FINAL SUBMITTAL - SPECIFICATIONS

for

CA-1807-C

WAREHOUSE

POHAKULOA, HAWAI'I, HAWAI'I

DEPARTMENT OF DEFENSE
HAWAII ARMY NATIONAL GUARD
Hawaii District

Submitted by:

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SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Comply with the GENERAL CONDITIONS "Shop Drawings and Other Submittals" section and "Material Samples" section.

B. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

1.02 SUBMITTAL PROCEDURES

A. Coordinate Work and Submittals: Contractor shall certify the submittals were reviewed and coordinated.

B. Submittal Certification: Provide a reproduction (or stamp) of the "Submittal Certification" and furnish the required information with all submittals. Include the certification on:

1. The title sheet of each shop drawing, or on

2. The cover sheet of submittals in 8-1/2 inch x 11-inch format, or on

3. One face of a cardstock tag (minimum size 3-inch x 6-inch) tied to each sample. On the sample tag, identify the sample to insure sample can be matched to the tag if accidentally separated. The opposite face of the tag will be used by the Contracting Officer to receive, review, log stamp and include comments.

C. Variances: The Contractor shall request approval for a variance. Clearly note any proposed deviations or variances from the Specifications, Drawings, and other Contract Documents on the submittal and also in a separately written letter accompanying the submittal.

D. Samples: Where not specified otherwise, provide no less than 3 samples. One sample will be kept by the Consultant, one sample will be kept by the State, and remaining sample(s) will be returned to the Contractor.

E. Submittal Certification Form (or stamp)

CONTRACTOR'S NAME: _____

PROJECT: _____

JOB NO: _____

As the General Contractor, we checked this submittal and we certify it is correct, complete, and in compliance with Contract Drawings and Specifications. All affected Contractors and suppliers are aware of, and will integrate this submittal into their own work.

SUBMITTAL NUMBER _____ DATE RECEIVED _____

REVISION NUMBER _____ DATE RECEIVED _____

SPECIFICATION SECTION NUMBER /PARAGRAPH NUMBER _____

DRAWING NUMBER _____

SUBCONTRACTOR'S NAME _____

SUPPLIER'S NAME _____

MANUFACTURER'S NAME _____

NOTE: DEVIATIONS FROM THE CONTRACT DOCUMENTS ARE PROPOSED AS FOLLOWS (Indicate "NONE" if there are no deviations)

_____

_____

_____

CERTIFIED BY	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SUBMITTAL REGISTER

A. The listing of required submittals within this Section is provided for the Contractor's convenience. Review the specification technical sections and prepare a comprehensive listing of required submittals. Furnish submittals to the Contracting Officer for review.

Section No. – Title	Shop Drawings & Diagrams	Samples	Certificates (Material, Treatment, Applicator, etc.)	Product Data, Manufacturer's Technical Literature	MSDS Sheets	Calculations	Reports (Testing, Maintenance, Inspection, etc.)	Test Plan	O & M Manual	Equipment or Fixture Listing	Schedules (Project Installation)	Maintenance Service Contract	Field Posted As-Built Drawings	Others	Guaranty or Warranty	Manufacturer's Guaranty or Warranty (Greater than one year)
01330 – Submittal Procedures			■													
02050-Demolition and Removal											■			■		
02100-Clearing and Grubbing											■			■		
02200-Earthwork							■									
02600-Aggregate Subbase Coarse			■	■			■									
02700-Asphalt Concrete Pavement			■	■			■									
02900-Chain Link Fence and Gate	■			■												
03300-Cast-In-Place Concrete	■		■	■	■		■								■	
05500-Metal Fabrications	■						■									
06070 – Wood Treatment			■	■											■	
06100 – Rough Carpentry			■													
07920 – Sealants		■		■	■										■	
08331 – Overhead Coiling Doors	■			■											■	■
09901 – Painting		■	■	■	■						■			■	■	
10140-Signage	■	■		■										■		

13340- Fabricated Engineered Structures- Metal Bldg Systems	■			■		■									■	■
16011 – Electrical Work			■	■												
16400 – Electrical Work	■			■					■				■		■	

END OF SECTION

DIVISION 2 – SITE CONSTRUCTION

SECTION 02050 – DEMOLITION AND REMOVAL

PART 1 – GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, tools and equipment necessary to complete all removal work and surface preparation work as specified herein. The work includes selective removal work of all construction indicated or specified. Submit a detailed description of methods and equipment to be used for each operation, and sequence of operations. All materials resulting from removal work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of State property.

1.02 PERMIT AND FEES

A. The Contractor shall obtain and pay for all necessary permits or certificates that may be required in connection with this work.

B. The Contractor shall serve proper notice and consult with the Engineer regarding any temporary disconnections of electrical or other utility lines in the area which may interfere with the removal work, and all such lines where necessary shall be properly disconnected before commencing with the work.

1.03 SCOPE

A. The work includes removal of all construction indicated or specified in the plans and specifications. All materials resulting from removal work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of State property. Remove rubbish and debris from the jobsite daily, unless otherwise directed; do not allow accumulations inside or outside the building, or around jobsite. Provide warning signs, lights, barricades, etc., as shown on the plans or as directed by the Engineer.

B. Removed material having no salvage value, as determined by the Engineer, shall become the property of the Contractor and shall be removed daily from the premises. Removed material with salvage value, as determined by the Engineer, shall be stored where directed. Remove carefully and do not damage, any existing related parts which are to be reused in this project.

1.04 SUBMITTALS

A. Schedule: Submit schedule indicating proposed methods and sequence of operation for demolition work to the Engineer for review prior to commencement of work

1.05 EXPLOSIVES:

A. Use of explosives will not be permitted.

1.06 BURNING

A. Burning will not be permitted, except for welding and hot work. Prior to any welding and hot work, the Contractor shall submit an application open flame welding to the Engineer for review and approval.

1.07 SITE CONDITIONS

A. The Contractor shall visit the site, examine and note all existing conditions and extent of work involved for the completion of the demolition and removal work.

B. Obvious conditions of the existing premises on the date of bid opening shall be accepted as part of the work, even though they may not be indicated on the drawings or may vary there from.

1.08 HAZARDOUS MATERIALS

A. Based on as-built drawings, an old below grade gas tank was previously installed. The tank was subsequently removed, but the Contractor shall verify its existence prior to the start of any demolition or construction. Should hazardous materials be encountered and need to be treated, the contractor shall notify the Engineer immediately.

1.09 PROTECTION

A. Safety: Where and when deemed necessary by the Engineer, removal work area shall be cordoned off. Contractor shall be responsible to verbally notify all personnel of impending health and safety hazards that may occur during the removal work.

B. Building Protection: Protect building interior and all contents from rain and wind at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and approved temporary covering of exposed areas. The existing roofing shall be removed only to the extent that contents and interior of the building can be protected at the end of each work day. Weather conditions shall be continuously observed. The Contractor shall be responsible to repair all damages resulting from failure of temporary protection systems at the Contractor's expense and at no additional cost to the State. Temporary coverings shall be attended, as necessary, to ensure effectiveness and to prevent displacement.

C. Fall Hazard Protection and Prevention Program: The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policies; identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures. Fall protection controls shall be implemented based on the type of roof being reroofed/constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

D. Building Protection: Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy. Maintain continuous temporary protection prior to and during installation of new roofing system to keep the building weather tight. Protect building interior and all contents from rain, wind and dust at all times.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 REPAIR WORK

A. Where exposed existing work is damaged or left unfinished by the removal work, the resultant exposed unfinished surfaces shall be repaired, patched, filled or finished to match the adjoining existing surfaces. Existing work at the completion of operations shall be left in a condition as good as existed before the new work started. Where the method of repair work is not indicated or specified, the Contractor shall perform the repair work in accordance with the best recognized workmanlike procedure for the surrounding construction involved.

3.02 DISPOSITION OF MATERIAL

A. All materials resulting from removal work, except for salvageable materials to be removed and installed, shall become the property of the Contractor and shall be removed from the limits of the State property at the Contractor's expense.

B. Salvable items shall be removed, protected from damages, loaded, hauled and unloaded for storage at Honolulu International Airport as directed.

3.03 DEBRIS CONTROL

A. All debris existing or accumulated from the demolition operation shall be completely and promptly removed from the site by the Contractor in a manner that will prevent spillage on streets or adjacent areas and to the satisfaction of the Engineer. Burning or burying of debris on the site will not be permitted. Local regulations regarding hauling and disposal shall be complied with.

3.04 LIMIT OF WORK

A. The Limit of Work shown on the drawings indicate only in general, the limits of the work involved. The Contractor, however, is required to perform any and all necessary and incidental work, which may fall outside of these demarcation lines. The Contractor is also expected to confine all of his construction activities within the Limit of Work and not to spread his equipment and materials indiscriminately about the area.

END OF SECTION

SECTION 02100 – CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 SUMMARY

A. The work covered in this section shall consist of furnishing all labor, materials, equipment, tools and incidentals necessary for clearing, grubbing, and removing and disposing of vegetation, debris, and unwanted material from project area. Perform clearing and grubbing in advance of grading operations.

1.02 DEFINITIONS

A. Clearing is defined as removing and disposing of all unwanted surface materials, such as trees, brush, grass, weeds, downed trees, and other material.

B. Grubbing is defined as removing and disposing of all unwanted vegetative matter from underground, such as stumps, roots, buried logs, and other debris.

C. Debris is defined as unusable or unwanted material produced by clearing and grubbing.

1.03 PERMITS AND FEES

A. The Contractor shall obtain and pay for all necessary permits and fees required to perform this work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 BEST MANAGEMENT PRACTICES (BMP)

A. The Contractor shall ensure that all BMP measures are in place before clearing and grubbing starts. If BMP measure is removed temporarily to accommodate construction operations, reinstall before end of workday.

3.02 CLEARING AND GRUBBING

A. The Contractor shall clear the project limits of all vegetative material and obstructions necessary for the proper reception, construction, execution and completion of other work specified in this contract.

