphic per ASME A17.1 which shall illuminate when required on fire service operation. It shall be marked "FIRE SERVICE".
      h. An audible signal system for fire service operation.
      i. A button marked “CALL CANCEL” for fire service operation.
      j. Door "OPEN" and door "CLOSE" buttons located below the car buttons. locate the door "OPEN" button adjacent to the car door

entrance column. For rear openings provide rear door "OPEN" and "CLOSE" buttons for full selective door operation.

k. Emergency “Push to Call” button for two way communication with auto dial system. “Push to Call” button or adjacent light jewel shall illuminate and flash when call is acknowledged. Button shall match floor pushbutton design. Provide “Push to Call” button, tactile symbol and Braille adjacent to button mounted integral with car front return panel Engrave “Push To Talk” in 6 mm(1/4

2.26 FIRE SERVICE

A. Provide Fire Service as per ASME A17.1.

B. Smoke Detectors:

1. Smoke detection devices in each elevator lobby, top of hoistway, and machine room, provided by Contractor. Furnish and install the smoke detection devices, together with all necessary conduit, wiring, relay, etc., required between the Fire Alarm System and the junction box of the elevator lobby control panel, under "FIRE ALARM SYSTEMS". All necessary connections from the elevator lobby control panel to the elevator control system in the machine room shall be furnished and installed under this section of the specification.
2. Upon activation of an elevator lobby, top of hoistway, and machine room smoke detection device, transmit a signal to the building fire alarm control console. Transmit an "Alarm" signal from the console to the elevators, which shall activate the "Fire Service" Phase I operation. The "Alarm" signal received from the elevator lobby, top of hoistway, or machine room smoke detection device, except that device located in the main lobby shall activate the same sequence of operation activated by the "Fire Service" key operated switch in the main lobby control panel. Together the "Alarm" signal received from the smoke detection device, located in the main landing lobby, shall activate the same sequence of operation activated by sending the elevator to the designated alternate floor.
3. When an "Alarm" signal initiates Phase I operation, momentary movement of the "Fire Service" key in the lobby control panel to the "ON" position shall be required to return elevators to automatic operation if "Alarm" signal is cleared.

2.27 AUXILIARY POWER OPERATION

A. The control system for the elevator shall include provisions for operation on auxiliary power upon failure of the normal power supply.

B. The electrical contractor provides auxiliary power supply, including its starting means, transfer switch for transfer of elevator supply from normal to auxiliary power, a pair of conductors in a conduit from an auxiliary contact on the transfer switch (contact closed on normal power - open on auxiliary power) to terminals on the elevator controller and other related work. If auxiliary power is not sufficient capacity to run all elevators, provide a timing relay from normal power to auxiliary power and another relay for delay back to normal power.

C. The elevator contractor provides auxiliary equipment on elevator controllers, wiring between associated elevator controllers and wiring between elevator controllers and remote selector panel as required to permit the elevators to operate as detailed.

D. Upon loss of normal power supply there shall be a delay before transferring to auxiliary power of three to fifteen seconds maximum the delay shall be accomplished through an adjustable timing device capable of delays from zero seconds to sixty seconds.

E. Remote Selector Panel:
   1. Locate as directed by COTR.
   2. Provide selector panel in a NEMA lB flush type enclosure furnished with a brushed finish stainless steel hinged door and frame. The door shall contain a tumbler type lock furnished with four keys. Identify the enclosure faceplate as "Auxiliary Power Control" with 13 mm (1/2 inch) engraved letters filled with black paint.
   3. Brush finish the inside selector panel of stainless steel with each device identified with 3 mm (1/8 inch) engraved letters filled with black paint. The panel shall contain:
      a. Selector switch or switches for selecting the elevators.
      b. Pilot lights to indicate normal mode of operation, auxiliary power service available, and which elevator is connected to auxiliary service.
      c. A lamp test circuit consisting of a momentary contact pushbutton to test all pilot lights in the circuit.
      d. Provide a permanently mounted, easy to read, instruction plate, which shall include operating instructions for auxiliary power service and instructions for lamp test circuits.

F. Upon restoration of normal power supply, an adjustable time circuit shall be activated which will cause all cars to remain at the floor, if already there, or stop and remain at the nearest floor if in flight. Actual transfer of power from auxiliary power to normal building power

shall take place after all cars are stopped at a floor. Individual cars in each group shall restart at five second intervals.

2.28 CAR POSITION INDICATOR

A. Provide an alpha-numeric LED digital position indicator in each main car operating panel, consisting of numerals and arrows not less than 50 mm (2 inch) high, to indicate position of car and direction of car travel. Indicator faceplate shall be stainless steel. Provide L.E.D. or L.C.D. illumination. Locate position indicator in the main car operating panel. When no direction has been established, neither arrow shall be illuminated.

B. Provide an audible signal to momentarily sound as the car is stopping at, or passing a floor. It shall be no less than 20dB with a frequency no higher than 1500 Hz.

2.29 CORRIDOR POSITION INDICATOR

A. Provide alpha-numeric digital L.E.D. position indicators directly over hoistway landing entranceways. Indicator cover plates shall consist of faceplates of stainless steel. Numerals shall be not less than 50 mm (2 inches) high. Cover plates shall be readily removable for relamping. In addition to the numerals, each indicator shall have a "WHITE" up arrow and a "RED" down arrow. When car is standing at landing with no direction established, arrows shall not be illuminated. Each corridor position indicator shall be equipped with a clearly audible gong which shall sound once for "UPWARD" bound car and twice for "DOWNWARD" bound car. Audible signal shall not sound when a car passes the floor without stopping.

2.30 CORRIDOR LANTERNS

A. Provide each car entrance with a digital corridor lantern mounted over the hoistway entrances at all floors except main and alternate fire response floors. Provide each terminal landing with a single "UP" or "DOWN" 50mm (2 inch) arrow lantern and each intermediate landing with "UP" and "DOWN" lanterns. Each lens shall be illuminated with L.E.D. illumination of proper intensity, so shielded to illuminate individual lens only. Connect lanterns to signal, Hall calls shall receive immediate assignment to individual cars and hall lantern shall sound and illuminate.

2.31 AUDIO VOICE SYSTEM

A. Provide voice audio activated by stopping at a floor. Audio voice to give floor designations. The voice announcer shall be a digitized floor announcer that will announce the floor numbers and direction of travel

and special announcements. The voice announcer will be a natural human voice that receives messages and shall comply with ADA requirements for audible car position indicators. The voice announcer shall have two separate volume controls. One for the floor announcement and another for the floor direction. The voice announcer shall be 250 mm W x 250 mm H x 150 mm D (10 inch W x 10 inch L x 6 inch D) voice box 450 mm (18 inch) full range loud speaker to be located on top of the cab. The voice box shall be concealed above the elevator dome. The speaker shall be mounted center of the elevator dome or as directed by the Engineering Officer. The voice announcer unit shall contain 21 ports which can accommodate 21 standard floors and direction messages. Install voice announcer per manufacturer’s recommendations and instructions. The voice announcer shall be the product of one manufacturer of established reputation. Provide manufacturer literature and list of voice messages. Provide special messages for Fire Service, Medical Emergency, “Do not block doors” or others as directed by COTR.

2.32 HOISTWAY ACCESS SWITCHES

A. Provide hoistway access switch for elevator at top terminal landing to permit access to top of car, and at bottom terminal landing to permit access to pit. When side slide doors are specified, mount the access key switch 1800 mm (six feet) above the corridor floor in the recessed portion of the strike jamb where it will be protected by the leading edge of the closed hoistway door. The exposed portion of each access switch or its faceplate shall have legible, indelible legends to indicate identity and "UP", "DOWN", and "OFF" positions. Design and location of access switches shall be submitted for approval. Each access switch shall be a constant pressure cylinder type lock having not less than five pins or five stainless steel disc combination with key removable only when switch is in "OFF" position. Barrel keys not acceptable. Lock shall not be operable by any other key which will operate any other lock or device used for any other purpose in the hospital. Arrange the hoistway switch to initiate and maintain movement of the car. When the car is moved down from the top terminal landing, limit the zone of travel to a distance not greater than the height of the car crosshead.

B. Provide emergency keyway for all hoistway entrances.

2.33 HOISTWAY ENTRANCES FOR PASSENGERS AND SERVICE ELEVATORS

A. Provide entrances of metal construction using cold rolled steel, except door frames which shall be of stainless steel. Complete entrances with sills, hanger supports, hangers, tracks, angle struts, unit frames, door

panels, fascia plates, toe guards, hardware, bumpers, sight guards, and wall anchors.

B. Provide one piece extruded nickel silver sills with non-slip wearing surface, grooved for door guides and recessed for fascia plates. Sills shall have an overall height of not less than 19 mm (3/4 inch), thickness of not less than 3 mm (1/8 inch), and set true, straight and level, with hoistway edges plumb over each other, and top surfaces flush with finished floor. Grout sills full length after installation.

C. Construct hanger supports of not less than 4.5 mm (3/16 inch) thick steel plate, and bolted to strut angles.

D. Structural steel angles as shown on the drawings shall extend from top of sill to bottom of floor beam above, and shall be securely fastened at maximum 457 mm (18 inch) O.C. and at each end with two bolts.

E. Provide jambs and head soffits, of not less than 14 gauge stainless steel, for entrances. Jambs and head soffits shall be combination buck and jamb welded construction, and provided with three tile anchors each side. Side jambs shall be curved type. Radius of curvature shall be about 90 mm (3 1/2-inches). Head jamb shall be square type, and shall overhang corridor face of side jambs by 6 mm (1/4 inch). Rigidly fasten jambs and head soffits to building structure. Provide jambs and head soffits with oiled paper covering suitably taped at factory, or other suitable type of protective covering. After installation, protect jambs and head soffits with wood framing to prevent damage to finish. Solidly grout jambs.

F. If drywall is used for hoistway construction, submit method of anchoring jambs to front hoistway walls for approval.

G. Provide hoistway entrance with flush two speed side slide hoistway door Elevator. Door panels shall be not less than 16 gauge sheet steel, flush type construction, and not less than 35 mm (1 1/2-inches) thick. Top and bottom of door panels shall have continuous stiffener channels welded in place. Reinforcement of the door panels shall be approximately 0.04-inch in thickness and of the hat section type. At bottom of each panel, provide two accurately fitted removable laminated phenolic or other approved material, guides with fire stops. Reinforce each door panel for hangers, interlock mechanism, power door operator and closer. One door panel of each entrance shall bear a BOCA label, Underwriters' label, or, in lieu of this, other labels may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to COTR. Fasten sight guard of 14 gauge metal, extending full height of

panel, to leading edge of fast speed panel of two-speed doors. Door finish shall be stainless steel.

H. Provide rubber bumpers at top and bottom of strike jambs and/or struts for stopping door panels at limits of travel in opening and closing directions.

I. Provide 14 gauge sheet steel fascia plates in hoistway to extend vertically from head of hanger support housing to sill above. Plates shall be the same width as the door opening of elevator and adequately reinforced to prevent waves and buckles. Below bottom terminal landing and over upper terminal landing provide suitable toe guard and dust cover beveled back to wall and adequately fastened. Provide cover plate the width of the door opening on hanger pockets.

J. Provide hangers for hoistway door panels and have means to transmit motion from one door panel to the other. Fasten the hangers to the door sections. Provide with reinforcements at the point of attachment. The hanger shall have provisions for vertical and lateral adjustment. The hanger shall be of the two-point suspension type, consisting of nylon or other non-metallic tired sheaves fitted with dustproof, grease packed ball or roller bearings mounted on a malleable iron or steel bracket. The hanger sheaves shall operate at a relatively low rotational speed, and shall roll on a high-carbon, cold-rolled or drawn steel track shaped so as to permit free movement of sheaves without regard to vertical adjustment of sheave, bracket or housing. Beneath the track and each hanger sheave, provide a hardened steel up-thrust roller capable of withstanding a vertical thrust equal to the carrying capacity of adjacent upper sheave. The up-thrust shall have fine vertical adjustments, and the face of the roller shaped so as to permit free movement of the hanger sheave. The up-thrust roller shall have ball or roller bearings. Provide the hanger sheaves with steel fire stops to prevent disengagement from tracks. Fit each hanger sheave with a felt, or similar material, wiper to provide a light lubricating film between the sheave and hanger track.

K. Do not use hangers that are constructed integrally with the door panels.

L. Provide raised numerals for all openings, with a centerline of 50 mm (2 inches) high, located on each side of entrance frame, at a height of 1500 mm (5-feet) above the landing sill. The numerals shall also contain Braille.

M. Provide unique car number on every elevator entrance at designated level, minimum 75 mm (3 inches) in height.

2.34 ELECTRIC POWER DOOR OPERATORS, PASSENGER ELEVATORS

A. Provide a high-speed, heavy duty, direct-current or alternating-current, master-type, door operator to automatically open the car and hoistway doors simultaneously when the car is leveling, and automatically close the doors simultaneously at the expiration of the door-open timing. Motor shall be of the high-internal resistance type, capable of withstanding high currents resulting from stall without damage to the motor. The door operator shall be capable of opening a car door and hoistway door simultaneously, at a maximum speed of not less than two feet per second. The closing speed of the doors shall be one foot per second. A reversal of direction of the doors from the closing to opening operation initiated by the infrared curtain unit reopening device, or the door "OPEN" button, shall be accomplished within no more than 38 mm (1 1/2-inches) maximum of door movement. Particular emphasis is to be placed on obtaining quiet interlock and door operation, and smooth, fast, dynamic braking for door reversals and stopping of the doors reversals, and stopping of the door extremes of travel. Construct all levers, operating the doors, of heavy steel members, and all pivot points shall have ball or roller bearings. Use electric power to open and close the doors. Auxiliary automatic door closers required under Rule 2.11.3 of ASME A17.1 shall be spring loaded sill mounted type.

B. Design the door operator so that in case of interruption or failure of the electric power from any cause, it shall permit emergency manual operation of both the car door and the hoistway door from within the car, at door zone only, outside of door zone, doors are restricted to 100 mm (4 inch) opening.

   1. It shall not be possible for the doors to open by power unless the elevator is within the leveling zone.
   2. Provide infrared curtain unit. The device shall cause the car and hoistway doors to reverse automatically to the fully-open position should the unit be actuated while the doors are closing. Unit shall function at all times when the doors are not closed, irrespective of all other operating features. The leading edge of the unit shall have an approved black finish.

C. Should the doors be prevented from closing for more than predetermined adjustable interval of 20 to 45 seconds by the interruption or failure of the infrared curtain unit door control shall be rendered inoperative and the doors shall close at reduced speed while a nudging buzzer located on the car shall sound.

1. If an obstruction in the sill should not activate the infrared curtain unit door control device and prevent the doors from closing for more than a predetermined adjustable interval of 45 to 90 seconds, the doors shall reverse to the fully open position and reestablish the closing cycle.

D. Provide door "OPEN" and "CLOSE" buttons. When the door "OPEN" button is pressed and held, the doors, if in the open position, shall remain open and, if the doors are closing, they shall stop, reverse and reopen. Momentary pressure of the door "CLOSE" button shall initiate the closing of the doors prior to the expiration of the normal door open time.