B. Within the grading limits and where indicated on the drawings, grub the entire ground surface of all grass, weeds, and plants. All debris accumulated from this operation shall be completely removed from the premises by the Contractor in accordance with item Section 3.03 – DISPOSITION OF MATERIAL.

C. No excavation or filling shall be undertaken until area has been cleared and grubbed.

D. The Contractor shall protect from injury and damage all surrounding plants, pavements, buildings, utilities, etc., and shall leave all in as good a condition as present. Any damage to existing improvements shall be repaired or replaced by the Contractor to the satisfaction of the Contracting Officer.

3.03 DISPOSITION OF MATERIAL

A. All materials resulting from the clearing and grubbing work, shall be removed from the limits of State property. Remove rubbish and debris from the jobsite daily, unless otherwise directed; do not allow accumulations inside or outside any buildings or roadways. The Contractor shall transport and legally dispose of materials off site. Remove and transport debris and rubbish in a manner that will prevent spillage on streets or adjacent areas.

B. If hazardous materials are encountered during the clearing and grubbing operations, comply with applicable State, Federal and local regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

C. Burning of removed materials is not permitted on project site.

3.04 INSPECTION AND APPROVAL

A. Prior to the construction of any new work, the Contracting Officer shall inspect the area that has been cleared and grubbed. The Contractor shall not proceed until the clearing and grubbing work has been approved by the Contracting Officer. Should the Contractor install any new work without the Contracting Officer approval, the Contracting Officer may require the Contractor to remove the installed work for inspection and reconstruct at no additional cost to the State.

END OF SECTION

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, tools, and equipment necessary for site excavation, backfilling, rough and finish grading, and related items necessary to complete all work shown on the Drawings and/or specified herein.

1.02 ORDINANCES AND PERMITS

A. The Contractor shall comply with the provisions of Chapter 11-55 Water Pollution Control and Chapter 11-54 Water Quality Standards of the Hawaii Administrative Rules, Department of Health, State of Hawaii.

1.03 EXISTING UTILITY LINES

A. The existence of active underground utility lines within the construction area is not definitely known other than those indicated in their approximate locations on the Drawings. Should any unknown line be encountered during excavation, the Contractor shall immediately notify the Contracting Officer of such discovery. The Contracting Officer shall then investigate and issue instructions for the preservation or disposition of the unknown line. Authorization for extra work shall be issued by the Contracting Officer only as he deems necessary.

1.04 LAYOUT OF PROJECT

A. The Contractor shall verify all lines, levels, elevations and improvements indicated on the drawings before any excavation begins. All lines and grades shall be verified by a Surveyor or Civil Engineer licensed in the State of Hawaii. Any discrepancy shall be immediately brought to the attention of the Contracting Officer and any change shall be made in accordance with his instruction. Starting of clearing and grubbing operations shall be construed to mean that the Contractor agrees that the existing grades and improvements are essentially correct as shown. The Contractor shall not be entitled to extra payment if existing grades and improvements are in error after his verification thereof, or if he fails to report the discrepancies before proceeding with any work whether within the area affected or not.

1.05 UNFORESEEN CONDITIONS BELOW GRADE

A. No geotechnical report was completed for this project. Bidders shall examine the site and shall draw their own conclusions therefrom as to the character of materials to be encountered.

B. If any conditions not described in the Contract Documents (such as perched water, seepage, and/or lenticular or confined strata of a potentially adverse nature) are encountered during grading, these conditions shall be immediately brought to the attention of the Contracting Officer so that supplemental recommendations may be made to treat these problems.

C. Should excavations encounter loose or unsuitable conditions, lava tubes, or voids, the Contractor shall notify the Contracting Officer immediately so that supplemental recommendation may be given.

1.06 SUBMITTALS

A. Submit in accordance with SECTION 01330 – SUBMITTAL PROCEDURES.

B. Reports: Field density tests shall be taken to determine whether the specified levels of compaction are being consistently attained. Testing shall be done as indicated.

1. Structural and Yard Fill: One (1) compaction test for every 1500 square feet of each lift.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All materials excavated shall be considered to be unclassified and shall be paid for as such, whether earth, boulders, solid rock, concrete, steel, rubbish, wood, or other materials.

B. Fill and Backfill Material

1. Yard fill: Yard fill shall be used for all areas where no concrete or A.C. pavement is to be constructed. Fill materials shall be non-expansive soil, free from debris, perishable or combustible materials, sod, and stones larger than 6 inches in maximum dimension and shall have a plasticity index not greater than 20. Any rock shall be well distributed in earth or other fine material with all voids filled and shall not be placed within 3 feet of the finished grade.

   In the event that insufficient amount of yard fill is delivered from earthwork operations, the Contractor shall import the necessary materials without any additional cost to the State. Such imported materials shall be subject to approval of the Contracting Officer and shall meet the requirements as specified for the materials.

2. Structural fill: Structural fill shall be used in areas where new concrete or A.C. paving is to be constructed and shall be non-expansive, granular, well-graded material with a 3 inch maximum particle size and less than 20 percent by weight passing the No. 200 sieve. The fill material shall be free from clumps of soil, organic debris, adobe or other deleterious matter.

   The plasticity index for that portion of soil passing the #40 sieve shall not be greater than 10. The CBR shall not be less than 25. Recycled asphalt pavement shall not be used as structural fill.

3. Materials excavated within the project boundary may be used as a source of fill provided that they are processed to meet gradation requirements herein.

PART 3 - EXECUTION

3.01 GENERAL

A. No excavation or filling shall be undertaken until the area has been cleared and grubbed.

B. Install temporary erosion, dust and siltation control measures as shown on the Drawings or ordered by the Contracting Officer. Remove temporary measures after permanent erosion control measures have been established.

C. All excavation shall be protected and guarded against danger to life, limb and property.

D. Shoring, cribbing and lagging, as required to safely preserve the excavations and earth banks from damages resulting from the work, shall be provided and installed by the Contractor.

E. Caution shall be exercised in all excavation work adjacent to existing trees which are to remain. All exposed fibrous and branchtype roots shall be carefully pruned or saw-cut to the extent required for excavation work. Every effort shall be taken to preserve the existing trees and to minimize damage to said trees.

F. The Contractor shall use the best management practices to reduce the amount of soil erosion resulting from the grading work.

The work areas and haul roads, including roadways leading to the project site, shall be continuously watered to prevent the generation of dust. Granular materials shall be spread over all unpaved haul routes. An 8-inch thick layer of #2 crushed rock shall be installed at delivery access points to reduce tracking mud onto public roadways.

All truck tires shall be free of mud before leaving the job site and entering a public roadway. The Contractor will clean all roads of mud and dirt resulting from his operations at no additional cost to the State.

G. The areas not covered by concrete or A.C. pavements shall be graded to conform to finish contours.

H. Laying Out

1. The laying out of base lines, establishment of grades and staking out the entire work shall be done by a surveyor or a civil engineer licensed in the State of Hawaii, at the Contractor's expense. The Contractor shall be solely responsible for their accuracy. The Contractor shall erect and maintain substantial batterboards showing construction of lines and levels.

2. Should any discrepancies be discovered in the dimensions given in the plans, the Contractor shall immediately notify the Contracting Officer before proceeding any further with the work.

3. The Contractor shall be responsible for re-establishing property corners or survey control points which are destroyed by his operations.

3.02 EXCAVATION

A. General Requirements

1. Excavation shall be done so as to obtain the elevations called for on Drawings, allowing for fill, grading, topsoil and drainage away from buildings.

2. Usable Materials as approved by the Contracting Officer shall be stockpiled (for later use as fill material) in a location designated by the Contracting Officer. Crushing basalt fragments may be necessary prior to reuse in compacted fills. This material may also be excavated directly to fill at the Contractor's option, provided that the materials conform to the requirements of the intended use as specified hereinbefore and sub grade preparation requirements have been met in the fill areas.

3. Non-usable Material such as mud, soft material, and expansive soils and excess materials shall become the property of the Contractor and shall be disposed of outside the project boundary limits at locations that have been approved by the County of Hawaii.

4. Blasting as a means of excavation shall not be permitted.

5. Unsuitable subgrade soil, as determined by the Contracting Officer shall be excavated and removed by the Contractor.

3.03 FILL AND BACKFILL

A. General Requirements

1. Filling operations shall be performed so as to bring the entire project area to the finished grades shown on the Drawings, allowing for concrete slab, or A.C. paving and base course.

2. At the time of compaction, the moisture content of fill and backfill material shall be such that the relative compactions specified can be obtained with the compacting equipment being used. At all times, it shall be the responsibility of the Contractor to employ such means as may be necessary to obtain a uniform optimum moisture content throughout the material being compacted.

3. Soft or loose soils that do not readily compact should be excavated and replaced with compacted structural fill at no cost to the State. All surface clayey silt/volcanic ash material shall be removed to the basalt or gravel strata prior to placement of the yard or structural fill.

4. All areas to receive fill shall be scarified, moisture conditioned to near optimum moisture content and compacted to a minimum of 95 percent relative compaction as determined by ASTM D1557 for a minimum depth of eight (8) inches.

5. In areas with gravelly material, the exposed gravelly material should be scarified to a depth of 6 inches and recompacted to a minimum of 95 percent compaction, as determined by ASTM D 1557, prior to placement of the fill.

B. Yard Fill

1. Yard fill shall be placed in layers, 8 inches or less in compacted thickness,

and compacted to 95 percent of maximum density as determined by the ASTM D1557 procedure.

C. Structural Fill for Pavement Areas
   1. Structural fill shall be placed in layers, 8 inches or less in loose thickness, moisture conditioned to near optimum moisture content, and compacted to at least 95 percent of maximum density as determined by ASTM D1557 procedure.