2.35 ELECTRIC INTERLOCKS

A. Equip each hoistway door with true interlock, functioning as hoistway unit system, to prevent operation of car until all hoistway doors are locked in closed position as defined by ASME A17.1. Interlock shall prevent opening of hoistway door from corridor side, unless car is at rest at landing, is operating in leveling zone at landing, or hoistway access switch is used.

B. Hoistway door interlock shall not be accepted, unless it has successfully met requirements of Rule 2.12.6 of ASME A17.1. Securely fasten approved devices to the car, and arrange to operate the interlocks without objectionable noise, shock or jar.

C. Equip car doors with electric contact which prevents operation of car until doors are closed as defined in ASME A17.1 unless car is operating in leveling zone or hoistway access switch is used. Locate door contact to prevent its being tampered with from inside of car. Car door contact shall not be accepted, unless it has successfully met requirements of Rule 2.13 of ASME A17.1.

D. Wiring installed from the hoistway riser to each door interlock shall be NEC type (SF-2), or equivalent.

1. Type SF-2 cable terminations in the interlock housing shall be sleeved with glass braid fillers, or asbestos braid jackets.

E. Provide devices, either mechanical or electrical, which shall prevent operation of the elevator in event an accident to or defective door operator equipment has permitted an independent car or hoistway door panel to remain in the "unclosed" or "unlocked" position.

2.36 CAR FRAME

A. Car frame shall conform with requirements of ASME A17.1, and constructed of steel plates and structural shapes securely riveted, bolted, or welded together. No iron casting will be permitted. The entire assembly shall be rugged construction, and amply braced to withstand unequal

loading of platform. Car frame members shall be such as to relieve the car enclosure of all strains. Balance car front to back and side to side. Provide balancing weights and frames, properly located, to achieve the required true balance.

2.37 CAR PLATFORM FOR PASSENGER AND SERVICE ELEVATORS

A. Construct the car platform so as to comply with all the requirements of ASME A17.1. Provide car entrances with extruded aluminum sill or better with machined or extruded guide grooves. Cover underside and all exposed edges of wood filled platform with black sheet iron of not less than 27 gauge, with all exposed joints and edges folded under. Fire resistant paint is not acceptable. Platform shall have flexible vinyl composition tile flooring not less than 3 mm (1/8 inch) thick. For color, see Section 09 06 00, SCHEDULE FOR FINISHES and/ or Drawings. Adhesive material shall be type recommended by manufacturer of tile. Lay tile flush with threshold plate and coved base. Equip platform with 533 mm (21 inch deep sheet-steel toe-guard apron of not less than 12 gauge at hoistway entrance side. Extend at least three-inches beyond each side of entrance jamb. Securely brace toe-guard apron to car construction, and bevel bottom edge at not less than 60 degree angle nor more than 75 degree angle from horizontal. Install platform in the hoistway, so that the clearance between front edge and landing threshold shall not exceed 32 mm (1 1/4-inches).

B. Provide sound and vibration isolator of neoprene or other resilient material in compression, which will resist oil and aging, in conjunction with platform steel platen. Provide buffer strike plates securely fastened to car frame plank or bolster.

C. Provide grounding connection between piston and underside of platform or car frame.

2.38 CAR ENCLOSURE FOR PASSENGER ELEVATORS

A. Car enclosure for passenger and service elevators shall have a minimum dome height inside the cab of 2440 mm (8 feet).

B. Securely fasten car enclosure to platform by through bolts located at intervals of not more than 457 mm (18 inches), running through an angle at the base of panels to underside of platform. Provide 6 mm (1/4 inch) bolts with nuts and lock washers.

C. Front return wall panel, entrance columns, rear corner columns, entrance head, jamb and transom shall be 14 gauge stainless steel. Side and rear wall panels 1220 mm (48 inches) from finished floor to top of panel shall be 14 gauge stainless steel. Side and rear panels from 1220 mm (48 inches) above finished floor up to and including the canopy shall be 14

gauge cold rolled steel covered with high pressure plastic laminate. Apply the plastic laminate to a minimum thickness of 15 mm (5/8 inch) particle board that meets ASME and Federal requirements. Submit a method of fastening particle board to steel. This particle board shall be one piece on back and sides. It shall be flush with the face of the bottom section of the stainless steel. Plastic laminate shall comply with Federal Spec. L-P-508, Style Type 1, Class 1. Color is specified in Section 09 06 00, SCHEDULE FOR FINISHES. Interior shall be flush panel construction with angles welded on exterior to insure adequate rigidity. Coat exterior of panels with mastic sound insulation material approximately 2.5 mm (3/32-inch) thick followed by a prime coat. Mastic material shall conform to ASTM E1042. Stainless steel wainscot and wall panels above shall be radius “vee” joint with ends of panels turned to exterior and bolted together.

1. Face side and rear wall panels above the stainless steel wainscot with high pressure plastic laminate. Smooth and flush all joints with no ragged or broken edges. Plastic laminate shall comply with NEMA LD3, textured finish, general purpose type, grade designation GP 50, 0.050-inch thickness, except with a minimum wear resistance of 1200 cycles, and backer sheet, grade designation BK 20, .51 mm (0.020-inch) thickness. For color and finish of plastic laminate see Section 09 06 00, SCHEDULE FOR FINISHES.

D. Provide a hinged top emergency exit to conform to ASME A17.1. Exit shall be unobstructed when open, and shall have a mechanical and electrical stop. Provide contacts to prevent operation of the elevator when the emergency exit is open.

E. Locate car position indicator in main car operating panel.

F. Provide duplex, GFCI protected type receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 6-inches above the car floor. The receptacle shall be in accordance with Fed. Spec. W-C-596, 2-pole, 3-wire grounded type rated for 15 amperes and 125 volts. Receptacle face plate stainless steel, and if removable, fasten with white metal tamperproof spanner head or bristol head screws. Receptacle shall permit current to flow only while a standard plug is in the proper position in the receptacle.

G. Construct canopy of not less than 12 gauge steel.

H. Provide car lighting with indirect fluorescent, lamps mounted above lighting coves along each side of cab, front to back. Ballasts for fluorescent fixtures shall be rapid starting type, UL Class P with a power factor not less than 90 percent. Sound ratings shall be "A",

except for ballast sizes which are not available with "A" ratings as standard products of any manufacturer. Such ballast shall have the quietest ratings available. Equip the fluorescent fixtures with a symmetrical reflector having specular ALZAK (or equal) finish. Maintain light level at a minimum 20 foot candles. Enclose the entire vertical space between the light trough outer edge and the cab canopy with approved clear plastic sheeting. Install the plastic sheets so that they are removable for cleaning and relamping.

I. Provide a blower unit arranged to exhaust through an opening in the canopy. Provide a stainless or chrome plated fan grill around the opening. Provide 2-speed type unit, capable of rated free delivery air displacement of approximately 380 and 700 cfm at respective speed. Mount unit on top of car with rubber isolation to prevent transmission of vibration to car structure. Provide screening over exhaust end of blower. Provide a 3-position switch to control the unit in main car operating panel.

J. Car enclosure base shall be of 14-gauge stainless steel, 150 mm (6 inches) high. Provide straight type base at front return sides, and rear of car. Vertical face of base at sides and rear shall be flush with, or recessed behind, the wainscot directly above the base. Base shall be not less than 14 gauge. There shall be no exposed fastenings in base. Provide a series of baffled openings around the base of the enclosure which shall provide a minimum area of 450 square mm (18 square inches) and a maximum area of 610 square mm (24 square inches).

K. Provide car enclosure with double handrails of solid stainless steel, not less than 75 mm (3 inches) wide by 9 mm (3/8 inch) thick. Locate handrails approximately 38 mm (1 1/2-inches) from cab wall. Install handrails on two sides and rear. Curve ends of handrails to wainscoting. Conceal all handrail fastenings, and handrails shall be removable from inside the car enclosure. The centerlines of the handrails shall be 75 mm and 1050 mm (30 and 42 inches) above the car floor.

L. Provide car entrance with two-speed side opening horizontal sliding car doors, of same type as hoistway doors for the elevator. Construct door panels to be flush hollow metal construction, not less than 25 mm (1 inch) thick, consisting of not less than one piece continuous 16 gauge stainless steel on car side face and leading and trailing edges. Separate the two plates by a sound-deadening material, and reinforce by steel shapes welded to the plates at frequent intervals. Reinforce panels as required for installation of hangers, power-operating and door-opening devices. Hang doors on two-point suspension hangers having

ball-bearing sheaves not less than 75 mm (3 inches) in diameter, with rubber or non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Upthrust roller shall be capable of being locked in position after adjustment to a maximum of 0.015-inch clearance. Provide two non-metallic gibs on each door panel. Gibs shall be replaceable without removal of door panel.

M. Provide a permanently attached stainless steel capacity plate on elevator. Capacity plate shall be conspicuously located on the front return panel containing the main car-operating panel. Plate shall show the rated load of the elevator in pounds, with engraved or cast letters not less than 6 mm (1/4 inch) high. Fill engraved letters with black paint. The capacity may be engraved in the main car-operating panel faceplate, in lieu of a separate capacity plate.

N. Provide an emergency car lighting system on each car, consisting of a rechargeable battery, charger, controls, and light fixture. The system shall automatically provide emergency light in the car upon failure or abnormal interruption of the normal car lighting service, and function irrespective of the position of the light control switch in the car. The system shall be capable of maintaining a minimum illumination of 1.0 foot-candle when measured four feet above the car floor, and approximately one foot in front of the car operating panel, for a period of not less than four hours. The emergency light shall be located in the main car operating panel.

O. A constant pressure switch that automatically returns to the "OFF" position when released, and a pilot light, for the periodic testing of battery and lamps, shall be provided.

2.39 AUTO DIAL PHONE SYSTEM

A. Furnish and install a complete intercommunication system, as part of this work.

B. The auto dial system shall be located in the auxiliary car operating panel. The speaker and unit shall be mounted on the backside of the perforated stainless steel plate cover.

C. An auto dial system shall be provided for each elevator. The auto dial, when activated by the “PUSH TO TALK” button, shall automatically dial to the 24 hour area.

D. Each elevator shall have an individual phone number.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which the work of this Section depends. Report defects to COTR in writing which may affect the work of this trade or equipment operation, dimensions from site for preparation of shop drawings.

B. Ensure that shafts and openings for moving equipment are plumb, level and in line, and that pit is to proper depth, waterproofed and drained with necessary access doors, ladder, guard.

C. Ensure that machine room is properly illuminated, heated and ventilated, and equipment, foundations, beams correctly located complete with floor and access door.

D. Before fabrication, take necessary job site measurements, and verify where work is governed by other trades. Check measurement of space for equipment, and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.

E. Ensure the following preparatory work, provided under other Sections, has been properly completed to receive the elevator work:

1. Supply of electric feeder wires to the terminals of the elevator control panel, including shunt trip circuit breaker. Provision of hoistway outlets for car light and for light in the pit and outlets in machine room for light. Furnishing of electric power for testing and adjusting elevator equipment.
2. Furnish circuit breaker panel in machine room for car and hoistway lights and receptacles.
3. Supply of power for emergency cab lighting and ventilation from a power panel specified in Division 26, ELECTRICAL and fed by building emergency circuits.
4. Machine room enclosed and protected from moisture, with self closing, self locking door.
5. Provide fire extinguisher in machine room.

F. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 INSTALLATION

A. Perform work with competent mechanics skilled in this work and under the direct control and supervision of the elevator manufacturer's experienced foreman.

B. Set hoistway entrances in alignment with car openings, and true with plumb sill lines.

C. Install machinery, guides, controls, car and all equipment and accessories in accordance with manufacturer's instructions, applicable codes, and standards, to provide a quiet, smooth operating installation, free from side sway, oscillation or vibration.

D. Isolate and dampen machine vibration with properly sized sound-reducing anti-vibration pads.

E. Erect hoistway sills, headers and frames prior to erection of rough walls and doors. Erect fascias and toe guards after rough walls are finished.

F. Grout sills and hoistway entrance frames.

3.3 CLEANING

A. Prior to final acceptance, remove protection from finished or ornamental surfaces, and clean and polish surfaces with due regard to type of material.

3.4 SPACE CONDITIONS

A. Attention is called to overhead clearance, pit clearances, overall space in machine room, and construction conditions at building site in connection with elevator work. Addition or revision of space requirements, or construction changes that may be required for the complete installation of the elevators, must be arranged for and obtained by the Contractor, subject to approval of COTR. Include cost of such changes in bid, and form a part of the contract. Provide proper, satisfactory code legal installation of equipment as a whole, including all construction, accessories and devices in connection with elevator, mechanical and electrical work specified herein.

B. Where concrete beams, floor slabs or other building construction protrude more than 50 mm (2 inches) into hoistway, bevel all top surfaces of said projections 20 gauge steel to an angle of at least seventy-five degrees with the horizontal.

3.5 ARRANGEMENT OF EQUIPMENT

A. Clearance around elevator, mechanical and electrical equipment shall comply with applicable provisions of NEC.

B. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement, without dismantling or removing other equipment in same machine room.

C. Where applicable, locate controller near and visible to its respective pump unit.

3.6 WORKMANSHIP AND PROTECTION

A. All installations shall be made in a first class, neat and skillful manner by mechanics experienced in the trade involved. Mechanically and

electrically correct all details of the installation. All materials and equipment shall be new, and without imperfections.

B. Include recesses, cutouts, slots, holes, patching, grouting, refinishing and the like, to accommodate installation of equipment in the elevator contractor's work. Core drill all new holes in concrete.

C. No structural members shall be cut or altered. Restore work in place, which has been damaged or defaced, equal to original condition.

D. Finish work shall be straight, level and plumb, with true, sharp surfaces and lines. Protect all machinery and equipment against dirt, water or mechanical injury. Thoroughly clean all work at final completion, and deliver in perfect unblemished condition.

E. Grease gun fittings shall be pressure relief type.

F. Completely enclose selector cables or tapes, which are exposed to accidental contact in the machine room with 16 gauge sheet metal or expanded metal guards.

G. Guard exposed gears, sprockets, selector drums, etc. from accidental contact, in accordance with Rule 2.10.1 of ASME A17.1.

3.7 PAINTING AND FINISHING

A. Elevator equipment shall be factory painted with manufacturer's standard finish and color.

1. Elevator pump unit, controllers, and crossheads of cars shall be identified by 100 mm (4 inch) high numerals and letters located as directed. Color of numbers shall contrast with color surfaces to which they are applied.
2. Surface (except contact surfaces of working parts) of elevator items, such as, controllers, car frame, underside of platforms, guide rails, rail brackets, all uncoated ferrous metal items and hydraulic piping shall be given approved prime coat.
3. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease oil, cement, plaster, and other debris. All equipment, except that which is otherwise specified to have factory finish, shall then be given two coats of paint of approved color.
4. Paint floor designation numbers not less than 100 mm (4 inches) high, on hoistway doors, fascias or walls as required by Rule 100.7 of ASME A17.1. The color of the paint used shall contrast with the color of the surfaces to which it is applied.

B. Hoistway entrances of passenger and service elevators:
   1. Door panels shall be parkerized or given equivalent rust resistant treatment and a factory finish of one coat of baked on primer and one factory finish coat of baked on enamel, unless stainless steel.
   2. Fascia plates, toe guards, dust covers, hanger covers and other metal work, including built-in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given approved prime coat in the shop, and one field coat of paint of approved color.

C. Hoistway entrances of freight elevators:
   1. Metal surfaces of doors and frames shall receive approved shop prime coat.
   2. Finish painting, after erection, shall be one coat of paint of approved color. For color, see Section 09 06 00, SCHEDULES FOR FINISHES.

D. Elevator cabs for passenger and service elevators:
   1. Interior and exterior steel surfaces shall be parkerized or given equivalent rust resistant treatment before finish is applied.
   2. Factory finish interior steel surfaces with one coat of baked on enamel or proxylin lacquer. For color, see Section 09 06 00, SCHEDULES FOR FINISHES.
   3. Give exterior faces of car doors one finish coat of oil base paint of medium gray color.

E. Elevator cabs for freight elevators:
   1. Give interior of cab one approved prime coat and a minimum of one coat of oil based enamel. For color, see Section 09 06 00, SCHEDULES FOR FINISHES and/ or Drawings.
   2. Give exterior of cab one approved prime coat and one finish coat of an approved oil base paint.
   3. Surfaces of door frames, door panels, interior cab surfaces, etc., that become damaged or marred from any cause shall be restored to original condition in a satisfactory manner before final acceptance of work.

3.8 PRE-TESTS AND TEST

A. Pre-test as per specifications, the elevators and related equipment, in the presence of the COTR. Test for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by the COTR’s Representative. Test elevators as specified in the presence of, and under the direction of, the COTR’s

Representative. Procedure outlined in the "Inspectors' Manual for Hydraulic Elevators ASME A17.2 shall apply.

B. Upon completion of elevator installation, conduct operating and car testing for approval of COTR. Furnish test instruments and materials, including properly marked test weights, voltmeters, amp probe, sound level meter, centigrade thermometers, light meter, stop watch, MEGGER, pressure gauges, direct reading tachometer for making tests and a means of two-way communication. Conduct tests in the presence of, and witnessed by, a QEI certified elevator inspector.

C. Speed Load Runs: Speed test with no load, 50 percent load, and contract load shall be made in both directions, before the full load run test and after the full load test.

D. Full Load Run Test: Subject the elevator to a test for a period of one hour continuous run, with specified full load in the car. During test run, stop the car at all floors in both directions of travel, for a standing period of not less than eight nor more than twelve seconds per floor. Elevator starting, stopping, acceleration and deceleration shall remain consistent during the test.

E. Temperature Rise Test: Test motors during Full Load Run Test to demonstrate that the temperature rise under operating conditions in the building will not exceed 40 degrees C, above ambient, when measured with a thermometer or other approved means. Do not make full load run tests until constant temperatures are reached on all such pieces of equipment.

F. For installations where microprocessor controls are used:

1. A diagnostic testing device, maintenance terminal or approved means of diagnostic and maintenance suitable for all trouble shooting procedures related to the specific type microprocessor controls installed on this project, shall be provided. This diagnostic testing device or maintenance terminal shall conform to the following:
   a. The diagnostic testing device or maintenance terminal shall become the property of the Veteran's Administration.
   b. The diagnostic testing device or maintenance terminal shall be demonstrated and tested during the final testing of the elevator installation.
   c. A series of not less than ten simulated malfunctions shall be diagnosed properly by the device.
   d. A period of at least four hours shall be dedicated to the instruction of its use to a representative of the Department of Veterans Affairs designated by the COTR.

e. The diagnostic testing device shall be programmed specifically for this job and this job only.

f. The device shall not require recalibration or reconfiguration and shall be functional for the life of the equipment specified herein.

G. Car Leveling Test: Test elevator car leveling device for accuracy of leveling at all floors with no load, 50 percent load, and full load in car, in both directions of travel before and after temperature test. Accuracy of floor leveling, as specified, shall be within plus or minus 3 mm (1/8 inch) of level with any landing floor for which the stop has been initiated (with a definite range of distance in advance of the landing), regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel, and shall maintain the car floor within plus or minus 3 mm (1/8 inch) of level with the landing floor regardless of change in load.

H. Setting of the Car-Door Contacts: Measure the position of the car door at which the car may be started. The distance from full closure shall not exceed that required by ASME A17.1. This test shall be made with the hoistway doors closed, or the hoistway door contact inoperative.

I. Setting of Interlocks: Measure the position of the hoistway door at which the car may be started. And shall not exceed ASME A17.1 requirements.

J. Overload Devices: Test all overload current protection devices in the system at final inspection.

K. Operating and Signal Systems: Operate the car by the operating devices provided. The operation, signals, and automatic floor leveling shall function in accordance with the requirements specified. Starting, stopping and leveling shall be smooth and comfortable, without bumps or jars.

L. Working Pressure: Verify working pressure of the hydraulic system by pressure gauges placed in the system line. Take readings in the machine room with no load, 50 percent load, balanced load and full load in car.

M. Test automatic shutoff valve for proper operation.

N. Insulation Resistance: Elevator's complete wiring system shall be free from short circuits and grounds; and the insulation resistance for the system shall be determined by use of MEGGER.

O. Evidence of malfunction in any tested system or parts of equipment or component part thereof that occurs during, or as a result of, the tests, shall be corrected, repaired, or replaced at no additional cost to the Government, and the test repeated.

P. If any equipment fails test requirements and a reinspection is required, the Contractor shall be responsible for the cost of reinspection including salaries, transportation expenses and other expenses incurred by the representatives of the COTR.

3.9 INSTRUCTION OF PERSONNEL

A. Provide competent instructors to train Veteran’s Administration personnel in care and operation of all parts of equipment. Instruction on hydraulic elevator installation shall be given during regular working hours. Instruction shall commence upon completion of all work required and upon initial operation before final acceptance of work. Instructors shall be qualified representatives, possessing complete knowledge of equipment.

B. Instructors shall be available for one 8-hour working day minimum, with instruction period directed by the COTR.

C. In addition to oral instruction, written instructions in triplicate relative to care and operation of all parts of equipment shall be furnished and delivered to the COTR in independently bound folders. Video cassette recording will also be acceptable. Written instructions shall include complete, correct and legible wiring diagrams, nomenclature sheets of all electrical apparatus, including location of each device, complete and comprehensive sequence of operations, complete parts lists with descriptive literature and identification, diagrammatic cuts of equipment and parts, etc. Information shall also include electrical operating characteristics of all circuits, fields, relays, timers and electronic devices, as well as RPM values and related characteristics for all rotating equipment. Provide any supplementary instructions for adjustment and care of new equipment as may become necessary due to changes, modifications and/or replacement of equipment or its operation, under requirements of paragraph entitled, "Warranty of Construction".

3.10 INSPECTIONS AND MAINTENANCE

A. Furnish complete maintenance and inspection service on entire elevator installation for a period of (1) one year after completion and acceptance of the elevator installation by the COTR. This maintenance service shall begin concurrently with the warranty. Maintenance work shall be performed by skilled elevator personnel directly employed and supervised by the same company that furnished and installed the elevator equipment specified herein.

B. The maintenance service shall include the following:

1. Bi-weekly systematic examination of equipment.

2. Cleaning, lubricating, adjusting, repairing and replacing of all parts as necessary to keep the equipment in first class condition and proper working order.
3. Furnishing all lubricant, cleaning materials and parts required.
4. The performance standards set forth in this specification, including flight time, cycle time, and door times shall be maintained at all times.
5. The operational system shall be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
6. Maintain smooth starting and stopping and accurate leveling at all times.

C. Maintenance service shall not include the performance of any work required as a result of improper use, accidents, or negligence for which the contractor is not directly responsible.

D. Provide 24 hour emergency call-back service which shall consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency trouble develop between regular examinations. Overtime emergency call-back service shall be limited to minor adjustments and repairs required to protect the immediate safety of the equipment and persons in and about the elevator.

E. Service and emergency personnel shall report to the COTR or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed shall be given to the COTR.

F. The contractor shall maintain a log in the machine room. The log shall list the date and time of all weekly examinations and all trouble calls. Each trouble call shall be fully described including the nature of the call, necessary correction performed or parts replaced.

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SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section shall apply to all sections of Division 22.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

D. Section 31 20 00, EARTH MOVING: Excavation and Backfill.

E. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout.

F. Section 05 50 00, METAL FABRICATIONS.

G. Section 07 84 00, FIRESTOPPING.

H. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.

I. Section 07 92 00, JOINT SEALANTS.

J. Section 09 91 00, PAINTING.

K. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

L. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

M. Section 23 09 23, DIRECT DIGITAL CONTROLS FOR HVAC.

N. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

O. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT .

P. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology

and basic design that has a proven satisfactory service record of at least three years.

2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Contracting Officers Technical Representative (COTR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos shall not be used.

B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
   2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
   3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
   4. All welds shall be stamped according to the provisions of the American Welding Society.

C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COTR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

D. Execution (Installation, Construction) Quality:
   1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the COTR for resolution. Written hard copies or computer files of manufacturer’s installation instructions shall be provided to the COTR at least two weeks prior to commencing installation of any item.
   2. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved.

E. Guaranty: Warranty of Construction, FAR clause 52.246-21.

F. Plumbing Systems: IPC, International Plumbing Code.

1.4 SUBMITTALS

A. Submittals shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMNON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Upon request by Government, lists of previous installations for selected items of equipment shall be provided. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.

G. Manufacturer's Literature and Data: Manufacturer’s literature shall be submitted under the pertinent section rather than under this section.
   1. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
   2. Equipment and materials identification.
   3. Fire stopping materials.
   4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   5. Wall, floor, and ceiling plates.

H. Coordination Drawings: In accordance with GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION. Complete consolidated and coordinated layout drawings shall be submitted for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and

adequate clearance for all equipment, piping, pumps, valves and other items. All valves, trap primer valves, water hammer arrestors, strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping until layout drawings have been approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.

1. Mechanical equipment rooms.
2. Interstitial space.
3. Hangers, inserts, supports, and bracing.
4. Pipe sleeves.
5. Equipment penetrations of floors, walls, ceilings, or roofs.

I. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.
3. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the COTR. Such replacement shall be at no additional cost to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.

4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC), latest edition. All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below shall 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 Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code (BPVC):
SEC IX-2007.....Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications.

C. American Society for Testing and Materials (ASTM):
A36/A36M-2008.....Standard Specification for Carbon Structural Steel
A575-96 (R 2007).....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
E84-2005.....Standard Test Method for Surface Burning Characteristics of Building Materials
E119-2008a.....Standard Test Methods for Fire Tests of Building Construction and Materials

D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-58-02.....Pipe Hangers and Supports-Materials, Design and Manufacture

SP 69-2003 (R 2004).....Pipe Hangers and Supports-Selection and Application

E. National Electrical Manufacturers Association (NEMA):
MG1-2003, Rev. 1-2007...Motors and Generators

E. International Code Council, (ICC):
IBC-06, (R 2007).....International Building Code
IPC-06, (R 2007).....International Plumbing Code

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. STANDARDIZATION OF COMPONENTS SHALL BE MAXIMIZED TO REDUCE SPARE PART requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
   1. All components of an assembled unit need not be products of same manufacturer.
   2. Constituent parts that are alike shall be products of a single manufacturer.
   3. Components shall be compatible with each other and with the total assembly for intended service.
   4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, shall be the same make and model

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 SAFETY GUARDS

A. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and

attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

B. All Equipment shall have moving parts protected from personal injury.

2.4 LIFTING ATTACHMENTS

Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.5 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods shall conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS; and, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70-2011 without additional time or cost to the Government.
2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71° C (160° F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
   b. Other wiring at boilers and to control panels shall be NFPA 70-2011 designation THWN.

c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.

4. Motor sizes shall be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

5. Motors utilized with variable frequency drives shall be rated “inverter-ready” per NEMA Standard, MG1, Part 31.4.4.2.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency or Premium Efficiency” by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act of 1992 (EPACT). Motors not specified as “high efficiency or premium efficient” shall comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.

F. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

2.6 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or

rigid black plastic with white letters specified in Section 09 91 00, PAINTING shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, fans, etc. shall be identified.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.

D. Control Items: All temperature, pressure, and controllers shall be labeled and the component’s function identified. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm(1/4-inch) for service designation on 19 gage, 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. A copy of the valve list shall be mounted in picture frames for mounting to a wall.
4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling.

2.7 FIRE STOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for pipe insulation.

2.8 GALVANIZED REPAIR COMPOUND

A. Mil. Spec. DOD-P-21035B, paint.

2.9 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC), latest edition, and SECTION 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Submittals based on the International Building Code (IBC), latest edition, SECTION 13 05 41 requirements, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the COTR in all cases. See these specifications for lateral force design requirements.

B. Type Numbers Specified: MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (4 inches) thick when approved by the COTR for each job condition.
   3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (4 inches) thick when approved by the COTR for each job condition.

D. For Attachment to Steel Construction: MSS SP-58.
   1. Welded attachment: Type 22.
   2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8-inch) outside diameter.

E. Attachment to Metal Pan or Deck: As required for materials specified in Section 05 31 00, STEEL DECKING.

F. For Attachment to Wood Construction: Wood screws or lag bolts.

G. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches

by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Trapeze hangers are not permitted for steam supply and condensate piping.

1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13 mm (1/2-inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

I. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with isolation tape to prevent electrolysis.
      2) For vertical runs use epoxy painted or plastic coated riser clamps.
      3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
      4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp. Spring Supports (Expansion and contraction of vertical piping):
   1) Movement up to 20 mm (3/4-inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
   2) Movement more than 20 mm (3/4-inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.
j. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):
   a. Horizontal piping: Type 1, 5, 7, 9, and 10.
   b. Chrome plated piping: Chrome plated supports.
   c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
   d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

J. Pre-insulated Calcium Silicate Shields:
   1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
   2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
   3. Shield thickness shall match the pipe insulation.
   4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
      a. Shields for supporting cold water shall have insulation that extends a minimum of one inch past the sheet metal.
      b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural

steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

K. Seismic Restraint of Piping: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.10 PIPE PENETRATIONS

A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.

B. Pipe penetration sleeve materials shall comply with all fire stopping requirements for each penetration.

C. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of COTR.

D. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

E. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.

F. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel Sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.

G. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.

H. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

I. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.11 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COTR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COTR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.12 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch) pipe, 0.89 mm (0.035-inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

2.13 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.

C. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:

1. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COTR where working area space is limited.
2. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COTR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COTR for approval.

3. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.

F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COTR. Damaged or defective items in the opinion of the COTR, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. shall be used for all pad or floor mounted equipment. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.

K. Many plumbing systems interface with the HVAC control system. See the HVAC control points list and section 23 09 23 DIRECT DIGITAL CONTROLS FOR HVAC

L. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

M. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

N. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.

O. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.

P. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain,

operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Para. 3.1 shall apply.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

3.3 RIGGING

A. Openings in building structures shall be planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.

C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Rigging plan and methods shall be referred to COTR for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the COTR.

B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents

use. A minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work shall be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC), latest edition, and these specifications.

E. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems shall be supported in channel troughs.

F. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each

different application shall be provided. All materials shall be delivered to COTR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.

D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points shall be extended to one side of the equipment.

3.6 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
2. The following Material And Equipment shall NOT be painted::
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gages and thermometers.
   j. Glass.
   k. Name plates.
3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer

5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
6. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this.

3.7 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance shall be placed on factory built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.8 STARTUP AND TEMPORARY OPERATION

A. Start up of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.9 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COTR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests such systems respectively during first actual seasonal use of respective systems following completion of work.