D. Placing, Spreading, and Compacting Fill Material
   1. When moisture content of the fill material is below optimum, water shall be added until the moisture content is optimum to ensure that the proper compaction can be obtained. When the moisture content of the fill material is above optimum, the fill material shall be aerated until the optimum moisture content is obtained.

   2. Recompaction: Where test results indicate that the moisture content of the fill is not suitable, or that insufficient compaction has been obtained, the fill shall be reconditioned and recompacted prior to placing additional fill material.

      The Contractor shall be responsible for placing and compacting approved fill material in accordance with these Specifications. If the Contractor fails to meet the compaction requirements, he shall stop hauling or reduce his rate of haul, furnish additional spreading, watering and/or compaction equipment as may be required, or make any other adjustments necessary to produce a satisfactory compacted fill. When the work is stopped by rain, filling shall not resume until the Contracting Officer has verified that the moisture content and the density of the fill surface are satisfactory.

   3. During construction, all fill surfaces shall be sloped to provide positive surface drainage and to prevent ponding of water. If it appears that rain is imminent, the Contractor shall roll the surface with smooth rollers or rubber-tired equipment to seal the surface against excessive infiltration of water. Temporary surface drains and ditches shall be provided by the Contractor as necessary to expedite runoff and to prevent erosion.

E. Slopes and Final Grading
   1. The Contractor will be required to obtain a minimum relative compaction of 95 percent of maximum dry density out to the finish fill slope face. Fill slopes shall be constructed by over-building and cutting-back to the finished grades to expose a well-compacted surface.

   2. Excavation and embankment shall be finished with all slopes cut true and straight, in accordance with the lines and grades shown in the Drawings. All slopes, whether old or new, shall be maintained with true and smooth surfaces. Over breaks shall be trimmed smoothly and neatly. The tops and ends of all slopes shall be flared and rounded.

   3. All cut and fill slopes shall be protected from erosion by approved methods immediately upon their completion.

4. Cut Slopes
   a. If any conditions not anticipated, such as perched water, seepage, lenticular or confined strata of a potentially adverse nature are encountered during grading, these conditions shall be analyzed by the Contracting Officer and recommendations shall be made to treat these problems. The Contractor shall halt the grading work in such areas until the recommendations are made.

3.04 GRADING TOLERANCES

A. All graded surfaces shall be finished to within 0.10 feet from the grades and cross sections indicated on the plans.

3.05 PROTECTION

A. Protect benchmarks, property monuments, fences, and roads.

B. Protect any above and below grade utilities that are to remain.

C. Protect newly graded surfaces from traffic and erosion; keep areas free of trash and debris. Repair and re-establish grades in settled, rutted, and eroded areas.

D. Repair all damages caused by and resulting from construction activities in accordance with the requirements these specifications and as directed by the Contracting Officer.

3.06 CLEAN UP

Clean up and remove all debris accumulated from construction operations from time to time, when and as directed by the Contracting Officer. Upon completion of the construction work and before final acceptance of the work, remove all surplus materials, equipment, etc., and leave entire job site clean and neat.

END OF SECTION

SECTION 02600 – AGGREGATE SUBBASE COURSE

PART 1 – GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, equipment, tools and incidentals necessary to place aggregate subbase course on a prepared surface in accordance with the contract drawings.

1.02 WORK SPECIFIED IN OTHER SECTIONS

A. Earthwork specified in SECTION 02220 – EARTHWORK.

1.03 SUBMITTALS

A. Submit in accordance with SECTION 01330 – SUBMITTAL PROCEDURES.

B. Product Data, Reports: The Contractor shall furnish the affidavits and data from the supplier for the following:
   1. Subbase Course Material.

C. Certificates: Testing laboratory accreditation data.

D. Certificates: Certification that the specified herbicides were applied at the specified application rate over the entire sub-grade to be paved.

1.04 SAMPLING AND TESTING

A. Density tests shall be taken to determine whether the specified levels of compaction are being consistently attained. Testing shall be done as indicated, with a minimum of one test for each material.
   1. Aggregate Subbase: One compaction test per lift of aggregate subbase for this project.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Aggregate for subbase shall consist of gravel, stone, basalt, or coral, or combination thereof, and shall be free of overburden, vegetable matter, and other deleterious substances. When tested in accordance with AASHTO T 27, subbase shall conform to Table 1.

TABLE 1 – SUBBASE GRADING REQUIREMENTS		
Sieve Size	Percent Passing by Weight	
	Subbase Material Placed in Top 6 Inches	Subbase Material Placed Below Top 6 Inches
6 Inch	-	100
2-1/2 Inch	100	-
No. 4	20 – 60	20 – 60
No. 200	0 – 15	0 – 15

When tested in accordance with AASHTO T 176, SE value shall not be less than 25. A minimum SE of 20 shall be provided when material passing No. 4 sieve is entirely crushed coral limestone.

When tested in accordance with AASHTO T 89 and AASHTO T 90, subbase shall conform to Table 2.

TABLE 2 – SUBBASE PLASTICITY INDEX	
Percent Passing No. 200 Sieve	Plasticity Index
0 – 9	15 Maximum
10 – 15	10 Maximum

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. The subgrade shall be prepared and compacted in accordance with SECTION 02220 – EARTHWORK and accepted by the Contracting Officer prior to construction of pavement structure. Soil tests shall be made at the subgrade level and verified or modified as necessary.

B. Apply pre-paving herbicide to gravel areas. Application shall not be made immediately after heavy rains or when rain is forecasted within the next 48 hours. The herbicide shall be applied in accordance with the manufacturer's recommended procedures and rates. Perform two herbicide applications at least three days apart.

3.02 HAULING AND PLACING

A. Haul, deposit, and spread aggregate subbase on a prepared surface in a manner that minimizes rutting, uneven compaction, and segregation. Should segregation occur, remove segregated material and replace with material conforming to the contract documents, at no increase in contract price or contract time.

B. Where compacted thickness is greater than 6 inches, spread and compact mixture in two or more lifts approximately equal in thickness. Maximum compacted thickness of one lift shall be 6 inches.

3.02 SHAPING AND COMPACTING

A. Prior to shaping, add water uniformly to aggregate subbase, as necessary, to obtain moisture content within 2 percent above or below optimum moisture content for compaction.

B. Immediately after spreading aggregate subbase, shape and compact each lift across full width using power roller. Roll in direction parallel to centerline of road. For areas inaccessible to roller, compact using tampers or compactors.

C. Compact each lift to produce uniform surface texture and to attain at least 95 percent of maximum density.

D. Limit surface deviations of finished areas to not more than 1 inch above or below theoretical grade. Correct surface deviations more than 1 inch above or below theoretical grade by scarifying, adding or removing material, blading, watering, and compacting. Reshape high or low spots as needed to correct surface deviations.

END OF SECTION

SECTION 02700 – ASPHALT CONCRETE PAVEMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, equipment, tools and incidentals necessary to construct asphalt concrete pavements in accordance with the contract drawings.

1.02 WORK SPECIFIED IN OTHER SECTIONS

A. Earthwork specified in SECTION 02220 – EARTHWORK.

1.03 SUBMITTALS

A. Submit in accordance with SECTION 01330 – SUBMITTAL PROCEDURES.

B. Product Data, Reports: The Contractor shall furnish the affidavits and data from the supplier for the following:
   1. Design Mix for asphalt concrete pavement.
   2. Base Course Material.

C. Certificates: Testing laboratory accreditation data.

D. Certificates: Certification that the specified herbicides were applied at the specified application rate over the entire sub-grade to be paved.

1.04 SAMPLING AND TESTING

A. The Contractor shall retain and pay for an independent soil testing laboratory with at least one Licensed Civil Engineer specializing in Geotechnical Engineering to provide monitoring and testing services. The soil testing laboratory shall be accredited by the American Association of State Highway and Transportation Officials (AASHTO) or the American Association for Laboratory Accreditation, and shall be accredited in the tests required under this contract. The soil testing laboratory shall meet the requirements of ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction.

   The Contractor shall furnish for approval, a copy of the Certificate of Accreditation and Scope of Accreditation and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract. The Contractor shall submit certified test results in accordance with Section 01330 – SUBMITTAL PROCEDURES. All test results must be approved before the Contractor can proceed with placing subsequent layers or material.

B. Density tests shall be taken to determine whether the specified levels of compaction are being consistently attained. Testing shall be done as indicated, with a minimum of one test for each material.
   1. Sub-Grade: One Compaction test per lift of subgrade for this project, where basalt rock is not exposed.

2. Aggregate Base: One compaction test per lift of aggregate base for this project.

C. Compaction and thickness testing for asphaltic concrete paving shall be performed at a rate of one test per lift for this project. Sampling shall be as specified in Section 34 – Asphalt Concrete Pavement, of the "Standard Specifications for Public Works Construction".

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials shall conform to the below-listed sections of the "Standard Specifications for Public Works Construction" except as amended in the plans and/or specifications herewith.

1. Subgrade	Section 29
2. Aggregate Base Course, 1 1/2-inch maximum	Section 31
3. Asphalt Concrete Pavement	Section 34

B. Herbicides
1. Pre-paving vegetation destruction herbicide shall be Roundup by Monsanto, or accepted equivalent.

2. Pre-emergence control herbicide shall be Treflan by Elanco Products Company, or accepted equivalent.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. The sub-grade shall be prepared and compacted in accordance with SECTION 02220 – EARTHWORK and accepted by the Contracting Officer prior to construction of pavement structure. Soil tests shall be made at the sub-grade level and the final pavement structure verified or modified as necessary.

B. Apply pre-paving herbicide to all new pavement or gravel road areas. Application shall not be made immediately after heavy rains or when rain is forecasted within the next 48 hours. The herbicide shall be applied in accordance with the manufacturer's recommended procedures and rates. Perform two herbicide applications at least three days apart.