3.10 OPERATION AND MAINTENANCE MANUALS

A. Provide four bound copies. The Operations and maintenance manuals shall be delivered to COTR not less than 30 days prior to completion of a phase or final inspection.

B. All new and temporary equipment and all elements of each assembly shall be included.

C. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.

D. Manufacturer’s installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.

E. Lubrication instructions, type and quantity of lubricant shall be included.

F. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.

G. Set points of all interlock devices shall be listed.

H. Trouble-shooting guide for the control system troubleshooting guide shall be inserted into the Operations and Maintenance Manual.

I. The combustion control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.

J. Emergency procedures.

3.11 INSTRUCTIONS TO VA PERSONNEL

Instructions shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 22 05 12
GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section describes the general motor requirements for plumbing equipment.

1.2 RELATED WORK:

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements common to more than one section of Division 26.

B. 26 29 11, LOW-VOLTAGE MOTOR STARTERS: Starters, control and protection of motors: Section

C. Section 26 24 19, MOTOR-CONTROL CENTERS: Motor Control Centers.

1.3 SUBMITTALS:

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Motor nameplate information shall be submitted including electrical ratings, dimensions, mounting details, materials, horsepower, power factor, current as a function of speed, current efficiency, speed as a function of load, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.

C. Manuals:

1. Companion copies of complete maintenance and operating manuals, including technical data sheets and application data shall be submitted simultaneously with the shop drawings.

D. Certification: Two weeks prior to final inspection, unless otherwise noted, four copies of the following certification shall be submitted to the Contracting Officer Technical Representative (COTR):

1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.4 APPLICABLE PUBLICATIONS:

A. The publications listed below (including amendments, addenda, revisions, supplements and errata) shall form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Electrical Manufacturers Association (NEMA):

MG 1-07.....Motors and Generators

MG 2-01.....Safety Standard and Guide for Selection, Installation and Use of Electric Motors and Generators

C. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC)

PART 2 - PRODUCTS

2.1 MOTORS:

A. For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.

B. Voltage ratings shall be as follows:

1. Single phase:
   a. Motors connected to 120-volt systems: 115 volts.
   b. Motors connected to 208-volt systems: 200 volts.
   c. Motors connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
2. Three phase:
   a. Motors connected to 208-volt systems: 200 volts.
   b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
   c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
   d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
   e. Motors connected to high voltage systems: Shall conform to NEMA Standards for connection to the nominal system voltage shown on the drawings.

C. Number of phases shall be as follows:

1. Motors, less than 373 W (1/2 HP): Single phase.
2. Motors, 373 W (1/2 HP) and larger: 3 phase.

3. Exceptions:
   a. Hermetically sealed motors.
   b. Motors for equipment assemblies, less than 746 W (1 HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

D. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

E. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

F. Motor Enclosures:
   1. Shall be the NEMA types shown on the drawings for the motors.
   2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.
   3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.
   4. All motors in hazardous locations shall be approved for the application and meet the Class and Group as required by the area classification.

G. Electrical Design Requirements
   1. Motors shall be continuous duty.
   2. The insulation system shall be rated minimum of class B, 130° C (266° F).
   3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80° C (176° F).
   4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
   5. Motors shall be suitable for full voltage starting, unless otherwise noted.
   6. Motors for variable frequency drive applications shall adhere to NEMA standards publication MG 1, Part 30, Application considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable voltage or

Adjustable frequency controls, or both, or Part 31, Definite Purpose Inverter Fed Polyphase Motors.

H. Mechanical Design Requirements

1. Bearings shall be rated for a minimum of 26,280 hours L-10 life at full load direct coupled, except vertical high thrust motors.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30% of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 0.15 inch per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and larger shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5° C (41° F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

I. Additional requirements for specific motors, as indicated in other sections, shall also apply.

J. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 Watts (1 Horsepower) or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 Watts (one horsepower) or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

K. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be installed unless the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

PART 3 - EXECUTION

3.1 INSTALLATION:

Install motors in accordance with manufacturer’s recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2 FIELD TESTS

Megger all motors after installation, before start-up. All shall test free from grounds.

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SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes the requirements for water meters and pressure gages.

1.2 RELATED WORK

Section 22 05 11, COMMON WORK RESULTS FOR 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. Water Meter.
2. Pressure Gages.
3. BACnet communication protocol
4. Product certificates for each type of meter and gauge

C. Operations and Maintenance manual shall include:

1. System Description
2. Major assembly block diagrams
3. Troubleshooting and preventive maintenance guidelines
4. Spare parts information.

D. Shop Drawings shall include the following:

1. One line, wiring and terminal diagrams including terminals identified, protocol or communication modules, and Ethernet connections.

1.4 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 National Standards Institute (ANSI):
American Society of Mechanical Engineers (ASME): (Copyrighted Society)
B40.1-05.....Gauges-Pressure Indicating Dial Type-Elastic

C. American Water Works Association (AWWA):
C700-07 (R 2003).....Standard for Cold Water Meters, Displacement Type, Bronze Main Case
C701-07.....Cold Water Meters-Turbine Type, for Customer Service AWWA/ ANSI

C702-01.....Cold water meters – Compound Type

D. International Code Council (ICC):

IPC-06.....(2007 Supplement) International Plumbing Code

1.5 AS-BUILT DOCUMENTATION

A. The electronic documentation and copies of the Operations and Maintenance Manual, approved submittals, shop drawings, and other closeout documentation shall be prepared by a computer software program complying with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C 794d). The manufacturer or vendor of the software used to prepare the electronic documentation shall have a Voluntary Product Accessibility Template made available for review and included as part of the Operations and Maintenance Manual or closeout documentation. All available accessibility functions listed in the Voluntary Accessibility Template shall be enabled in the prepared electronic files. As Adobe Acrobat is a common industry format for such documentation, following the document, "Creating Accessible Adobe PDF files, A Guide for Document Authors" that is maintained and made available by Adobe free of charge is recommended.”

B. Four sets of manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

C. Four sets of operation and maintenance data updated to include submittal review comments shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

PART 2 – PRODUCTS

2.1 TURBINE WATER METER

A. The water meter shall be Turbine type, Class II, in-line, horizontal axis, and fully conform to AWWA C701. Peak domestic flow shall be 4.73

L/S (75 gpm). The meter Register shall indicate flow in liters (U.S. gallons).

B. The water meter shall be rated for use at temperatures ranging from -40° C (-40° F) and +70° C (158° F) and operate at a working pressure of 1034 kPa (150-psig).

C. The turbine case shall be constructed of bronze.

D. The register box rings and lid shall be made of cast copper alloy containing not less that 75% copper. Forged or die cast copper alloy containing not less than 75% copper or a suitable synthetic polymer.

E. The flow measuring turbine shall be made of vulcanized hard rubber or suitable synthetic polymer with specific gravity approximately equal to that of water. The measuring turbine shall have sufficient dimensional stability to retain operating clearances at the full range of working temperatures.

F. All external case closures, such as rings, clamps, screws, bolts, cap bolts, nuts and washers shall be designed for easy removal following lengthy service.

G. The turbine meter shall have flanged ends and supplied with companion flanges, gaskets, and with bolts and nuts. The companion flanges shall be made of cast iron.

H. The meter shall not register less than 97% and not more than 103% of the water actually passing through it at any rate of flow within the normal test flow limits specified in AWWA 701.

2.2 WATER METER STRAINER

A. All meters sizes 50 mm or DN50 (2 inches) and above, shall be fitted with a bronze inlet strainer with top access. The strainer shall conform to AWWA 702.

2.3 WATER METER PROGRAMMING

A. All meters 50 mm or DN50 (2 inches) and above shall be programmable with software supplied by the meter manufacturer.

B. The software shall have a Microsoft based interface and operate on the latest Windows operating system. The software shall allow the user to configure the meter, troubleshoot the meter, query and display meter parameters, and configure data and stored values.

C. The meter firmware shall be upgradeable through one of the communication ports without removing the unit from service.

D. the meter shall include output for analog 4-20 milliamp signals and binary output.

E. The meter shall have two dry contact relays outputs for alarm or control functions.

2.4 WATER METER COMMUNICATION PROTOCOL

A. The meter shall use a native BACnet Ethernet communication protocol supporting HTTP. The communications shall be protected against surges induced on its communications channels.

2.5 PRESSURE GAGES FOR WATER AND SEWAGE USAGE

A. ANSI B40.1 all metal case 114 mm (4-1/2 inches) diameter, bottom connected throughout, graduated as required for service, and identity labeled. Range shall be 0 to 1375 kPa (0 to 200 psi) gauge.

B. The pressure element assembly shall be bourdon tube. The mechanical movement shall be lined to pressure element and connected to pointer.

C. The dial shall be non-reflective aluminum with permanently etched scale markings graduated in kPa and psi.

D. The pointer shall be dark colored metal.

E. The window shall be glass.

F. The ring shall be brass or stainless steel.

G. The accuracy shall be grade A, plus or minus 1 percent of middle half of scale range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Direct mounted pressure gages shall be installed in piping tees with pressure gage located on pipe at the most readable position.

B. Valves and snubbers shall be installed in piping for each pressure gage.

C. Test plugs shall be installed on the inlet and outlet pipes all heat exchangers or water heaters serving more than one plumbing fixture.

D. Pressure gages shall be installed where indicated on the drawings and at the following locations:

1. Building water service entrance into building
2. Inlet and outlet of each pressure reducing valve
3. Suction and discharge of each domestic water pump or re-circulating hot water return pump.

E. Water meter installation shall conform to AWWA C700, AWWA C701, and AWWA C702. Electrical installations shall conform to IEEE C2, NFPA 70-

2011 (National Electric Code), and to the requirements specified herein. New materials shall be provided.

F. Each water meter shall communicate with the building energy management and control system and report daily water consumption and peak daily flow rate.

3.2 FIELD QUALITY CONTROL

A. The meter assembly shall be visually inspected and operationally tested. The correct multiplier placement on the face of the meter shall be verified.

3.3 TRAINING

A. A training course shall be provided to the medical center on meter configuration and maintenance. Training manuals shall be supplied for all attendee with four additional copies supplied. The training course shall cover meter configuration, troubleshooting, and diagnostic procedures.

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SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

1.2 RELATED WORK

A. Section 22 05 11, COMMON WORK RESULTS FOR 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. Valves.
2. Backflow Preventers.
3. Pressure Reducing Valves.
4. Backwater Valves5. All items listed in Part 2 - Products.

1.4 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):A536-84(R 2004) Standard Specification for Ductile Iron Castings

C. American Society of Sanitary Engineering (ASSE)

ASSE 1003-01 (R 2003)...Performance Requirements for Water Pressure Reducing Valves

ASSE 1012-02.....Backflow Preventer with Intermediate Atmospheric Vent

ASSE 1013-05.....Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers

D. International Code Council (ICC)

IPC-06 (R 2007).....International Plumbing Code

E. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-25-98.....Standard Marking System for Valves, Fittings, Flanges and UnionsSP-67-02a (R 2004) Butterfly Valve of the Single flange Type (Lug Wafer)

SP-70-06.....Cast Iron Gate Valves, Flanged and Threaded Ends.
SP-72-99.....Ball Valves With Flanged or Butt Welding For General Purpose
SP-80-03.....Bronze Gate, Globe, Angle and Check Valves.
SP-110-96.....Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

1.5 DELIVERY, STORAGE, AND HANDLING

A. Valves shall be prepared for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.
B. Valves shall be prepared for storage as follows:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature.
C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES

A. Asbestos packing and gaskets are prohibited.
B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.
C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.

D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 meters (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.

E. Ball valves, pressure regulating valves, gate valves, globe valves, and plug valves used to supply potable water shall meet the requirements of NSF 61.

F. Shut-off:

1. Cold, Hot and Re-circulating Hot Water:

a. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-72, SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4140 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be solder,

b. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A 536, ductile iron.

C. Balancing:

1. Hot Water Re-circulating, 80 mm or DN80 (3 inches) and smaller manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure read-out ports across the valve seat area. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (¼" NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.

D. Check:

1. Check valves less than 80 mm or DN80 (3 inches) and smaller) shall be class 125, bronze swing check valves with non metallic Buna-N

disc. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B 62, solder joints, and PTFE or TFE disc.

E. Globe:

1. 80 mm or DN80 (3 inches) or smaller: Class 150, bronze globe valve with non metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B 62 with solder ends, copper-silicon bronze stem, TPFE or TFE disc, malleable iron hand wheel.

2.2 WATER PRESSURE REDUCING VALVE AND CONNECTIONS

A. 80 mm or DN80 (3 inches) or smaller: The pressure reducing valve shall consist of a bronze body and bell housing, a separate access cover for the plunger, and a bolt to adjust the downstream pressure. The bronze bell housing and access cap shall be threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no flow conditions. The assembly shall be accessible for maintenance without having to remove the body from the line.

B. The regulator shall have a tap for pressure gauge.

C. The regulator shall have a temperature rating of 100° C (210° F) for hot water or hot water return service. Pressure regulators shall have accurate pressure regulation to 6.9-kPa (+/- 1 psig).

D. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.

E. Connections Valves and Strainers: shut off valves shall be installed on each side of reducing valve and a bypass line equal in size to the regulator inlet pipe shall be installed with a normally closed globe valve. A strainer shall be installed on inlet side of, and same size as pressure reducing valve. A pressure gage shall be installed on the low pressure side of the line.

2.3 BACKWATER VALVE

A. The backwater valve shall have a cast iron body, automatic type ABS valve seat and flapper which are slightly open during periods of non

operation. The cleanout shall be extended to the finish floor and fit with a threaded countersunk plug. A clamping device shall be included when the cleanout extends through the waterproofing membrane.

B. When the backwater valve is installed greater than 600 mm (24 inches) below the finish floor elevation, a pit or manhole large enough for a repair person can enter to service the backwater valve shall be installed.

2.4 BACKFLOW PREVENTERS

A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be ASSE 1013 listed and certified.

B. Reduced pressure backflow preventers shall be installed in the following applications.

1. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.
2. Water service entrance from loop system.
3. Atmospheric Vacuum Breaker: ASSE 1001
   a. Hose bibs and sinks w/threaded outlets.
   b. Disposers.
   c. All kitchen equipment, if not protected by air gap.
   d. Detergent system

C. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated duct iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be Noryl (NSF listed). The stem shall be stainless steel conforming to ASTM A276. The seat disc elastomer shall be EPDM. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet.

D. The atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be either cast bronze. All internal polymers shall be NSF listed. The seat disc elastomer shall be silicone. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or

inaccessible location or where the venting of water from the device during normal operation is deemed objectionable.

E. The double check detector backflow prevention assembly shall be ASSE listed 1048 and supply with full port OS&Y gate valves. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve shall be Noryl (NSF listed). The stem shall be stainless steel conforming to ASTM A 276. The seat disc elastomers shall be EPDM. The first and second check valve shall be accessible for maintenance without removing the device from the line.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.

B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.

C. Threads on valve and mating pipe shall be examined for form and cleanliness.

D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.

C. Valves shall be installed in horizontal piping with stem at or above center of pipe

D. Valves shall be installed in a position to allow full stem movement.

E. Check valves shall be installed for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves shall be replaced if persistent leaking occurs.

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SECTION 22 08 00
COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 22.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the Department of Veterans Affairs will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning plumbing systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

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 (USGBC) LEED™ rating program and to support delivery of project performance in accordance with the Contract Documents developed with the approval of the VA.

1. Commissioning activities and documentation for the LEED™ section on “Energy and Atmosphere” prerequisite of “Fundamental Building Systems Commissioning”.
2. Commissioning activities and documentation for the LEED™ section on “Energy and Atmosphere” requirements for the “Enhanced Building System Commissioning” credit.
3. Activities and documentation for the LEED™ section on “Measurement and Verification” requirements for the Measurement and Verification credit.

D. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in this Division 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 Plumbing systems will be commissioned:

1. Domestic Hot Water Systems (Domestic water heaters, steam-to-hot water converters, hot water circulating pumps and motors, controls, combustion burners/fans/motors).
2. Storm Sump Pumps (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the

checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.2 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 22 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Contracting Officer Technical Representative (COTR). The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.4 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the COTR and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the COTR after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 22 Sections for additional Contractor training requirements.

----- END -----

SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

A. Penetrations in rated enclosures: Section 07 84 00, FIRESTOPPING.

B. Preparation and finish painting and identification of piping systems: Section 09 91 00, PAINTING.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Pipe Insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

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. Piping.
2. Strainers.
3. All items listed in Part 2 - Products.

1.4 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. Federal Specifications (Fed. Spec.):

A-A-1427C.....Sodium Hypochlorite Solution

A-A-59617.....Unions, Brass or Bronze Threaded, Pipe Connections and Solder-Joint Tube Connections

C. American National Standards Institute (ANSI):

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A13.1-96.....Scheme for Identification of Piping Systems

B16.3-98.....Malleable Iron Threaded Fittings ANSI/ASME

B16.4-98.....Cast Iron Threaded Fittings Classes 125 and 250 ANSI/ASME

B16.9-01.....Factory-Made Wrought Steel Buttwelding Fittings ANSI/ASME

B16.11-01.....Forged Steel Fittings, Socket-Welding and Threaded ANSI/ASME
B16.12-98.....Cast Iron Threaded Drainage Fittings ANSI/ASME
B16.15-85(R 1994).....Cast Bronze Threaded Fittings ANSI/ASME
B16.18-01.....Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME
B16.22-01.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings ANSI/ASME Element ANSI/ASME

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

A47-99.....Ferritic Malleable Iron Castings Revision 1989
A53-02.....Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless
A74-03.....Cast Iron Soil Pipe and Fittings
A183-83(R1998).....Carbon Steel Track Bolts and Nuts
A312-03.....Seamless and Welded Austenitic Stainless Steel Pipe
A536-84(R1999) E1.....Ductile Iron Castings
A733-03.....Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
B32-03.....Solder Metal
B61-02.....Steam or Bronze Castings
B62-02.....Composition Bronze or Ounce Metal Castings
B75-99(Rev A).....Seamless Copper Tube
B88-03.....Seamless Copper Water Tube
B584-00.....Copper Alloy Sand Castings for General Applications Revision A
B687-99.....Brass, Copper, and Chromium-Plated Pipe Nipples
C564-03.....Rubber Gaskets for Cast Iron Soil Pipe and Fittings
D2000-01.....Rubber Products in Automotive Applications
D4101-03b Propylene Plastic Injection and Extrusion Materials
D2447-93.....Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter
D2564-94.....Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D2665-94 Revision A.....Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
D4101-03b.....Propylene Plastic Injection and Extrusion Materials
E1120.....Standard Specification For Liquid Chlorine
E1229.....Standard Specification For Calcium Hypochlorite

E. American Water Works Association (AWWA):
C110-03/ A21.10-03.....Ductile Iron and Gray Iron Fittings - 75 mm thru 1200 mm (3 inch thru 48 inches) for Water and other liquids AWWA/ ANSI
C151-00/ A21.51-02.....Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids AWWA/ ANSI
C203-02.....Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied AWWA/ ANSI
C651-99.....Disinfecting Water Mains

F. American Welding Society (AWS):
A5.8-92.....Filler Metals for Brazing

G. International Association of Plumbing and Mechanical Officials (IAPMO):
International Plumbing Code - 2006
IS6-93.....Installation Standard

H. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
SP-72-99.....Ball Valves With Flanged or Butt Welding For General Purpose
SP-110-96.....Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

I. American Society of Sanitary Engineers (ASSE):
1001-02.....Pipe Applied Atmospheric Type Vacuum Breakers
1018-01.....Performance for trap seal primer valve-water supply fed
1020-04.....Vacuum Breakers, Anti-Siphon, Pressure Type

J. Plumbing and Drainage Institute (PDI):

PDI WH-201.....Water Hammer Arrestor

PART 2 - PRODUCTS

2.1 WATER SERVICE CONNECTIONS TO BUILDINGS

A. From inside face of exterior wall to a distance of approximately 1500 mm (5 feet) outside of building and underground inside building, material selected shall be the same for the size specified.

B. Under 75 mm (3 inch) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings as specified under Article, INTERIOR DOMESTIC WATER PIPING. Use brazing alloys, AWS A5.8, Classification BCuP.

C. Flexible Expansion Joint: Ductile iron with ball joints rated for 1725 kPa (250 psi) working pressure conforming to ANSI/AWWA A21.53/C153, capable of deflecting a minimum of 30 degrees and expanding simultaneously to the amount shown on the drawings. Flexible expansion joint shall have the expansion capability designed as an integral part of the ductile iron ball castings. Pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be factory holiday tested with a 1500 volt spark test. Flexible expansion joint shall have flanged connections conforming to ANSI/AWWA A21.11/C110. Bolts and nuts shall be 316 stainless steel and gaskets shall be neoprene.

2.2 INTERIOR DOMESTIC WATER PIPING

A. Pipe: Copper tube, ASTM B88, Type K or L, drawn.

B. Fittings for Copper Tube:

1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints.

2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

C. Fittings for Stainless Steel:
   1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.
   2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or Malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining screwed pipe to copper tubing.

E. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8, Classification BCuP.

2.3 EXPOSED WATER PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
   1. Pipe: Fed. Spec. WW-P-351, standard weight.
   2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
   3. Nipples: ASTM B 687, Chromium-plated.
   4. Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

2.4 TRAP PRIMER WATER PIPING:

A. Pipe: Copper tube, ASTM B88, type K, hard drawn.

B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.

C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

2.5 WATERPROOFING

A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.

B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.

C. Walls: See detail shown on drawings.

2.6 STRAINERS

A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.

B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.

C. Body: Smaller than 80 mm (3 inches), brass or bronze; 80 mm (3 inches) and larger, cast iron or semi-steel.

2.7 DIELECTRIC FITTINGS

Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.8 STERILIZATION CHEMICALS

A. Liquid Chlorine: ASTM E1120.

B. Hypochlorite: ASTM E1229, or Fed. Spec. AA-1427C, grade B.

2.9 WATER HAMMER ARRESTER:

Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N 0-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI WH 201). Unit shall be as manufactured by Precision Plumbing Products Inc., Watts or Sioux Chief. Provide water hammer arrestors at all solenoid valves, at all groups of two or more flush valves, at all quick opening or closing valves, and at all medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the International Plumbing Code and the following:

1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.

3. All pipe runs shall be laid out to avoid interference with other work.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. Pipe Hangers, Supports and Accessories:
   a. All piping shall be supported per of the National Standard Plumbing Code, Chapter No. 8.
   b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
   c. Floor, Wall and Ceiling Plates, Supports, Hangers:
      1) Solid or split unplated cast iron.
      2) All plates shall be provided with set screws.
      3) Pipe Hangers: Height adjustable clevis type.
      4) Adjustable Floor Rests and Base Flanges: Steel.
      5) Concrete Inserts: "Universal" or continuous slotted type.
      6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
      7) Riser Clamps: Malleable iron or steel.
      8) Rollers: Cast iron.
      9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
      10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
      11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.

6. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
   a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
   b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

B. Piping shall conform to the following:
1. Domestic Water:
   a. Where possible, grade all lines to facilitate drainage. Provide drain valves at bottom of risers. All unnecessary traps in circulating lines shall be avoided.
   b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

A. General: Test system either in its entirety or in sections.
B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.
C. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.

3.3 STERILIZATION

A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.

B. Use either liquid chlorine or hypochlorite for sterilization.

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SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Hot water recirculation pump system.

1.2 RELATED WORK

A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

C. SECTION 22 08 00 – COMMISSIONING OF PLUMBING SYSTEMS.
Requirements for commissioning, systems readiness checklist, and training.

D. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

a. Pump:

i. Manufacturer and model.

ii. Operating speed.

iii. Capacity.

iv. Characteristic performance curves.

b. Motor:

i. Manufacturer, frame and type.

ii. Speed.

iii. Current Characteristics.

iv. Efficiency.

C. Certified copies of all the factory and construction site test data sheets and reports.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

a. Include complete list indicating all components of the systems.

b. Include complete diagrams of the internal wiring for each item of equipment.

c. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

E. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

1.4 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. National Electrical Manufacturers Association (NEMA):
ICS6-93 (R2006).....Industrial Control and Systems Enclosures
250-08.....Enclosures for Electrical Equipment (1000 Volts Maximum)

C. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code: 2010
Section VIII.....Pressure Vessels, Division I and II

D. Underwriters' Laboratories, Inc. (UL):
508-99 (R2008)..... Standards for Industrial Control Equipment

PART 2 - PRODUCTS

2.1 INLINE HOT WATER RECIRCULATING PUMP

A. Centrifugal in-line horizontal oil lubricated pump designed for quiet operation and 862 kPa (125 psi).

B. Bronze body construction capable of pumping 15 LPM (4 GPM) @ 10.5 Meters of head (35 Feet of head) when drive by 0.5 HP single phase, 208 VAC motor. Pump shall be non-overloading at any point on the pump curve.

C. Pump controlled from on/off aquastat located at pump. In addition, the pump shall be provided with "on-off" switch for shut down. In the inlet and outlet piping of the pump shutoff valves shall be installed to permit service to the pump without draining the system. A check valve shall be installed in the pump discharge piping immediately downstream of the pump.

PART 3 - EXECUTION

3.1 STARTUP AND TESTING

A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. System Test: After installation is completed provide an operational test of the completed system including flow rates, pressure compliance, alarms and all control functions.

C. When any defects are detected, correct defects and repeat test.

D. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing

schedules with the Contracting Officer Technical Representative (COTR) and Commissioning Agent. Provide a minimum of 7 days prior to notice.

3.2 COMMISSIONING

A. Provide Commissioning Documentation accordance with the requirements of Section 22 08 00 – COMMISSIONING OF PLUMBING SYSTEMS for all inspection, startup, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this Section of the specification will be tested as part of a larger system. Refer to Section 22 08 00 – COMMISSIONING OF PLUMBING SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.3 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for four hours to instruct VA Personnel in operation and maintenance of units.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 13 00
FACILITY SANITARY AND VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.

D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.

E. Section 07 92 00 Joint Sealants: Sealant products.

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. Piping.
2. Floor Drains.
3. Cleanouts.
4. All items listed in Part 2 - Products.

C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

1.4 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 of Mechanical Engineers (ASME): (Copyrighted Society)

A112.6.3-01 (R 2007)....Standard for Floor and Trench Drains
A13.1-07.....Scheme for Identification of Piping Systems
B16.3-06.....Malleable Iron Threaded Fittings, Classes 150 and 300.
B16.4-06.....Standard for Grey Iron Threaded Fittings Classes 125 and 250

B16.12-98 (R 2006)......Cast Iron Threaded Drainage Fittings
B16.15-06..............Cast Bronze Threaded Fittings, Classes 125 and 250

C. American Society for Testing and Materials (ASTM):
A47/A47M-99 (R 2004)....Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process
A53/A53M-07.............Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated, Welded and Seamless
A74-06.................Standard Specification for Cast Iron Soil Pipe and Fittings
A183-03.................Standard Specification for Carbon Steel Track Bolts and Nuts
A536-84(R 2004).........Standard Specification for Ductile Iron Castings
B32-08..................Standard Specification for Solder Metal
B75-02..................Standard Specification for Seamless Copper Tube
B306-02.................*Standard Specification for* Copper Drainage Tube (DWV)
B584-06a................Standard Specification for Copper Alloy Sand Castings for General Applications
C564-03a................Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
D2000-08................Standard Classification System for Rubber Products in Automotive Applications
D2564-04E1..............Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
D2665-08................*Standard Specification for* Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D. International Code Council:
IPC-06..................International Plumbing Code

E. Cast Iron Soil Pipe Institute (CISPI):
301-05..................Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-04.....Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

F. American Society of Sanitary Engineers (ASSE):

1018-01.....Trap Seal Primer Valves – Potable, Water Supplied

G. Plumbing and Drainage Institute (PDI):

PDI WH-201.....Water Hammer Arrestor

PART 2 - PRODUCTS

2.1 SANITARY WASTE, DRAIN, AND VENT PIPING

A. Cast iron waste, drain, and vent pipe and fittings

1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
   a. pipe buried in or in contact with earth
   b. sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
   c. interior waste and vent piping above grade.
2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer’s installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or be installed with lead and oakum.

B. Polyvinyl Chloride (PVC)

1. Polyvinyl chloride (PVC) pipe and fittings are permitted where the waste temperature is below 60°C (140°F).
2. PVC piping and fittings shall NOT be used for the following applications:
   a. Waste collected from steam condensate drains
   b. spaces such as mechanical equipment rooms, kitchens, SPD, and sterilizer areas.

b. Vertical waste and soil stacks serving more than two floors

c. Exposed in mechanical equipment rooms.

d. Exposed inside of ceiling return plenums

3. Polyvinyl chloride sanitary waste, drain, and vent pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D 1785 and ASTM D2665, sewer and drain series with ends for solvent cemented joints.

4. Fittings:

a. PVC fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

2.2 EXPOSED WASTE PIPING

A. Full iron pipe size chrome plated brass piping shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.

1. The Pipe shall meet Fed. Spec. WW-P-351, standard weight.
2. The Fittings shall conform to ANSI B16.15, cast bronze threaded fittings with chrome finish, (125 and 250).
3. Nipples shall conform to ASTM B 687, Chromium-plated.
4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. In unfinished Rooms such as mechanical Rooms and Kitchens, Chrome-plated brass piping is not required. The pipe materials specified under the paragraph “Sanitary Waste, Drain, and Vent Piping” can be used. The sanitary pipe in unfinished rooms shall be painted as specified in Section 09 91 00, PAINTING.

2.3 SPECIALTY PIPE FITTINGS

A. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
2. For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.
3. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.

C. Dielectric flange insulating kits shall be of non conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.

D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.4 CLEANOUTS

A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.

B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic

tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

2.5 FLOOR DRAINS

A. Type C (FD-C) floor drain shall comply with ANSI A112.6.3. The type C floor drain shall have a cast iron body, double drainage pattern, clamping device, light duty square or round nickel bronze adjustable strainer and grate with vandal proof screws. The grate shall be square, 150 mm (6 inches) minimum.

B. Type E (FD-E) floor drain shall comply with ANSI A112.6.3. The type E floor drain shall have a heavy, cast iron body, double drainage pattern, heavy non-tilting ductile iron grate not less than 300 mm (12 inches) square, removable sediment bucket. Clearance between body and bucket shall be ample for free flow of waste water. For traffic use, an extra heavy duty load classification ductile iron grate shall be provided.