3.02 PAVEMENT INSTALLATION

A. Asphalt concrete shall be as indicated on the plans and shall be constructed in accordance with Section 34 – Asphalt Concrete Pavement, of the "Standard Specifications for Public Works Construction". Aggregate base course shall be compacted to a minimum 95% compaction as determined by ASTM D1557, and constructed in accordance to Sections 31 – Aggregate Base Course, of the "Standard Specifications for Public Works Construction".

B. Prior to placement of the base course, the subgrade shall be scarified to a depth of about 8 inches, moisture conditioned to above the optimum moisture content, and recompacted to a minimum of 95 percent relative compaction. In areas where dense clinker materials or basalt rock formations are exposed, the subgrade should be proof-rolled with a minimum 10-ton vibratory roller or similar heavy equipment for a minimum of six passes to help detect and collapse near surface cavities in lieu of scarification and compaction.

C. Pavement smoothness for the finished surface shall be true to grade, free from depressions and grainy spots, and of uniform texture. It shall not vary more than 1/8 of an inch over 10 feet.

D. Surface tolerance for the finished surface of the asphalt concrete pavement shall be within 0.04 foot above or below the theoretical grade.

E. Low or defective areas shall be corrected by cutting out the faulty areas and replacing with new materials. Skin patching for correcting low areas will not be permitted.

3.02 CLEAN UP AND REPAIR

A. Any existing asphaltic concrete pavements including roads and walkways that have been damaged by construction activities shall be repaired to the original condition and to the satisfaction of the State. Damage done by the heavy equipment, especially on roads not stable for such equipment, shall be repaired to the original condition and to the satisfaction of the State.

B. Repair work may consist of asphalt concrete resurfacing, and scarifying and removing the existing pavement and reconstructing a new pavement of equivalent thickness.

END OF SECTION

SECTION 02900 – CHAIN LINK FENCE AND GATE

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION

A. This item of work shall consist of furnishing all material, labor, tools, equipment, and incidentals required to install chain link fence, and all appurtenances in place complete, in accordance with these specifications and as shown on the plans or as ordered by the Officer-in-Charge.

1.02 SUBMITTALS

A. Product Data: Manufacturer's product data sheets on each product to be used, including details and drawings.

B. Shop Drawings: Provide plan, post spacing and sizing, location of gates and material finish as necessary to depict actual products specified, proper design considerations, and installation procedures. Coordinate fencing locations with the Contract Drawings.

PART 2 - PRODUCTS

2.01 POSTS, RAILS AND BRACINGS

A. All posts and rails shall be standard full weight galvanized steel pipes. Galvanizing shall be in accordance with ASTM A153. Welding shall not be permitted. Sizes shall be as specified in Table 1.

TABLE 1 – FENCE POSTS AND RAILS	
POST TYPE	**SIZE**
Top, Bottom Or Brace Rail	1.660" OD, 2.27 LB/LF
Gate/End Post	2.8775" OD, 5.79 LB/LF
Line Post	2.375 OD, 3.65 LB/LF
Gate Frame	2" OD, 2.72 LB/LF

2.02 FENCE FABRIC

A. Fence fabric shall be No. 9 gauge and have a uniform diamond mesh measuring approximately 2 inches between its parallel sides. It shall be woven of copper bearing steel wire, heavily galvanized by hot dip process before weaving. Top and bottom selvages shall have twisted and barbed finish. All barbing shall be done by cutting wire on bias, thus creating sharp points.

2.03 FENCE ATTACHMENT FITTINGS AND HARDWARE:

A. All fittings used in connection with chain link fencing shall be hot-dipped galvanized, malleable wrought iron or pressed steel.

B. Tension wire for bottom of fence fabric shall be No. 8 gauge extra heavy galvanized high carbon coiled steel wire steel.

C. Gate

1. Gate shall be chain link double leaf gate as called for on the plans.

2. Gate frame shall be 2 inches OD, galvanized steel pipe.

3. Corner fittings shall be galvanized malleable castings.

4. Gate fabric shall be as specified for fencing.

5. The gate shall be furnished complete with special pivot type hinges, catch, stops, center rest and locking device for padlock.

6. Gate shall be securely braced and trussed to prevent sagging.

2.04 BARBED WIRE AND EXTENSION ARMS

A. Barbed wire shall be composed of 3 strands of No. 12-1/2 gauge wire with 4 point barbs spaced 5 inches apart and heavily galvanized.

B. Post extension arms for supporting barbed wires shall be formed from 0.090-inch steel sheet and hot dip galvanized. Arms shall be designed to extend at a 45-degree angle with lock to securely fasten strands of barbed wire equally spaced with top strand located 12 inches above the fabric and 12 inches out from the fence line.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until site has been properly prepared to finish grading requirements.

3.02 PREPARATION

A. All new installations shall be laid out by the contractor in accordance with construction plans.

B. Prepare all work areas and components. Clean all debris from work area prior to installation.

3.03 EXCAVATION

A. Excavate for fence posts to a depth as shown on the construction plans.

3.04 POST SPACING

A. Line posts shall be spaced 10 feet apart maximum, measured from center to center of posts. Post spacing shall be determined by measurement parallel to the slope of the ground. All posts shall be placed plumb.

3.05 END, CORNER AND GATE POSTS:

A. End, corner and gate posts shall be braced to the nearest line post with horizontal braces and each brace shall be diagonally trussed using galvanized 3/8-inch steel rods with tighteners and necessary fittings.

3.06 INSTALLATION

A. Install posts plumb and set on center per manufacturer's drawings. All posts shall be set in concrete footings. Size of footings for the posts shall be as shown on the construction plans.

B. Top rail shall pass through the base of post top and form a continuous brace from end to end of each stretch of fence. Top rail shall be securely fastened to end, gate, and corner posts by means of suitable connectors.

C. The bottom tension wire shall be stretched tight and installed on a straight grade between posts. Wire shall be parallel to the top rail approximately 2 inches above the bottom of fabric and be securely fastened to the posts.

D. Chain link fabric shall be mounted on the side of the posts designated by the Officer-in-Charge with the bottom of fabric not more than 3 inches nor less than one inch above the ground.

E. The fabric shall be stretched taut and securely fastened to the posts. Fabric shall be fastened to line posts, approximately 12 inches apart, and to top rail and bottom tension wire, approximately 24 inches apart. Tie wire to be used as fasteners shall be No. 9 galvanized wire.

F. The fabric shall be fastened to end, corner and gate posts with 1/4"x3/4" stretcher bar and 1/8"x3/4" stretcher bar bands spaced at 12-inch intervals.

3.07 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before substantial completion.

END OF SECTION

DIVISION 3 - CONCRETE

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. Provide cast-in-place concrete, reinforcing steel, and formwork for the structure as shown.

1.02 STORAGE OF MATERIALS

A. Cement and aggregates shall be stored in such a manner as to prevent their deterioration or the intrusion of foreign matter. Any material which has deteriorated or which has been damaged shall not be used for concrete and shall be promptly removed from the site.

B. Store reinforcement and accessories off the ground on platforms, skids, or other supports.

1.03 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. Concrete Sampling: ASTM C172. Collect samples of fresh concrete to perform tests specified. ASTM C31 for making test specimens.

B. Concrete Testing:

1. Slump Tests: ASTM C143. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

2. Temperature Tests: Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3. Compressive Strength Tests: ASTM C39. Make six 6 inch by 12 inch test cylinders for each set of tests in accordance with ASTM C31, ASTM C172 and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinder in reserve. Take samples for strength tests of each mix design of and for concrete placed each day not less than once a day, nor less than once for each 100 cubic yards of concrete for the first 500 cubic yards, then every 500

cubic yards thereafter, nor less than once for each 5,400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of ACI 318 Section 5.6. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the Owner.

a. Cost of making, tagging, delivering and testing of concrete cylinders will be borne by the Contractor.

b. In all cases where the strength of any group of cylinders falls below the minimum compressive strength specified, the Owner shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by the Owner from the location in the structure represented by the test specimen or specimens which failed. Specimens shall be secured, prepared, and tested in accordance with ASTM C42 within a period of 60 days after placing the concrete. The testing shall be done by a laboratory reviewed by the Owner. Concrete in the area represented by the core tests will be considered structurally adequate if the average strength of 3 cores is no less than 85% and the strength of a single core is no less than 80% of the 28-days strength specified. Should laboratory analysis indicate, however, that the proper concrete mix has not been used by the Contractor, all such concrete placed using the improper mix shall be subject to rejection. The cost of cutting specimens from the structure, patching the resulting holes, and making the analysis, including laboratory and consultation costs, shall be borne by the Contractor.

c. The holes where the cored samples are taken shall be packed solid with no-slump concrete proportioned in accordance with the ACI 211.3 "Standard Practice for Selecting Proportions of No-Slump Concrete". The patching concrete shall have an "extremely dry" consistency and the same design strength as the specified concrete. Match color and finish of adjacent concrete.

d. If the strength of the specimens cut from the structure falls below the requirements stipulated above, the Owner shall have the right to require any and all defective concrete to be replaced, and all costs resulting therefrom shall be borne by the Contractor.

C. Welding Qualifications: Welders are required to be qualified in accordance with AWS D1.4/D1.4M. Perform qualification test at the worksite and notify the Owner 247 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4/D1.4M. Submit a list of qualified welders names.

1.04 SUBMITTALS

A. Product Data: Submit for each material required: leveling grout, epoxy, admixtures, and adhesive compound, curing compound and sealer and hardener, joint filler, waterstops, admixtures, vapor barrier, curing material, and fly ash.

B. Submit concrete mix design and admixtures for review. Review shall occur before concrete production can begin.

C. Submit certified mill test results or laboratory test results for all reinforcing steel indicating the following: bar size; yield strength; ultimate tensile strength; elongation; and, bend test. Rebar chemical composition shall be provided for rebars which are to be welded

1.05 DELIVERY, STORAGE AND HANDLING

A. Follow ACI 301 and ACI 304R requirements and recommendations. Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Asbestos Prohibition: No asbestos containing materials shall be used under this section. The Contractor shall ensure that all materials incorporated in the project are asbestos-free unless specifically reviewed by the Owner.