C. Type S (FD-S) floor sink shall comply with ANSI A112.6.3. The type S floor sink shall be constructed from type 304 stainless steel and shall

be 300 mm (12 inches) square, and 200 mm (8 inches deep). The interior surface shall be polished. The double drainage flange shall be provided with weep holes, internal dome strainer, and heavy duty non-tilting loose set grate. A clamping device shall be provided.

2.6 TRAPS

A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints are not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.7 TRAP SEAL PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS

A. Trap Primer (TP-1): The trap seal primer system shall be electronic type conforming to ASSE 1044.
   1. The controller shall have a 24 hour programmable timer, solid state, 6 outlet zones, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, manual switch for 120VAC power, 120VAC to 24VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled steel or plastic.
   2. The cabinet shall be recessed mounting with a stainless steel cover.
   3. The solenoid valve shall have a brass body, Buna “N” seats, normally closed, 5.98 kPa (125 psi) rated, 24VAC.
   4. The control wiring shall be copper in accordance with the latest edition of the National Electric Code, Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with Division 26 of the specifications.
   5. The vacuum breaker shall conform to ASSE 1001.

B. Trap Primer (TP-2): The trap seal primer valve shall be hydraulic, supply type with a pressure rating of 5.98 kPa (125 psig) and conforming to standard ASSE 1018.
   1. The inlet and outlet connections shall be 15 mm or DN15 (NPS ½ inch)
   2. The trap seal primer valve shall be fully automatic with an all brass or bronze body.

3. The trap seal primer valve shall be activated by a drop in building water pressure, no adjustment required.
4. The trap seal primer valve shall include a manifold when serving two, three, or four traps.
5. The manifold shall be omitted when serving only one trap.

2.8 WATERPROOFING

A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

B. Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.

B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

D. All pipe runs shall be laid out to avoid interference with other work.

E. The piping shall be installed above accessible ceilings where possible.

F. The piping shall be installed to permit valve servicing or operation.

G. Unless specifically indicated on the drawings, the minimum slope shall be 2% slope.

H. The piping shall be installed free of sags and bends.

I. Seismic restraint shall be installed where required by code.

J. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.

Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.

L. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"

M. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

3.2 JOINT CONSTRUCTION

A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
2. Pipe sections with damaged threads shall be replaced with new sections of pipe.

E. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.3 PIPE HANGERS, SUPPORTS AND ACCESSORIES:

A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.

B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:

1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
2. 80 mm or DN 80 (NPS 3 inch): 1500 mm (60 inches) with 13 mm (½ inch) rod.
3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 to NPS 5): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 19 mm (¾ inch) rod.
5. 250 mm or DN250 to 300 mm or DN 300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 22 mm (7/8 inch) rod.

E. The maximum spacing for plastic pipe shall be 1.22 m (4 feet).

F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).

G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
   1. Solid or split unplated cast iron.
   2. All plates shall be provided with set screws.
   3. Height adjustable clevis type pipe hangers.
   4. Adjustable floor rests and base flanges shall be steel.
   5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
   7. Riser clamps shall be malleable iron or steel.
   8. Rollers shall be cast iron.
   9. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.

H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.

I. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

J. Penetrations:
   1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
   2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

K. Piping shall conform to the following:
   1. Waste and Vent Drain to main stacks:

Pipe Size	Minimum Pitch

80 mm or DN 80 (3 inches) and smaller	2%
100 mm or DN 100 (4 inches) and larger	1%

2. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.4 TESTS

A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.

B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
2. For an air test, an air pressure of 35 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.
3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.
3. Final Tests: Either one of the following tests may be used.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.

b. Peppermint Test: Introduce (2 ounces) of peppermint into each line or stack.

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SECTION 22 13 23
SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 DESCRIPTION

This section pertains to the scope of work associated with sanitary waster interceptors.

1.2 RELATED WORK

Section 22 05 11, COMMON WORK RESULTS FOR 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. For each type of interceptor indicated, the submittal shall include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain shall be submitted.

1.4 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.

Element ANSI/ASME

B. International Code Council (ICC)

IPC.....International Plumbing Code

PART 2 - PRODUCTS

2.1 FIBERGLASS GREASE & SOLIDS INTERCEPTOR:

A. Provide a fiberglass grease interceptor having a capacity of 500 US gallons(1893 L)and a fiberglass solids interceptor having a capacity of 200 US gallons(757 L)

B. The interceptor shall be of glass-fiber construction using a thixotropic polyester resin specifically for the manufacture of reinforced products. The resulting material shall be inert, non-corrosive and impervious to retained wastes.

C. The interceptor system shall provide adequate treatment time to limit effluent discharge levels of non-emulsified solvent extractable matter of animal or vegetable origin to 100 PPM and total suspended solids(TSS) to 350 PPM.

D. The bottom cell of the interceptor shall have a hemispherical shape to concentrate solids and to allow easy and complete removal of oil and solids.

E. The interceptor manufacturer shall provide a 30 year bonded warranty against leakage or permeation through the sidewall.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manhole risers from top of underground interceptors to manhole and gratings at finished grade shall be installed.

B. Provide cast iron manhole cover for H20 Traffic Loading.

C. Interceptor shall have man way ladder.

D. Tops of manhole frames and covers shall be set flush with finish surface in pavements. The tops shall be set 80 mm (3 inches) above finish surface elsewhere unless otherwise indicated.

E. Tops of grating frames shall be set flush with the finish surface.

F. Interceptors shall be set level and plumb.

3.2 CONNECTIONS

A. Pipe installation requirements are specified in other plumbing sections.

B. Piping connections shall be made between interceptors and piping systems.

3.3 CONNECTIONS

A. Warning tape shall be place over ferrous piping.

B. Detectable warning tape shall be used over nonferrous pipe and over the edges of underground structures.

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SECTION 22 14 00
FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes the requirements for storm drainage systems, including piping and all necessary accessories as designated in this section.

1.2 RELATED WORK

A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.

D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.

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. Piping.
2. Roof Drains.
3. Cleanouts.
4. All items listed in Part 2 - Products.

C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

1.4 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 National Standards Institute (ANSI).

C. American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A112.21.2m-83.....Roof Drains

A13.1-07.....Scheme for Identification of Piping Systems

B16.3-06.....Malleable Iron Threaded Fittings, Classes 150 and 300. B16.9-07 Factory-Made Wrought Steel Butt welding Fittings

B16.11-05.....Forged Steel Fittings, Socket-Welding and Threaded B16.12-98 (R 2006) Cast Iron Threaded Drainage Fittings

B16.15-06).....Cast Bronze Threaded Fittings, Class 125 and 250

B16.18-01 (R 2005).....Cast Copper Alloy Solder-Joint Pressure Fittings

B16.22-01 (R 2005).....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

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

A47-99 (R 2004).....Standard Specification for Steel Sheet, Aluminum Coated, by the Hot-Dip Process

A53-07.....Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless

A74-06.....Standard Specification for Cast Iron Soil Pipe and Fittings

A183-03).....Standard Specification for Carbon Steel Track Bolts and Nuts

A312-03.....Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe

A536-84(R 2004).....Standard Specification for Ductile Iron Castings

A733-03.....Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

B32-04.....Standard Specification for Solder Metal

B61-08.....Standard Specification for Steam or Bronze Castings

B62-02.....Standard Specification for Composition Bronze or Ounce Metal Castings

B75-02.....Standard Specification for Seamless Copper Tube

B88-03.....Standard Specification for Seamless Copper Water Tube

B306-02.....Standard Specification for Copper Drainage Tube (DWV)

B584-08.....Standard Specification for Copper Alloy Sand Castings for General Applications

B687-99.....Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

C564-06a.....Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D2000-08.....Standard Classification System for Rubber Products in Automotive Applications

D4101-07.....Standard Specification for Propylene Plastic Injection and Extrusion Materials

D2447-03.....Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter

D2564-04e1.....Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D2665-07.....Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

E. American Welding Society (AWS):

A5.8-04.....Specification for Filler Metals for Brazing and Braze Welding

F. International Code Council (ICC):

IPC-06.....International Plumbing Code

G. Cast Iron Soil Pipe Institute (CISPI):

301-05.....Hubless Cast Iron Soil and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-04.....Couplings for Use in Connection with Hubless Cast Iron Soil and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

H. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-72-99.....Standard for Ball Valves with Flanged or Butt Welding For General Purpose

SP-110-96.....Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

PART 2 - PRODUCTS

2.1 STORM WATER DRAIN PIPING

A. Cast Iron Storm Pipe and Fittings:

1. Cast iron storm pipe and fittings shall be used for the following applications:
   a. Pipe buried in or in contact with earth.
   b. Extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls.
   c. Interior storm piping above grade.
   d. All mechanical equipment rooms or other areas containing mechanical air handling equipment.
2. The cast iron storm Pipe shall be bell and spigot, or hubless (plain end or no-hub) as required by selected jointing method.
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer’s installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or be installed with leak and oakum.

B. Polyvinyl Chloride (PVC)

1. Polyvinyl chloride storm sewer pipe and fittings are permitted for single story structures except for mechanical equipment rooms and other areas containing air handling equipment or hot water generation equipment.
2. Polyvinyl chloride storm sewer pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D1785 and D 2665, Sewer and Drain Series, with ends for solvent cemented joints.
3. Polyvinyl chloride joints shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

C. Roof drain piping in locations where the outdoor conditions are subject to freezing shall be insulated.

2.2 PUMPED DRAIN PIPING:

A. Pumped drain piping under 100 mm (4 inches) shall be copper tube conforming to ASTM B88, type K or L. For pumped drain piping 100 mm (4

inches) and above, galvanized steel conforming to A 53, seamless, schedule 40 may be used.

B. Pumped drain pipe fittings shall comply with the following:
   1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22.
   2. Unions shall be bronze, Mss SP-72, SP-110. Solder or braze joints.
   3. Grooved fittings, 65 mm to 100 mm (2-1/2 to 4 inch) wrought copper ASTM A75 C12200, 125 to 150 mm (5 to 6 inch) bronze castings ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with colored alkyd enamel.

C. Adapters shall be provided for joining screwed pipe to copper tubing.

D. The solder shall use a non-corrosive flux conforming to ASTM B32.

2.3 SPECIALTY PIPE FITTINGS

A. Transition pipe couplings shall join piping with small differences in outside diameters or be of different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear erring and corrosion resistant metal tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:
   1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
   2. For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.
   3. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.

C. Dielectric flange insulating kits shall be of non conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt

sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.

D. The dielectric nipples shall be electroplated steel nipple comply with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.4 CLEANOUTS

A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. A minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged storm sewer line.

B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts where shall be provided where indicated on the drawings and at each building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty.

C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover with minimum opening of 150 mm by 150 mm (6 inch by 6 inch) shall be provided at each wall cleanout.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule.

Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.5 ROOF DRAINS AND CONNECTIONS

A. Roof Drains: Roof Drains (RD) shall be cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, a soft copper membrane shall be provided 300 mm (12 inches) in diameter greater than outside diameter of drain collar. An integral gravel stop shall be provided for drains installed on roofs having built up roofing covered with gravel or slag. Integral no-hub, soil pipe gasket or threaded outlet connection shall be provided.

1. Flat Roofs: The roof drain shall have a beehive or dome shaped strainer with integral flange not less than 300 mm (12 inches) in diameter. For an insulated roof, a roof drain with an adjustable drainage collar shall be provided, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. The Bottom section shall serve as roof drain during construction before insulation is installed.
2. Canopy Roofs: The roof drain shall have a beehive or dome shaped strainer with the integral flange not larger than 200 mm (8 inches) in diameter. For an insulated roof, the roof drain shall be provided with an adjustable drainage collar, which can be raised or lowered to meet the required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.
3. Promenade Decks: the roof drain shall be the same as for canopy roofs, except decks shall have flat, round, loose, non-slip, bronze grate set in square, non-slip, bronze frame.
4. Portico Roofs and Gutters: Roof drains shall be horizontal angle type drain with flat bottom and horizontal outlet at the same elevation as the pipe to which it is connected. Strainer shall be removable angle grate type.
5. Protective Roof Membrane Insulation Assembly: The roof drain shall have a perforated stainless steel extension filter, non puncturing clamp ring, large sump with extra wide roof flange and deck clamp.

a. Non pedestrian Roofs: The roof drain shall have large polypropylene or aluminum locking dome.

b. Pedestrian Roof: The rood drain shall have a bronze promenade top 350 mm (14 inches) square, set in square secured frame support collar.

6. Roof Drains, Overflow: Roof Drains identified as overflow drains shall have a 50 mm (2 inch) water dam integral to the drain body.

7. Roof drains in areas subject to freezing shall have heat tape and shall be insulated.

B. Expansion Joints: Expansions joints shall be heavy cast iron with cast brass or copper expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.

C. Interior Downspouts: An expansion joint shall be provided, specified above, at top of run on straight, vertical runs of downspout piping 12 m (40 feet) long or more.

D. Downspout Nozzle: The downspout nozzle fitting shall be of brass, unfinished, with internal pipe thread for connection to downspout.

2.6 WATERPROOFING

A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked joint shall be provided at the top hub.

B. Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. The pipe installation shall comply with the requirements of the International code and these specifications.

B. Branch piping shall be installed from the piping system and connect to all drains and outlets.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

D. All pipe runs shall be laid out to avoid interference with other work.

E. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.

F. Unless otherwise stated on the documents, minimum horizontal slope shall be one inch for every1.22 m (4 feet) of pipe length.

G. The piping shall be installed free of sags and bends.

H. Seismic restraint shall be installed where required by code.

I. Changes in direction for storm drainage piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and 1/8 bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Buried storm drainage piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer’s written instruction for use of lubricants, cements, and other installation requirements.

K. Caste iron piping shall be installed according to CISPI’s “Cast Iron Soil Pipe and Fittings Handbook,” Chapter IV, “Installation of Cast Iron Soil Pipe and Fittings”

L. Aboveground copper tubing shall be installed according to CDA’s “Copper Tube Handbook”.

M. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

3.2 JOINT CONSTRUCTION

A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI’s “Cast Iron Soil Pipe and Fittings Handbook” for compression joints.

B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

C. Hubless, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
2. Pipe sections with damaged threads shall be replaced with new sections of pipe.

E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.

F. for PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES:

A. All piping shall be supported according to the International plumbing code, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications.

B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
   1. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
   2. NPS 3 (DN 80): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
   3. NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
   4. NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
   5. NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm (60 inches) with 22 mm (7/8 inch) rod.

E. The maximum support spacing for horizontal plastic shall be 1.22 m (4 feet).

F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).

G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates shall have the following characteristics:
   1. Solid or split unplated cast iron.
   2. All plates shall be provided with set screws.
   3. Height adjustable clevis type pipe hangers.
   4. Adjustable Floor Rests and Base Flanges shall be steel.
   5. Hanger Rods shall be low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
   6. Riser Clamps shall be malleable iron or steel.
   7. Roller shall be cast iron.
   8. Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gage steel. The shield shall be sized for the insulation.

H. Miscellaneous Materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in

the center of that span. All necessary auxiliary steel shall be provided to provide that support.

I. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

J. Penetrations:

1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
2. Water proofing: At floor penetrations, Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

K. Piping shall conform to the following:

1. Storm Water Drain and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm (3 inches) and smaller	2%
100 mm (4 inches) (4 inches) and larger	1%

3.5 TESTS

A. Storm sewer system shall be tested either in its entirety or in sections.

B. Storm Water Drain tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested with water, tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10

feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. For an air test, an air pressure of 35 kPa (5 psi) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the test.
3. Final Tests: Either one of the following tests may be used.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
   b. Peppermint Test: Introduce .06 liters (2 ounces) of peppermint into each line or stack.

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SECTION 22 14 29
SUMP PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Sump pumps. See schedule on Drawings for pump capacity and head.

1.2 RELATED WORK

A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

C. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.Requirements for commissioning, systems readiness checklist, and training.

D. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

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. Pump:
   a. Manufacturer and model.
   b. Operating speed.
   c. Capacity.
   d. Characteristic performance curves.
2. Motor:
   a. Manufacturer, frame and type.
   b. Speed.
   c. Current Characteristics and W (HP).
   d. Efficiency.

C. Certified copies of all the factory and construction site test data sheets and reports.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

1. Include complete list which indicates all components of the system.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

E. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.4 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. National Electrical Manufacturers Association (NEMA):
ICS6-93 (2006).....Industrial Control and Systems Enclosures
250—2008.....Enclosures for Electrical Equipment (1000 Volts Maximum)

C. Underwriters' Laboratories, Inc. (UL):
508-99 (R2008).....Standards For Industrial Control Equipment

PART 2 - PRODUCTS

2.1 SUMP PUMP

A. Centrifugal, vertical, submersible pump and motor, designed for 60 degrees C (140 degrees F) maximum water service. Driver shall be electric motor. Support shall be rigid type. Provide perforated, suction strainer. Systems may include one pump with alternator as required by Contract Documents. Pump shall be capable of continuous duty cycle.
1. Pump housings may be cast iron, bronze, aluminum, plastic or stainless steel. Cast iron and aluminum housings for submersible pumps shall be epoxy coated.

B. Impeller: Brass, bronze or cast iron.

C. Shaft: Stainless steel or other approved corrosion-resisting metal.

D. Bearings: As required to hold shaft alignment, anti-friction type for thrust permanently lubricated.

E. Motor: Maximum 40 degrees C (104 degrees F) ambient temperature rise above the maximum fluid temperature being pumped , drip-proof, completely enclosed, voltage and phase as shown in schedule on Electrical drawings conforming to NEMA 250-Type 6P. Size the motor capacity to operate pump without overloading the motor at any point on the pump curve. Refer to Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

F. Starting Switch: Manually-operated, tumbler type, as specified in Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

G. Automatic Control and Level Alarm: Furnish a control panel in a Nema 1 enclosure for indoors or in a Nema 4X enclosure for outdoors. The controls shall be suitable for operation with the electrical characteristics listed on the Electrical drawings. The control panel shall have a level control system with switches to start and stop pumps automatically, and to activate a high water alarm. The level control system will include sensors in the sump that detect the level of the

liquid. The sensors may be float type switches, ultrasonic level sensors, transducers, or other appropriate equipment. The high water alarm shall have a red beacon light at the control panel and a buzzer, horn, or bell. The alarm shall have a silencing switch. Provide auxiliary contacts for remote alarming to the Energy Control Center and BAC net compatible open-protocol type interface to DDC Controls System.

1. The circuitry of the control panel shall include:
   a. power switch to turn on/off the automatic control mechanism
   b. HOA switches to manually override automatic control mechanism
   c. run lights to indicate when pumps are powered up
   d. level status lights to indicate when water in sump has reached the predetermined on/off and alarm levels
   e. magnetic motor contactors
   f. disconnect/breaker for each pump
   g. automatic motor overload protection
2. Sensors that detect the level of water in the sump shall be so arranged as to allow the accumulation of enough volume of liquid below the normal on level that the pump will run for a minimum cycle time as recommended by the pump manufacturer. Sensors shall be located to activate the alarm adequately before the water level rises to the inlet pipe.
3. Provide two separate power supplies to the control panel, one for the control/alarm circuitry and one for power to the pump motors. Each power supply is to be fed from its own breaker so that if a pump overload trips a breaker, the alarm system will still function. Each power supply is to be wired in its own conduit.
4. Wiring from the sump to the control panel shall have separate conduits for the pump power and for the sensor switches. All conduits are to be sealed at the basin and at the control panel to prevent the intrusion of moisture and of flammable and/or corrosive gases.

H. Sump: Furnish cast iron or fiberglass basin with gas tight covers. Cover shall have 280 mm by 380 mm (11-inch by 15-inch) manhole with bolted cover, vent connection, openings for pumps and controls. Sump shall be sized to allow an adequate volume of water to accumulate for a minimum one minute cycle of pump operation.

I. Provide a check and ball valve in the discharge of each pump.

J. Removal/Disconnect System: In a system utilizing a submersible pump, where sump depth, pump size, or other conditions make removal of the pump unusually difficult or unsafe, a removal/disconnect system shall be provided. The system will consist of a discharge fitting mounted on

vertical guide rails attached to the sump. The pump shall be fitted with an adapter fitting that easily connects to/disconnects from the discharge fitting as the pump is raised from or lowered into the sump. The discharge piping will connect to the discharge fitting so that it is not necessary to disconnect any piping in order to remove the pump. Where the sump depth is greater than five feet or other conditions exist to make the removal of the pump difficult or hazardous, the system shall include a rail guided quick disconnect apparatus to allow the pump to be pulled up out of the sump without workers entering the sump and without disconnecting the piping.

PART 3 - EXECUTION

3.1 STARTUP AND TESTING

A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. The tests shall include system capacity and all control and alarm functions.

C. When any defects are detected, correct defects and repeat test.

D. The commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer Technical Representative (COTR) and Commissioning Agent. Provide a minimum of 7 days prior to notice.

3.2 COMMISSIONING

A. Provide commissioning documentation accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS for all inspection, startup, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.3 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for four hours to instruct VA Personnel in operation and maintenance of units.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 34 00
FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section describes the requirements for installing a complete domestic gas fired hot water heating system ready for operation including water heaters, thermometers, and all necessary accessories, connections, and equipment.

1.2 RELATED WORK:

A. Section 09 91 00, PAINTING: Preparation and finish painting.

B. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

C. Section 22 11 23, DOMESTIC WATER PUMPS: Circulating Pump.

D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Heater Insulation.

E. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING, 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING, and 22 11 00, FACILITY WATER DISTRIBUTION: Piping, Fittings, Valves and Gages.

F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENT FOR NON STRUCTURAL COMPONENTS: Seismic Restraint for Equipment.

1.3 QUALITY ASSURANCE:

A. Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) for efficiency performance:

1. ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings” for commercial water heaters.”

B. Electrical components, devices and accessories shall be listed and label as defined in NFPA 70-2011 by a qualified testing agency, and marked for intended location and application.

C. ASME code construction shall be a vessel fabricated in compliance with the ASME boiler and Pressure Vessel Code: Section VIII, Division 1.

D. Fabricate and label equipment components that will be in contract with potable water to comply with NSF 61, “Drinking Water System Components – Health Effects”

E. the gas fired domestic water heater shall conform to Section 13 05 41 on Seismic restraint requirements, withstanding Seismic movement without separation of any parts from the equipment when subjected to a Seismic event.

1.4 SUBMITTALS:

A. Submit manufacturer's literature and data pertaining to the water heater in properly bound package, in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include the following as a minimum:
   1. Water Heaters.
   2. Pressure and Temperature Relief Valves.
   4. Thermometers.
   5. Pressure Gages.
   6. Vacuum Breakers.

B. For each natural gas fired domestic hot water heater type and size, the following characteristics shall be submitted:
   1. Rated Capacities
   2. Operating characteristics
   3. Electrical characteristics
   4. Furnished specialties and accessories
   5. A form U-1 or other documentation stating compliance with the ASME Boiler and Pressure Vessel code.

C. Shop drawings shall include wiring diagrams for power, signal and control functions.

D. Seismic qualification certificates shall be submitted that details equipment anchorage components identifies equipment center of gravity with mounting and anchorage provisions, and whether the seismic qualification certificate is based on an actual test or calculations.

E. The domestic water heater shall be certified and labeled by a testing agency.

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 Of Sanitary Engineering (ASSE):
   1005.....Performance Requirements for Water Heater Drain Valves, 20 mm (3/4 inch) size

C. American National Standard Institute (ANSI):
   Z21.10.1-06.....Gas Water Heaters Volume 1, Storage Water Heaters with Input Ratings of 75000 Btu per hour or less.

Z21.10.3-04.....Gas Water Heaters, Volume III, Storage Water Heaters with Input Ratings above 75000 Btu per hour, circulating and instantaneous.

Z21.15A-01.....Manually Operated Gas Valves for Appliances, Appliance connector Valves, and Hose End Valves

Z21.18-07.....Gas appliance Pressure Regulators

Z21.20-05.....Automatic Gas Ignition Systems and Components

Z21.21-05.....Automatic Valves for Gas Appliance

Z21.22B-01.....Relief Valves for Hot Water Supply systems

D. American Society of Mechanical Engineers (ASME):

B1.20.1-83(R 2006).....Pipe Threads, General Purpose(Inch)

B16.5-03.....Standard for Pipe Flanges and Flanged Fittings: NPS ¾ through NPS 24.

B16.24-06.....Cast Copper Alloy Pipe Flanges and Flanged Fittings: classes 150, 300, 400, 600, 900, 1500, and 2500.

PTC 25.3-02.....Pressure Relief Devices

Section IV-07.....Boiler and Pressure Vessel Code; Section IV, Recommended Rules for the Care and Operation of Heating Boilers

Section VIII D1-07.....Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels Division 1 –Basic Coverage

E. National Fire Protection Association (NFPA)

54-09.....National Fuel Gas Code

F. Underwriters Laboratories, Inc. (UL):

1.6 AS-BUILT DOCUMENTATION

A. The electronic documentation and copies of the Operations and Maintenance Manual, approved submittals, shop drawings, and other closeout documentation shall be prepared by a computer software program complying with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C 794d). The manufacturer or vendor of the software used to prepare the electronic documentation shall have a Voluntary Product Accessibility Template made available for review and included as part of the Operations and Maintenance Manual or closeout documentation. All available accessibility functions listed in the Voluntary Accessibility Template shall be enabled in the prepared electronic files. As Adobe Acrobat is a common industry format for

such documentation, following the document, "Creating Accessible Adobe PDF files, A Guide for Document Authors" that is maintained and made available by Adobe free of charge is recommended.”

B. Four sets of manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

C. Four sets of operation and maintenance data updated to include submittal review comments shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

PART 2 - PRODUCTS

2.1 POWER VENT, GAS FIRED, STORAGE DOMESTIC WATER HEATERS:

A. The gas fired domestic water heater shall comply with ANSI Z21.10.3.

B. The water heater design shall provide a combustion efficiency of at least 95 percent at operating conditions.

C. The tank Construction shall be ASME code Steel, glass lined, with 1035 kPa (160 psig) working pressure rating.

D. The tapping (Fittings) shall be factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards for piping connection, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls. The tappings shall be:

1. 50-mm or DN50 (2 inch) and smaller: Threaded ends according to ASME B1.20.1.
2. 65 mm or (DN65) (2 1/2-inch) and larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B 16.24.

E. The natural gas-fired burner shall include the following:

1. Thermostatic adjustment.

2. Designed for use with power vent heaters
3. High temperature limit and low water cutoff devices for safety controls.
4. Automatic ignition in accordance with ANSI Z21.20.
5. Automatic damper in accordance with ANSI Z21.66. The automatic dampers shall be mechanically activated, automatic vent damper device with size matching draft hood for 300,000 BTUH and below.

F. Temperature Setting shall be set for a maximum water temperature of 55 degrees C (130 degrees F).

G. The insulation shall surround the entire storage tank except connection and controls and shall comply with ASHRAE 90.1.

H. The jacket shall be steel with enameled finish.

I. The drain valve shall be corrosion resistant metal complying with ASSE 1005.

J. The power vent system shall be interlocked with the burner.

K. Combination Pressure and Temperature relief Valve: ANSI Z21.22 rated, constructed of all brass or bronze with a self-closing reseating valve.

2.2 DOMESTIC HOT WATER COMPRESSION TANKS

A. A steel pressure rated tank constructed with welded joints and factory installed butyl rubber diaphragm shall be installed as scheduled. The air pre charge shall be set to minimum system operating pressure at tank.

B. The tappings shall be factory fabricated steel, welded to the tank and include ASME B1.20.1 pipe thread.

C. The interior finish shall comply with NSF 61 barrier materials for potable water tank linings and the liner shall extend into and through the tank fittings and outlets.

D. The air charging valve shall be factory installed.

2.3 HEAT TRAPS

A. Heat traps shall be installed in accordance with ASHRAE 90.1, latest edition.

2.4 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES

A. The combination temperature and pressure relief valves shall be ASME rated and stamped and include a relieving capacity at least as great as the heat input and include a pressure setting less than the water heater’s working pressure rating.

2.5 GAS SHUTOFF VALVES

A. The gas shutoff valve shall be manually operated conforming to ANSI Z21.15.

B. In high Seismic areas, an earthquake shear valve shall be installed.

2.6 GAS PRESSURE REGULATORS

A. The gas pressure regulator shall be appliance type, pressure rating matching inlet natural gas supply temperature, and conforming to ANSI Z21.18.

2.7 AUTOMATIC GAS VALVES

A. The automatic gas valves shall be appliance type, electrically operated, on-off automatic control, and conforming to ANSI Z21.21.

2.8 THERMOMETERS:

The thermometers shall be straight stem, iron case, red reflecting mercury thermometer or red liquid-filled thermometers, approximately 175 mm (7 inches) high, 4 to 115°C (40 to 240°F).

PART 3 - EXECUTION

3.1 INSTALLATION:

A. The water heaters shall be installed on concrete bases. Refer to Specification Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING

B. The water heaters shall be installed level and plumb.

C. The water heaters shall be installed and connected in accordance with manufacturer’s written instructions.

D. All pressure and temperature relief valves discharge shall be piped to a nearby floor drains.

E. Thermometers shall be installed on the water heater inlet and outlet piping.

F. Vent piping from gas-train pressure regulators and valves shall be piped to the outside of building and shall conform to NFPA 54.

G. The thermostats shall be set for a maximum setting of 54°C (130°F).

H. Shutoff valves shall be installed on the domestic water supply piping to the water heater and on the domestic hot water outlet piping.

I. All manufacturers’s required clearances shall be maintained.

J. The natural gas fueled domestic water heaters shall be installed with seismic restraint devices.

K. A combination temperature and pressure relief valve shall be installed at the top portion of the storage tank. The sensing element shall

extend into the tank. The relief valve outlet drain piping shall discharge by positive air gap into a floor drain.

L. Piping type heat traps shall be installed on the inlet and outlet piping of the electric domestic hot water heater storage tanks.

M. Water heater drain piping shall be installed as indirect waste to spill by positive air gap into open drains or over floor drains. Hose end drain valves shall be installed at low points in water piping for natural gas fueled domestic hot water heaters without integral drains.

N. The type B combustion vent shall be installed and sized according to the water heaters recommendations and extended through the roof or wall as allows by the local fuel gas code or NFPA 54.