B. Portland Cement shall conform to the requirement of ASTM C150, Type I or II with tri-calcium aluminates C_3A content less than 10 percent and a maximum cement-alkali content of 0.80 percent (sodium oxide) equivalent.

C. Concrete Aggregates:

1. Fine Aggregates shall be basalt sands. They shall meet the grading requirements of ASTM C33 unless the concrete producer can provide past data that shows that a proposed non-conforming gradation will produce concrete with the required strength and suitable workability. Calcareous sands shall not be used.

   If manufactured sands are used in the concrete mix, the Contractor may select and use a water-reducing and/or an air-entraining admixture as specified hereinafter to provide satisfactory workability in the concrete. The cement content of a mix shall be as specified hereinafter, and use of an admixture shall in no way result in the reduction of the cement factor.

2. Coarse Aggregates shall be crushed close-grained, blue lava rock meeting the grading requirements of sizes 57 or 67 (ASTM D448) or both. The maximum size of aggregate shall not be larger than 1/5th of the narrowest dimensions between sides of the forms of the member for which the concrete is to be used nor larger than 3/4th of the minimum clear spacing between individual reinforcing bars or bundles of bars.

D. Fly Ash: ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 3 percent.

   Add with cement. Fly ash content must be a minimum of 30 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, provide the maximum amount of fly ash permittable that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C311. Evaluate and classify fly ash in accordance with ASTM D5759.

E. Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkaline, salts, organic materials or other substances that may be deleterious to concrete or reinforcement. Non-potable water shall not be used.

F. Expansion Joint filler: A pre-molded material of 1/2 inch thickness, unless otherwise indicated, composed of fiberboard impregnated with asphalt conforming to ASTM D1751.

G. Joint Sealing Compound shall be a polysulfide or urethane compound conforming to ASTM C920 or other approved equal, compatible with the floor finish to be applied.

H. Bond Breaker Filler shall be mineral-surfaced roofing cap sheet or coated asphalt felt.

I. Admixture: Conform to ASTM C494, Type A, B, D, F, or G and shall be mixed in proper amount in accordance with directions of manufacturer.

   Waterproofing admixture for concrete shall be Krystol Internal Membrane (KIM) manufactured by Kryton. KIM is a hydrophilic crystalline waterproofing admixture.

J. Curing Compound shall conform to the requirements of ASTM C 309.

K. Pervious Sheeting shall be burlap or other acceptable absorbent material, free from substances that will harm the concrete or cause discoloration.

L. Epoxy compound for dowels and anchor bolts shall be "SET-XP" by Simpson Strong-Tie, "Sikadur 32 Hi-Mod" by Sika Corporation, "Pro-Proxy" by Unitex, Hilti HY-200 by Hilti or reviewed equal.

M. Nonshrink grout shall have minimum compressive strength of 5,000 psi and conform to ASTM C1107.

N. Vapor Barrier: Polyethylene sheet, 10 mils thick, ASTM E1745 Class C. Water vapor permeance 0.0071 perms, ASTM F1249. Decay resistant, ASTM E154. Tensile Strength 97.7 lbf/in, ASTM D882.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing steel shall be deformed bars conforming to ASTM A615.

B. Accessories such as spacers, chairs, ties, and other devices necessary for properly placing, supporting and fastening the reinforcement in place shall be provided. Annealed steel wire of not less than 16-gauge shall be used to secure the reinforcement. Support chairs shall be of Class 1 or 2, as classified by the Concrete Reinforcing Steel Institute.

2.03 FORMWORK MATERIALS:

A. The design, engineering, and construction of the formwork is the responsibility of the Contractor. Design formwork in accordance with ACI 347 for anticipated loads, lateral pressures, and stresses, and capable of withstanding the pressures resulting from placement and vibration of concrete.

B. Plywood shall be commercial-standard Douglas Fir, moisture resistant concrete form plywood not less than 5-ply and at least 3/8" thick.

C. Metal forms may be used if they will produce surfaces equal to those produced by wood forms.

D. Forms of other materials shall not be used unless reviewed by the Owner.

E. Form Ties: Form ties shall be factory-fabricated, snap off ties of design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Ties shall be fitted with devices that will leave holes in concrete surfaces not less than 3/8-inch nor more than 1-inch in diameter and not more than 1 inch deep. Portion of the tie remaining permanently in the concrete shall not project beyond the surface of the concrete and shall be at least 1 inch back from any concrete surface. Provide ties which pass through walls subjected to hydrostatic pressure, including exterior foundation walls, with acceptable waterstops, such as washers, securely and continuously fastened to ties.

F. Form coatings shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces; will not impair subsequent surface treatments or finishes requiring bond or adhesion, nor impede wetting of concrete surfaces by water or curing compound.

2.04 FLOOR SURFACE SEALANT:

A. Provide Klere Seal 9100-S floor sealant or pre-reviewed equal.

PART 3 - EXECUTION

3.01 DESIGN OF CONCRETE MIXES

A. Ingredients for concrete shall be Portland cement, fine and coarse aggregates, admixtures, fly ash and water. Waterproofing admixture shall be added to all concrete structures used for liquid containment including the Chlorine Contact Tank and Sludge Lagoon.

B. Normal weight concrete shall meet the requirements outlined in Subsection C and D below.

C. Concrete shall be designed so that the concrete materials will not segregate nor cause excessive bleeding. Slump shall be as required to facilitate placement and finishing.

D. The Contractor shall submit, for review by the Owner, the mixes he intends to use at least 21 days before the actual concrete placing operations.

E. The Contractor shall use only reviewed mixes.

F. Class of concrete or concrete strength shall be as indicated on the drawings.

3.02 MIXING CONCRETE

A. All concrete throughout shall be plant mixture in an approved type of power operated mixer that will ensure uniformity and homogeneity of the concrete produced.

B. Ready Mixed and Mixed-In-Transit Concrete shall be mixed to conform to the provisions of ASTM C94 and as follows:

1. The plant shall have sufficient capacity and transportation equipment to deliver concrete at the rate desired. The interval between batches for a pour shall not exceed 30 minutes.

2. The time elapsed between the introduction of the mixing water to the cement and aggregates or the cement to the aggregates, and the placing of concrete in its final position shall not exceed 90 minutes.

3. In hot weather (more than 90 degrees F, ambient temperature) or under conditions contributing to quick stiffening of the concrete, the elapsed time in 3.2.B.2. shall not exceed 60 minutes, if no retarding admixture is used. If an ASTM C494 Type B or D admixture is added to the concrete, the elapsed time in 3.2.B.2 shall remain at 90 minutes.

4. Concrete shall be mixed only in such quantity as is required for immediate use. No retempering will be permitted and concrete that has started to harden shall be discarded and promptly removed from the job.

5. Admixtures conforming to Paragraph 2.1.I used in the concrete shall be added at the batch plant as recommended by the supplier and reviewed by the Owner.

6. Hand mixing of concrete will not be permitted except to make up shortages for sign post footings.

7. Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C94:

   a. Type and brand cement.

   b. Cement and complementary cementitious materials content in 94-pound bags per cubic yard of concrete.

   c. Maximum size of aggregate.

   d. Amount and brand name of admixtures.

   e. Total water content expressed by water cementitious material ratio.

C. Concrete Curing Materials: Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

3.03 PLACING CONCRETE

A. No concrete shall be placed in the absence of the Owner or the Independent Special Inspector who shall be given 72 hours advance notice of starting time of concrete pour. Place no concrete until forms, reinforcing steel, conduits, sleeves, hangers, anchors, inserts and other work required to be built into or placed ahead of concrete placing have been inspected and reviewed by the Owner. Concrete placed without such notice and review shall be rejected.

B. Preparation

1. All sawdust, chips and other construction debris and extraneous matter shall be removed from interior of forms. Struts, stays, bracing, or blocking serving temporarily to hold forms in correct shape or alignment shall be removed when the concrete placing has reached an elevation rendering their services unnecessary.

2. Concrete shall be placed upon clean, damp surfaces with no free water, or upon properly compacted fills but never upon soft mud or dry, porous earth.

Before pouring footings or foundations, bottoms of excavations shall be properly leveled off and tamped.

3. Before depositing new concrete on or against concrete which has set, all accumulations of mortar splashed upon reinforcing steel and the surfaces of forms shall be removed and the forms shall be retightened. The surfaces of previously set concrete shall be thoroughly roughened and cleaned of all foreign matter and laitance, saturated with water and slushed with a coat of cement grout. New concrete shall be placed before the grout has attained its initial set.

C. Subgrade Under Foundations and Footings: When subgrade material is semiporous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

D. Subgrade Under Slabs on Ground: Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

Previously constructed subgrade or fill must be cleaned of foreign materials.

Finish surface of cushion fill under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

E. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

F. Reinforcement and Other Embedded Items: Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

3.04 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

A. ACI 301 and ACI SP-66. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

B. General: Provide details of reinforcement that are in accordance with ACI 301

and ACI SP-66 and as specified.

C. Vapor Barrier: Install in accordance with ASTM E1643. Provide beneath the on-grade interior concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches and tape. Remove torn, punctured, or damaged vapor barrier material and provide with new vapor retarder and vapor barrier prior to placing concrete. Concrete placement must not damage vapor barrier material.

D. Reinforcement Supports: Support reinforcement in accordance with ACI 301 Section 3.

E. Splicing: As indicated. For splices not indicated ACI 301. Do not splice at points of maximum stress. Overlap welded wire reinforcement the spacing of the cross wires, plus 2 inches. AWS D1.4. Approve welded splices prior to use.

F. Setting Miscellaneous Material: Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

G. Fabrication

1. Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

   a. Provide fabrication tolerances that are in accordance with ACI 318 and ACI SP-66.

   b. Provide hooks and bends that are in accordance with ACI 318 and ACI SP-66.

   c. Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

   d. Tolerance on nominally square-cut, reinforcing bar ends must be in accordance with ACI SP-66.

   e. Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

2. Do not use reinforcement that has any of the following defects:

   a. Bar lengths, depths, and bends beyond specified fabrication tolerances.

b. Bends or kinks not indicated on drawings or approved shop drawings.

c. Bars with reduced cross-section due to rusting or other cause.

3. Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

H. Placing Reinforcement: Place reinforcement in accordance with ACI 301 and ACI SP-66.

For slabs on grade (over earth or over cushion fill) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

1. Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 318, ACI SP-66 and CRSI 10MSP. Do not use supports to support runways for concrete conveying equipment and similar construction loads.

b. Equip supports on ground and similar surfaces with sand-plates.

c. Support welded wire reinforcement as required for reinforcing bars.

d. Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.

e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to ACI SP-66.

f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in ACI SP-66 and ACI 318.

I. Spacing of Reinforcing Bars: Spacing must be as indicated. If not indicated, spacing must be in accordance with the ACI 318 and ACI SP-66.

Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Owner.

J. Concrete Protection for Reinforcement: Concrete protection must be in accordance with the ACI 318 and ACI SP-66.

K. Welding: Welding must be in accordance with AWS D1.4.

3.05 BATCHING, MEASURING, MIXING AND TRANSPORTING CONCRETE

A. ASTM C94, ACI 301, ACI 302.1R and ACI 304R, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

B. Mixing: ASTM C94, ACI 301 and ACI 304R. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 84 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required. [If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits.] Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

C. Transporting: Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

D. Conveying

1. Concrete shall be conveyed from mixer to forms as rapidly as practicable by methods that will prevent segregation.

2. Concrete shall be deposited as nearly as practicable in its final position. Extensive spading as a means of transportation shall be avoided and in no case shall vibrators be used to transport concrete inside the forms.

3. Open troughs and chutes shall have a slope not to exceed 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

4. The concrete shall not be allowed to drop freely more than 4 feet except where specifically authorized by the Owner. When placing operations would involve the dropping of concrete from a height of more than 4 feet, it shall be conveyed through pipes or flexible drop chutes.

5. If any appreciable segregation occurs through the conveying methods employed, their use shall be ordered discontinued by the Owner and some other satisfactory method of placing concrete shall be used.

6. All chutes, troughs, pipes and other means of conveyances shall be kept clean and free from coatings of hardened cement or concrete by thoroughly cleaning with water and chipping after each pour. Water used for flushing shall be discharged away from the vicinity of the concrete or forms already in place.

3.06 PLACING CONCRETE

A. Place concrete in accordance with ACI 301 Section 5.

B. Footing Placement: Concrete for footings may be placed in excavations without forms upon inspection and approval by the Owner. Excavation width must be a minimum of 4 inches greater than indicated.

C. Pumping: ACI 304R and ACI 304.2R. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

D. Hot Weather: Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

E. Bonding: Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance,

loosened particles of aggregate, nor damaged concrete at the surface.

1. Obtain bonding of fresh concrete that has set as follows:

   a. At joints between footings and curbs, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

F. Depositing

1. Unless adequate protection is provided, concrete shall not be placed during rain. Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish. Fresh concrete that has been deposited but has not attained its initial set shall be protected in the event of rain.

2. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcing. As nearly as practicable, the concrete shall be dropped vertically without hitting reinforcement, sleeves or forms into its final position in order to avoid segregation of coarse aggregates from concrete. After the initial set of concrete, the form shall not be jarred and no strain shall be placed on the projecting reinforcing.

3. Formed concrete shall be deposited in horizontal layers not deeper than 2 feet avoiding inclined layers and inclined construction joints. The depth of layers shall be shallow enough so that the succeeding layer will be placed before the previous layer has attained its initial set. Concrete shall not be allowed nor shall it be caused to flow horizontally or on slopes in the form. Concrete placing on a slope shall begin at the lower end of the slope and progress upward.

4. If depositing of concrete must be stopped short of a full placement, it shall be leveled to a horizontal plane or stopped against a vertical bulkhead. Such bulkhead or horizontal plane shall be located only as reviewed by the Owner.

G. Compaction

1. All concrete shall be consolidated by vibration so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. All compaction shall be done by use of high frequency internal vibrators. Where the vibrator cannot be inserted into the concrete, compaction shall be done by spading, rodding or forking.

2. Frequency of vibrator shall be not less than 7,000 impulses per minute. The Contractor shall provide a sufficient number of vibrators to properly consolidate all concrete immediately after placing. At least one standby vibrator shall be on hand at all times during placement of the concrete.

3. Vibration shall not be applied through contact with reinforcement of forms. Vibration shall penetrate previously deposited concrete sufficiently to prevent pockets or voids or construction joints from occurring between pours, but must not be applied to concrete which has set up sufficiently to cease to be plastic under vibration.

3.07 FLOOR SLAB-ON-GRADE

A. All earth-supported slabs shall be reinforced as called for on the plans. Reinforcing bar dowels shall be provided as detailed for construction joints.

B. Care shall be taken in handling and placing the reinforcement. Reinforcement shall be positively set to the level required within the slabs as indicated on the plans.

C. Floor slabs shall be placed in alternate panels, long strip pattern, following construction or expansion joints. Narrow construction/control joints shall be provided transverse to the length of the cast strip. There shall be an interval of at least 2 days between the placing of the initial panels and that of the adjacent ones.

D. A bond-breaker filler shall be provided where edge or slab abut any vertical surface where indicated on plans. Width of filler strips shall equal depth of floor slab.

E. Finishing Tolerances for slabs shall be in accordance with the following:

1. Finish shall be true planes within + or -1/4 inch in 10 feet, as determined by 10 feet straightedge placed anywhere on the slab in any direction.

2. Unless otherwise shown on the plans, all slabs shall meet this tolerance. The tolerances will be checked prior to removing of forms or shores.

F. Slope floors uniformly to drains where drains are provided.

3.08 FINISHING OF SLABS

A. Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

B. Finish A - Scratch Finish. After the concrete has been placed, struck off, consolidated and leveled, the surfaces shall be roughened with stiff brushes or rakes (cross-scratched) before final set.

C. Finish B - Light Trowelled Finish. After the concrete has been placed, struck off, consolidated and leveled, the concrete shall not be worked further until ready for

floating. Floating shall begin when the water sheen has disappeared and/or when the mix has stiffened sufficiently to permit the proper operation of a power-driven float. The surface shall then be consolidated with power-driven floats. Hand tools shall be used in locations inaccessible to the power-driven machine. The slab shall then be steel trowelled to a uniform, smooth texture.

D. Finish C - Trowelled Finish. The surface shall be finished first with impact power floats, as specified above for Finish B, then with power trowels and finally with steel hand trowels. The first trowelling after power floating shall be done by a power trowel and shall produce a smooth surface which is relatively free of defects but which may still contain some trowel marks.

   Additional trowelling shall be done by hand after the surface has hardened sufficiently. The final trowelling shall be done to a point when a ringing sound is produced as the trowel is moved over the surface. The finish surface shall be free of any trowel marks and shall be uniform in texture and appearance, On surfaces intended to support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

E. Finish D - Broom Finish. The concrete shall be given a coarse transverse scored texture by drawing a broom across the surface. The operation shall follow immediately after steel-trowelling performed under Finish B above

F. Finish tolerances for slabs shall be in accordance with the following:

   1. Finish shall be true planes within + or -1/4 inch in 10 feet, as determined by 10 feet straightedge placed anywhere on the slab in any direction.

      Unless otherwise shown on the plans, all slabs shall meet this tolerance. The tolerances will be checked prior to removing of forms or shores.

3.09 SELECTION OF FLOOR FINISHES

A. Unless otherwise indicated on the plans, the following floor finishes shall be used:

   1. Finish D - Broom Finish. For exterior slab-on-grade and surfaces exposed to weather.

   2. Finish C - Trowelled Finish. For interior floors.

3.10 REPAIR OF DEFECTS

A. Repair surface defects in accordance with ACI 301 Section 5 and as indicated.

B. Before the Owner accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation

must be submitted to the Owner for approval before any corrective work is accomplished.

1. Crack Repair: Prior to final acceptance, all cracks in excess of 0.02 inches wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Owner for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

2. Repair of Weak Surfaces: Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 1/4 inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 1/4 inch thick must be removed and replaced or mitigated in a manner acceptable to the Owner.

C. After forms have been removed, any concrete which is not constructed as shown on the plans, or is out of alignment or level beyond required tolerances, or which shows a defective surface, which in the opinion of the Owner cannot be properly repaired or patched, shall be removed.

D. Where cast-in-place which is exposed to view requires repairing or patching, the texture of the surface of such repair or patch shall closely match that of the surrounding surface.

E. All tie holes and repairable defective areas shall be patched immediately after form removal as follows:

1. All honeycombed concrete shall be chipped out to sound concrete but in no case to a depth of less than 1 inch. If possible, edges of the chipped-out areas shall be undercut.

2. Rock pockets, form tie holes, deep holes not too large in area, other holes with relatively high ratio of depth to area, and similarly confined areas shall be dry packed.

   After the area to be patched has been thoroughly cleaned and dampened, mortar, which shall consist of a 1 part cement, 2-1/2 parts sand passing a #16 screen, and only enough water to produce a mortar that will stick together upon being molded into a ball by slight pressure of the hands, shall be placed in holes in layers having a compacted thickness of about 3/8 inch. Each such layer shall be solidly rammed over its entire surface using a hardwood stick and a hammer.

3. Shallow depressions where lateral restraint cannot be obtained, voids behind reinforcement, and holes extending through concrete sections shall be patched using a commercially prepared bonding agent, a stiff mortar mix of 1 part cement and not more than 2-1/2 parts sand.

   For filling holes in exterior surfaces, an epoxy bonding agent shall be used.