3.2 LEAKAGE TEST:

Before piping connections are made, the water heaters shall be test at a hydrostatic pressure of 1375 kPa (200 psi) and 1654 kPa (240 psi) for a unit with a MAWP of 1103 kPa (160 psi). Correct If any leakage is found on the water heater, the water heater shall be replaced with a new unit at no additional cost to the VA.

3.3 PERFORMANCE TEST:

All of the remote water outlets shall be tested to ensure a minimum of 49°C (120°F) and a maximum of 54°C (130°F) water flow at all times. If necessary, all corrections shall be made to balance the return water system or reset the thermostat to make the system comply with design requirements.

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

1.2 RELATED WORK

A. Sealing between fixtures and other finish surfaces: Section 07 92 00, JOINT SEALANTS.

B. Flush panel access doors: Section 08 31 13, ACCESS DOORS AND FRAMES.

C. Through bolts: Section 10 21 13, TOILET COMPARTMENTS.

D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.

1.4 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 National Standard Institute (ANSI):
The American Society of Mechanical Engineers (ASME):
A112.6.1M-02(R2008).....Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
A112.19.1M-04.....Enameled Cast Iron Plumbing fixtures
A112.19.2M-03(R2008)....Vitreous China Plumbing Fixtures
A112.19.3-2001(R2008)...Stainless Steel Plumbing fixtures (Designed for Residential Use)

C. American Society for Testing and Materials (ASTM):
A276-2003.....Stainless and Heat-Resisting Steel Bars and Shapes

D. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM AMP 500-505
Metal Finishes Manual (1988)

E. American Society of Sanitary Engineers (ASSE):
1016-05.....Performance Requirements for Individual Thermostatic, Pressure Balancing and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings

F. National Sanitation Foundation (NSF)/American National Standards Institute (ANSI):
61-03.....Drinking Water System Components-Health Effects

G. American with Disabilities Act(A.D.A) Section 4-19.4 Exposed Pipes and Surfaces

PART 2 - PRODUCTS

2.1 STAINLESS STEEL

A. Corrosion-resistant Steel (CRS):
1. Plate, Sheet and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.

B. Die-cast zinc alloy products are prohibited.

2.2 STOPS

A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.

B. Furnish keys for lock shield stops to Contracting Officer Technical Representative (COTR).

C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.

D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple.

E. Psychiatric Area: Provide stainless steel drain guard for all lavatories not installed in casework.

2.3 ESCUTCHEONS

A. Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.4 LAMINAR FLOW CONTROL DEVICE

A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.

B. Flow Control Restrictor:

1. Capable of restricting flow from 95 to 110 mL/s (1.5 to 1.7 gpm) for lavatories; 125 to 140 mL/s (2.0 to 2.2 gpm) for sinks P-505 through P-520, P-524 and P-528; and 170 to 190 mL/s (2.75 to 3.0 gpm) for dietary food preparation and rinse sinks.
2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 and 550 kPa (25 and 80 psi).
3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-clearing action, and is capable of easy manual cleaning.

C. Device manufactured by OMNI Products, Inc. or equal.

2.5 CARRIERS

A. ASME/ANSI A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down.

B. ASME/ANSI A112.6.1M, lavatory, chair carrier for thin wall construction. All lavatory chair carriers shall be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture.

C. Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers. The drainage fitting of the back to back carrier shall be so constructed that it prevents the discharge from one fixture from flowing into the opposite fixture.

2.6 WATER CLOSETS

A. (P-101) Water Closet (Floor Mounted, ANSI 112.19.2M, Figure 6) - office and industrial, elongated bowl, siphon jet 4.8 L (1.28 gallons) per flush, floor outlet. Top of rim shall be 434 to 437 mm (17 1/8 inch to 17 1/4 inch)above finished floor.

1. Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.
2. Fittings and Accessories: Floor flange fittings-cast iron; Gasket-wax; bolts with chromium plated cap nuts and washers.

3. Flush valve: Large chloramines resistant diaphragm, semi red brass valve body, exposed chrome plated, non-hold-open ADA approved side oscillating handle, water saver design 4.8 L (1.28 gallons) per flush with maximum 10 percent variance, top spud connection, adjustable tailpiece, one-inch IPS screwdriver back check angle stop with vandal resistant cap, high back pressure vacuum breaker, and sweat solder adapter with cover tube and cast set screw wall flange. Set centerline of inlet 275 mm (11-1/2) inches above rim. Seat bumpers shall be integral part of flush valve. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM Alloy classification for semi-red brass.

B. (P-102) Water Closet (Floor Mounted, ANSI 112.19.2M, Figure 6) - office and industrial, elongated bowl, siphon jet 4.8 L (1.28 gallons) per flush, floor outlet. Top of rim shall be 434 to 437 mm (18 inches)above finished floor.
   1. Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.
   2. Fittings and Accessories: Floor Flange fittings - cast iron; gaskets - wax; bolts with chromium plated cap nuts and washers.
   3. Flush valve: Large chloramines resistant diaphragm, semi-red brass valve body, exposed chrome plated, non-hold-open ADA approved side oscillating handle, water saver design 4.8 L (1.28 gallons) per flush with maximum 10 percent variance, offset top spud connection, adjustable tailpiece, one-inch IPS screwdriver back check angle stop with vandal resistant cap, sweat solder adapter with cover tube and cast set screw wall flange, and high back pressure vacuum breaker. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM Alloy classification for semi-red brass. Set centerline of inlet 673 mm (26 1/2) inches above rim. Seat bumpers shall be set in wall behind fixture at proper contact height.

C. (P-103) Water Closet (Wall Hung, ASME/ANSI A112.19.2M, Figure 9) office and industrial, elongated bowl, siphon jet 4.8 L (1.28 gallons) per flush, wall outlet. Top of rim shall be between 410 and 435 mm (16 to 17 inches) above finished floor. Handicapped water closet shall have rim set 460 mm (18 inches) above finished floor.
   1. Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally

molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.

2. Fittings and Accessories: Gaskets - neoprene; bolts with chromium plated caps nuts and washers.
3. Flush valve: Large chloramines resistant diaphragm, semi-red brass valve body, exposed chrome plated, non-hold-open ADA approved side oscillating handle, water saver design 4.8 L (1.28 gallons) per flush with maximum 10 percent variance 25mm (one-inch) screwdriver back check angle stop with vandal resistant cap, adjustable tailpiece, a high back pressure vacuum breaker, spud coupling for 40 mm (1-1/2 inch) top spud, wall and spud flanges, and sweat solder adapter with cover tube and set screw wall flange. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM alloy classification for semi-red brass. Seat bumpers shall be integral part of flush valve. Set centerline of inlet 292 mm (11-1/2 inches) above rim.

2.7 URINALS

A. (P-202) Urinal (Wheelchair, Waterless, Wall Hung, ANSI A112.19.19; ANSI Z124.9, A117, Figure 30) wall to front of flare 356mm (14 inches). Wall hung with integral trap, with 50mm (2-inch) back outlet.
   1. Support urinal with chair carrier and install with rim 380 mm (15 inches) above finished floor.

2.8 LAVATORIES

A. Dimensions for lavatories are specified, Length by width (distance from wall) and depth.
B. Brass components in contact with water shall contain no more than 3 percent lead content by dry weight.
C. (P-408) Lavatory (ASME/ANSI A112.19.2M, Figure 16) straight back, approximately 450 by 380 mm (18 by 15 inches) and a 102 mm (4-inch) maximum apron, first quality vitreous china. Punching for faucet on 102 mm (4-inch) centers. Support lavatory to wall with steel wall plate. Set with rim 864 mm (34 inches) above finished floor:
   1. Faucet: Solid cast brass construction with washerless ceramic disc mixing cartridge type and centrally exposed rigid gooseneck spout Outlet 125-150 mm (5-6 inches) above rim. Provide laminar flow control device. One hundred two millimeters (4-inch) wrist blade type handles on faucets shall be cast, formed or drop forged copper alloy. Faucet, wall and floor escutcheons shall be either copper alloy or CRS. Exposed metal parts, including exposed part under valve handle

when in open position, shall be chrome plated with a smooth bright finish.

2. Drain: Cast or wrought brass with flat grid strainer and offset tailpiece, chrome plated finish.
3. Stops: Angle type. See paragraph 2.2. Stops
4. Trap: Cast copper alloy, 40 by 32 mm (1-1/2 by 1-1/4 inch) P-trap. Adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing extension to wall. Exposed metal trap surface, and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to wall.
5. Provide cover for drain, stops and trap per A.D.A 4-19.4.

D. (P-413) Lavatory (Counter Mounted ASME/ANSI A112.19.2M, Figure 25) vitreous china, self-rimming, approximately 480 mm (19 inches) in diameter with punching for faucet on 203 mm (8-inch) centers. Mount unit in countertop. Support countertop with ANSI A112.6.1M, Type I, chair carrier with exposed arms.

1. Faucet: Solid cast brass construction with washerless ceramic disc mixing cartridge type, rigid gooseneck spout with outlet 102 to 127 mm (four to five inches) above slab with 102 mm (four-inch) wrist blade handles. Provide laminar flow control device. Faucet, wall and floor escutcheons shall be either copper alloy or CRS. Exposed metal parts shall be chrome plated with a smooth bright finish.
2. Drain: cast or wrought brass with flat grid strainer, offset tailpiece, brass, chrome plated.
3. Stops: Angle type. See paragraph 2.2. Stops
4. Trap: Cast copper alloy, 40 by 32 mm (1-1/2 by 1-1/4 inch) P-trap, adjustable with connected elbow and 1.4mm thick (17 gauge) tubing extension to wall. Exposed metal trap surface and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to the wall.
5. Provide cover for drain, stops and trap per A.D.A 4-19.4.

2.9 SINKS AND LAUNDRY TUBS

A. Dimensions for sinks and laundry tubs are specified, length by width (distance from wall) and depth.

B. (P-502) Service Sink (Corner, Floor Mounted) stain resistant terrazzo, 711 by 711 mm (28 by 28 by 12 inches) with 152 mm (six-inch) drop front. Terrazzo, composed of marble chips and white Portland cement, shall develop compressive strength of 20 684 kPa (3000 psi) seven days after casting. Provide extruded aluminum cap on front side.

1. Faucet: Solid brass construction, combination faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, integral stops, mounted on wall above sink. Spout shall have a pail hook, 20 mm (3/4-inch) hose coupling threads, vacuum breaker, and top or bottom brace to wall. Four-arm handles on faucets shall be cast, formed, or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish. Provide 914 mm (three-foot) hose with wall hook. Centerline of rough in is 1220 mm (48 inches) above finished floor.
2. Drain: Eighty millimeter (3-inch) cast brass drain with nickel bronze strainer.
3. Trap: P-trap, drain through floor.

C. (P-524) Sink, (CRS, Double Compartment, Counter Top, ASME/ANSI A112.19.3M, Kitchen Sinks, Figure 6) self rimming, approximately 838 by 559 mm (33 by 22 inches) with two compartments inside dimensions approximately 343 by 406 by 191 mm (13-1/2 by 16 by 7-1/2) inches, minimum 20 gage CRS. Corners and edges shall be well rounded.
1. Faucet: Kitchen sink, solid brass construction, chrome plated copper alloy with spray and hose.
2. Drain: Drain plug with cup strainer, stainless steel.
3. Trap: Cast copper alloy, 40 mm (1/-1/2 inch) P-trap with cleanout plug, continuous drain with wall connection and escutcheon.
4. Provide cover for drain, stops and trap per A.D.A 4-19.4.

2.10 SHOWER BATH FIXTURE

A. (P-701) Shower Bath Fixture (Detachable, Wall Mounted, Concealed Supplies, Type T/P Combination Valve):
1. Shower Installation: Wall mounted detachable spray assembly, 600 mm (24-inch) wall bar, elevated vacuum breaker, supply elbow and flange and valve. All external trim, chrome plated metal.
2. Shower Head Assembly: Plastic shower head with flow control to limit discharge to 190 mL/s (3 gpm), 1500 mm (5-foot) length of rubber lined CRS, chrome plated metal flexible, or white vinyl reinforced hose and supply wall elbow. Design showerhead to fit in palm of hand. Provide CRS or chrome plated metal wall bar with an adjustable swivel hanger for showerhead. Fasten wall bar securely to wall for hand support.
3. Valves: Type T/P combination thermostatic and pressure balancing, with chrome plated metal lever type operating handle adjustable for

rough-in variations and chrome plated metal or CRS face plate. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 15 mm (1/2-inch) IPS. Provide external screwdriver check stops, vacuum breaker and temperature limit stops. Set stops for a maximum temperature of 40 degrees C (105 degrees F). All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 380 mL/s at 310 kPa (6 gpm at 45 psi) pressure drop.

2.11 HYDRANT, HOSE BIBB AND MISCELLANEOUS DEVICES

A. (P-801) Wall Hydrant: Cast bronze non-freeze hydrant with detachable T-handle. Brass operating rod within casing of bronze pipe of sufficient length to extend through wall and place valve inside building. Brass valve with coupling and union elbow having metal-to-metal seat. Valve rod and seat washer removable through face of hydrant; 20 mm (3/4-inch) hose thread on spout; 20 mm (3/4-inch) pipe thread on inlet. Finish may be rough; exposed surfaces shall be chrome plated. Set not less than 460 mm (1-1/2 feet) nor more than 920 mm (3-feet) above grade. On porches and platforms, set approximately 760 mm (2-1/2 feet) above finished floor. Provide integral vacuum breaker which automatically drains when shut off.

B. (P-804) Hose Bibb (Single Faucet, Wall Mounted to Exposed Supply Pipe): Cast or wrought copper alloy, single faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, mounted on wall 914 mm (36 inches) above floor to concealed supply pipe. Provide faucet with 20 mm (3/4-inch) hose coupling thread on spout and vacuum breaker. Four-arm handle on faucet shall be cast, formed or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a bright finish.

C. (P-808) Washing Machine Supply and Drain Units: Fabricate of 16-gage steel with highly corrosion resistant epoxy finish. Unit to have 50 mm (2-inch) drain connection, 15 mm (1/2-inch) combination MPT brass sweat connection, ball type shut-off valve, 50 mm (2-inch) cast brass P-trap, duplex electric grounding receptacle and dryer outlet. Size 229 by 375 mm (9-inch by 14-3/4 inch) rough wall opening 200 by 330 by 92 mm (8-inch by 13-inch by 3-5/8 inch). Centerline of box shall be 1100 mm (44 inches) above finished floor.

D. (P-811_ Ice maker Valve Box: Fabricate of 16-gauge steel with highly corrosion-resistant epoxy finish. 15mm (1/2 inch) MPT brass sweat

connection, ball type shut-off valve. Size 210mm x 143mm (8-1/4 inches x 5-5/8 inches).

PART 3 - EXECUTION

3.1 GENEAL

A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 07 92 00, JOINT SEALANTS.

B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.

C. Through Bolts: For free standing marble and metal stud partitions refer to Section 10 21 13, TOILET COMPARTMENTS.

D. Toggle Bolts: For hollow masonry units, finished or unfinished.

E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4-inch) diameter bolts, and to extend at least 75 mm (3-inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.

F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4-inch) threaded studs, and shall extend at least 35 mm (1-1/4 inches) into wall.

G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.

I. Do not use aerators on lavatories and sinks.

3.2 CLEANING

A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

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