Applications of the bonding agent shall be in strict conformance with the manufacturer's instructions.

4. An epoxy-and-sand mixture may be used in lieu of the mortar-and-bonding agent mixture for any of the patching above. The preparation of the surface to receive the patch, as well as the mixture proportions of the epoxy-and-sand, shall be in strict conformance with the manufacturer's instructions.

F. Any concrete which is not constructed as shown on the plans or is out of alignment and/or level beyond allowable tolerances may be patched using an epoxy-and-sand mixture.

The proportions of the mix and the preparation of the surface to receive the patch shall be in strict conformance with the manufacturer's instructions except as or unless otherwise specified herein. The minimum thickness of the patch shall be 1/4 inch. No "feathering" to a lesser thickness will be permitted.

Misalignment which requires correction more than 1 inch thickness shall be repaired in the following manner:

1. The surface of the affected area shall be chipped, etched, or otherwise cleaned and roughened to provide a sound surface for bonding;

2. Concrete nails or other fasteners which can provide positive mechanical bonding of the patch shall be set into the surface at about 18 inches o.c. in all directions with a minimum of 2 rows;

3. Wire mesh reinforcement as reviewed by the Owner shall be installed in those portions of the patch which exceed 2 inch thickness;

4. A bonding agent suitable for use in the repair location (epoxy required for exterior use) shall be applied over the entire surface to be patched;

5. Formwork to the true lines called for shall be installed over the area requiring the patch; and

6. Concrete or grout with aggregate sized appropriately for the cavity and which will provide strength equivalent to that of the base surface shall be placed in the form, properly compacted and suitably cured.

G. Remedies for Out of Tolerance Work: Contractor is required to repair and retest any floors not meeting specified tolerances. Prior to repair, Contractor must submit and receive approval for the proposed repair, including product data from any materials proposed. Repairs must not result in damage to structural integrity of the floor. For floors exposed to public view, repairs must prevent any uneven or unusual coloring of the surface.

H. Concrete Walks: Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 0.5

inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

3.11 JOINTS

A. Construction Joints: Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints.

1. Construction Joints for Constructability Purposes

a. At top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into walls.

2. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

3.12 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

A. Not Against Forms (Top of Walls): Surfaces not otherwise specified must be finished with wood floats to even surfaces. Finish must match adjacent finishes.

B. Formed Surfaces

1. As-Cast Rough Form: Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

2. Smooth Finish: Provide for surfaces exposed to public view a smooth surface.

C. Plywood Finish. Finish of all exposed surfaces cast against forms constructed of plywood or lined with "Plyform" shall be true to line and plane within the tolerances in Section 03100, Paragraph 3.1.

D. Joint marks and fins shall be removed and surfaces left smooth, dense and free from prominent grain markings.

E. The surface shall be scrubbed to remove any laitance or loose particles and to expose any defects.

F. Tie holes, honeycombing and defects including bug holes shall be repaired in accordance with Paragraph 3.11.E.3 herein.

G. The surface shall be thoroughly wetted. Then, as the concrete approaches surface dryness, a mortar consisting of 1 part Portland cement, 2 parts well-graded sand passing a #30 sieve, and enough water to provide consistency of thick paint shall be vigorously and thoroughly rubbed over the area with clean burlap pads so as to fill all voids.

H. While the mortar is still plastic but partially set so that it cannot be easily pulled from the voids, the surface shall be rubbed again with a dry (no water) mortar mix of the same proportions as above. Burlap pads, stretched tightly around a board to prevent dishing the mortar in the voids, shall be used for this operation. There shall be no discernible thickness of mortar on the surface except in the voids when this operation is concluded.

I. Immediately following the rubbing treatment, the surface shall be continuously moist-cured for 72 hours.

J. Install floor sealant per section 03300, 2.04 in strict conformance with manufacturer installation instructions.

K. Pavement: Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained or a burlap drag. Drag a strip of clean, wet burlap from 3 to 10 feet wide and 2 feet longer than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks. Round edges and joints with an edger having a radius of 1/8 inch.

3.13 CURING AND PROTECTION

A. All concrete shall be cured for a period of not less than 7 days by one of the methods listed below. During this curing period, the concrete shall be maintained with minimal moisture loss at a relatively constant temperature. Fresh concrete shall be protected from heavy rains, flowing water, mechanical injury, and injurious action of the sun. Curing method selected must be compatible with the finish to be applied to the concrete. Curing shall immediately follow the finishing operation.

B. Water Curing - If cured with water, concrete shall be kept wet by mechanical sprinklers, by ponding, or by any other method which will keep the surfaces continuously wet.

C. Curing Compounds - Curing compounds shall not be used on concrete surfaces that are to receive paint finish, acid stain or resilient flooring,

except those that are recommended by the manufacturer to be compatible with the applied finish.

The Contractor shall submit to the Owner a letter certifying that the curing compound is compatible with the applied finish. Application shall be in accordance with the manufacturer's recommendations. If curing, sealing or other compounds are used which are incompatible with the applied finish, such compound shall be thoroughly removed by grinding with a terrazzo grinder.

D. Waterproof Paper - Waterproof paper or opaque polyethylene film conforming to ASTM C171 may be used. The paper or film shall be anchored securely and all edges sealed or applied in such a manner as to prevent moisture escaping from the concrete. Waterproof paper shall not be used on floors that will be exposed when finished.

E. Liquid Sealer and Hardener - Apply to interior concrete floor indicated for trowel finish and to be exposed to view. Apply in accordance with manufacturer's recommendations.

F. Clean Up: Contractor shall clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work and upon completion of the entire concrete and related work.

3.14 REINFORCEMENT

A. Reinforcing steel bars shall be provided in the sizes, lengths and configurations as indicated on the plans and shall be thoroughly cleaned, before placing, of loose mill scale, loose flaky rust, oil and all coatings that will destroy or reduce bond. If necessary, they shall be cleaned again before placement of the concrete. All items shall be fabricated, positioned and secured in place as indicated in the plans and as herein specified. Annealed steel wire shall be used to secure the reinforcement. The reinforcement shall be placed in the specified positions within the tolerances listed in Sub-Section 3.1. Unless otherwise noted, cleaning, bending and placement of the reinforcement shall be done in accordance with the standard practice of the Concrete Reinforcing Steel Institute.

B. Concrete or metal support and spacers shall be used to insure the proper spacing of reinforcement within the formwork. Stirrups shall be accurately and securely wired to the bars at both top and bottom. At footings, pre-cast concrete blocks (not bricks or hollow tile) or chairs shall be used to hold the reinforcement at a proper distance above the earth.

C. Reinforcing bars shall be tied at all intersections. The distance of the reinforcing bars from the forms shall be maintained by means of pre-cast concrete blocks, ties, hangers, chairs or other approved supports.

D. Bars shall be bent cold to the shapes shown on the plans. Bends shall be made around a pin having a diameter not less than 6 times the bar

diameter except that for bars of larger than one (1) inch in diameter, the pin diameter shall be 8 times the bar diameter. If required, bars may be bent in the field using a "hickey" bar.

E. All reinforcing steel bars shall be furnished in the lengths indicated on the plans. Splicing of bars, except where shown, will not be permitted without the review of the Owner. Splices where permitted shall be staggered as far as possible, wired together in such a manner as to maintain the clear depth of the member and the minimum clear distance to the surface of the concrete.

F. Unless reviewed by the Owner, reinforcement shall not be bent after being partially embedded in hardened concrete. Improperly and/or excessively bent bars shall be replaced.

G. Minimum concrete protective covering for reinforcement shall conform to the following unless otherwise indicated:

1. Concrete cast against and permanently exposed to earth or liquid: 3 inches

2. Formed surfaces in contact with earth or exposed to weather: 2 inches

3. Formed surfaces not in contact with earth or exposed to weather: 1 inch

H. Provide three-week schedule showing expected concrete pour locations and times. Notify Owner and Special Inspector 72 hours prior to any concrete pour if different than shown on the three-week schedule. The Construction Manger may also review the reinforcement placement. This review process shall not be construed to relieve the Contractor of his/her responsibility to place all reinforcement in accordance with the plans.

3.15 FORMWORK

A. Tolerances: Forms shall be constructed so that the concrete surfaces do not deviate from established lines, grades and dimensions. Comply with ACI 301 Section 2 with surface tolerances in accordance with ACI 117.

B. Preparation: Provide temporary shoring, guys, braces, and other supports during erection to keep the structural framing secure, plumb, and in alignment against temporary construction loading.

C. Secure inserts and dowels as required for the attachment of other work. Properly locate all embedded items in cooperation with other trades and secure in position before concrete is placed.

D. All concrete forms shall be placed with metal clamps and ties. Locate ties level and plumb in horizontal rows and vertical tiers.

E. Temporary access openings to forms for cleaning prior to depositing of concrete shall be provided.

F. All exposed concrete surfaces shall be formed with plywood. Only new or unmarred plywood shall be used. Metal forms may be used if they will produce surfaces equal to those produced with wood forms.

G. Forms which cannot be removed shall be of a material other than wood and must be reviewed by the Owner.

H. All forms other than those for the non-removable form described under the preceding sub-paragraph shall be constructed so that they can be removed without hammering or prying against the concrete.

I. Forms shall not be removed before the expiration of the minimum lapsed time from concrete pour shown below unless information and/or data justifying a request for a shorter period is submitted to and reviewed by the Owner. Even with such review, however, the Contractor shall be fully responsible to repair any damages which may result from the early removal.

1. Footing side forms 24 hours

No construction loads exceeding the structural design live loads shall be supported upon any unshored portion of the structure under construction. No construction load shall be supported upon any part of the structure under construction until the portion of the structure has attained sufficient strength to support safely its weight and the loads placed thereon. This strength may be demonstrated by job-cured test specimens and by a structural analysis considering the proposed loads in relation to this test strength. Such analysis and test data shall be furnished by the Contractor to the Owner.

END OF SECTION

DIVISION 5 – METALS

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide metal fabrications as indicated and as specified herein.

1.02 REFERENCES: The latest publications listed below form a pad of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. ASTM International (ASTM)
ASTM A 36 - Structural Steel

ASTM A 53 – Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless

ASTM A 123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products

ASTM A 153 - Zinc-Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

ASTM A 500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing

ASTM A 563 - Carbon and Alloy Steel Nuts

ASTM A 780 - Repair of Damaged Hot-Dip Galvanized Coating

ASTM A 924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM F 844 - Washers, Steel, Plain (Flat) Unhardened for General Use

B. American Welding Society (AWS)
AWS D1.1 - Structural Welding Code - Steel

1.03 GENERAL REQUIREMENTS

A. Provide all miscellaneous metal fabrication work, including but not limited to, the following:
1. Steel pipe bollards.

5. Miscellaneous metal fabrications as indicated on the drawings or specified herein.

6. Furnish miscellaneous steel attachments, anchors, plates, angles, etc. to be set in concrete.

7. Include all anchors, angles, bolts, expansion shields for items in this section only, and other accessories shown in details and/or required for the complete installation of all work.

1.04 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Shop Assembly: Preassemble 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 reassembly and coordinated installation.

C. Welders Certificates: Submit certification that welders employed for the work of this section have received AWS certification within the previous 12 months. All welds shall conform with AWS D1.1 – Structural Welding Code.

1.05 SUBMITTALS

A. Shop Drawings: Submit complete shop drawings of all miscellaneous metal work to the Contracting Officer for review before fabrication. Detail all members and connections not specifically shown but which are required to complete the work.

B. Indicate welded connections using standard AWS A2.0 welding symbols.

1.06 DELIVERY AND STORAGE: Handle, store, and protect materials in accordance with the manufacturer's recommendations. Replace all damaged material with new material or repair as approved by the Contracting Officer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Asbestos Prohibition: No asbestos containing materials or equipment shall be used under this section. The contractor shall ensure that all materials and equipment incorporated in the project are asbestos-free.

B. Structural Steel: Conforming to ASTM A 36.

C. Structural Steel Tubing: ASTM A 500 or ASTM A 501.

D. Miscellaneous Steel Bars and Shapes: ASTM A 108, A 575, A 663, or A 675 as applicable.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

F. Bolts, Nuts, and Washers: ASTM A 307, Grade A. Hot-dip galvanize all hardware items in accordance with ASTM A 153.

G. Expansion Shields: Lead, case hardened steel or non-ferrous metal for application.

H. Toggle Bolts: Fed. Spec. FF-B-588, Tumble-wing type of class, style, and type as required; hot-dip galvanized in accordance with ASTM A 153, or otherwise treated for corrosion resistance.

I. Shop Paint:
   1. Metal Prime Paint: Shop prime all welds after grounded smooth with rust inhibiting metal primer.

   2. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint and assure that primer conforms to all requirements specified in Section 09901 - PAINTING.

J. Welding Materials: AWS D1.1, type required for materials being welded.

2.02 FABRICATION

A. Workmanship:
   1. Use materials of size and thickness shown, or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

   2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

   3. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

   4. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Galvanizing: Provide a zinc coating for those items shown or specified to be galvanized, as follows:
   1. ASTM A 153 for galvanizing iron and steel hardware.

   2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier, and for galvanizing assembled steel products.

C. Shop Painting:
   1. Shop paint miscellaneous steel metal work and galvanized surfaces, unless otherwise specified.

   2. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at a rate to provide uniform dry film thickness of 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

D. Miscellaneous Framing and Supports:
   1. Provide miscellaneous steel framing and supports as required to complete work.

2. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars. Cut, drill and tap units to receive hardware and similar items.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

B. Cutting, Fitting and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

3.02 MISCELLANEOUS METAL FABRICATIONS

A. The following fabricated assemblies are described in brief outline to indicate, in addition to the drawings, the general design and details desired. Standard products of manufacturers specializing in similar work will be considered insofar as they fulfill the requirements and do not violate governing codes for building and standards for good construction work.

1. Pipe Bollards: Shall consist of heavy duty, extra strong, steel pipe with welded steel bars, etc., as indicated on the drawings. Provide concrete fill or welded steel flat bar cap as required. Paint and/or apply reflective tape as indicated. Hot-dip galvanize after fabrication.

2. Miscellaneous Metal Fabrications: Shall consist of steel components welded similar to metal pipe handrails, in sizes and arrangements as shown. Hot-dip galvanize after fabrication.

3.03 FABRICATION

A. Fabrication shall be performed by skilled mechanics of the trade and in accordance with manufacturer's directions. Metal work shall be well formed to shape and size, with sharp lines and angles and true curves. Provide welding and bracing of adequate strength and durability, with tight, flush joints, dressed smooth and clean.

B. Measurements: Before fabrication, take necessary field measurements and verify all measurements.

C. Metal surfaces shall be clean and free from mill scale, flake rust and rust pitting; well formed and finished to shape and size, with sharp lines and angles and smooth surfaces. Shearing and punching shall leave clean true lines and surfaces. Welds shall be used and finished flush and smooth on surfaces that will be exposed after installation.

D. Fastening: Provide the necessary rebates, lungs and brackets so that the work can be assembled in a neat, substantial manner. Holes for bolts shall be drilled.

E. Welding of structural steel shapes and bar stock shall be in accordance with AWS D1.1.

3.04 ADJUST AND CLEAN

A. Touch-Up Painting: Immediately after erection, clean bolted connection and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION

DIVISION 6 – WOOD AND PLASTICS

SECTION 06070 – WOOD TREATMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Plant preservative and insecticide treatment of lumber and other wood products specified in other Sections of this Specification by pressure and dip methods.

B. Field treatment of field cut or drilled lumber.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Lumber products and fire retardant treatment of lumber products.

1.03 REFERENCES

A. American Wood-Preservers' Association
   1. AWPA C2-00: Lumber, Timber, Bridge Ties and Mine Ties-Preservative Treatment by Pressure Processes.

   2. AWPA C9-00: Plywood-Preservative Treatment by Pressure Processes.

   3. AWPA C31-00: Lumber Used out of Contact with the Ground and Continuously Protected from Liquid Water-Treatment by Pressure Processes.

   4. AWPA M4-01: Care of Preservative-Treated Wood Products.

   5. AWPA C20-99: Structural Lumber- Fire Retardant Treatment by Pressure Process.

   6. AWPA N1-01: All millwork, Preservative Treatment by Non-Pressure Process.

   7. AWPA N2-00: Composite Wood Products, Preservative Treatment by Non-Pressure Process.

1.04 SUBMITTALS

A. Product Data: Submit six (6) sets of data on all treatment products, including field application instructions if applicable.
   1. Provide manufacturer's Material Safety Data Sheets on all products, and hazardous materials.

B. Preserver Certifications:
   1. Provide a Certificate of Treatment showing compliance with these specifications for the following:
      a. Kiln drying.

      b. Method of treatment performed, including dip treatment.

C. Contractor's Certification: Provide a certification letter stating that all wood used on this job including cuts and penetration were treated and coated with preservatives in compliance with requirements of this contract.

D. Guarantee: Guarantee form for written guarantee.

1.05 REGULATORY REQUIREMENTS

A. Comply with State OSHL (Occupancy Safety and Health Law) and pollution controls regulations of the State Department of Health and EPA.

1.06 QUALITY ASSURANCE

A. Source Limitations for Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

B. Comply with the American Wood-Preservers' Association standards as described in the applicable building or residential code. Preservatives shall be EPA registered.

C. Do not use preservatives containing arsenic or other EPA banned chemicals.

D. Do not use Perma-Clear 65 or other zinc napthanate and permethrin products.

1.07 DELIVERY STORAGE AND HANDLING

A. Protect AWPA C31 inorganic boron treated wood from contact with the ground, rain or other sources of liquid water until permanent installation of covering construction.

1.08 GUARANTEE

A. Provide a two year guarantee to replace all treated wood which is attacked by subterranean termites.

B. Provide a five year guarantee to replace all treated wood which is attacked by dry wood termites or deteriorates due to dry rot. This guarantee period supersedes the guarantee provisions of the General Conditions (GC). The Surety shall not be held liable beyond two years from the project acceptance date.

C. Guarantee periods shall commence on Project Acceptance date.

PART 2 - PRODUCTS

2.01 GENERAL

A. Mill lumber to finish size and shape prior to treating, and treat before assembly. Plywood may be treated in regular panel sizes.

2.02 PRESSURE TREATMENT WITH WATER-BORNE PRESERVATIVES

A. Treating solutions:
   1. Copper azole, Type A (CBA-A).

   2. Inorganic boron (SBX).

B. Treatment Methods:
   1. General:
      a. All water-borne treatment methods require incising of lumber of nominal 2 inch thickness (1-1/2 inches actual dimension).

      b. Choice of treatment method and conditions of use of each treating solution shall conform to the treatment schedule contained in Part 3.

   2. CBA-A: Treatment methods, depth of penetration and treating solution retention shall conform to AWPA C2 for lumber and C9 for plywood.

   3. SBX: Treatment method shall conform to AWPA C31. Treating solution retention shall be a minimum of 0.28 pounds per cubic foot (equivalent to 0.42 DOT).

C. Drying:
   1. Before Treatment:
      a. CBA-A Treatment: Wood shall be air dried or kiln-dried before treatment to an average moisture content of 28 percent or less per AWPA standards.

      b. SBX Treatment: Wood having a moisture content higher than 28% is acceptable when treating with SBX.

   2. After Treatment:
      a. All 1 inch and 2 inch lumber and all plywood shall be dried to a moisture content of 19 percent or less after treatment.

2.03 PRESSURE TREATMENT WITH OIL-BORNE PRESERVATIVES

A. Treating Solution:
   1. 0.50 percent by weight chlorpyrifos, 0.75 percent by weight 3-iodo-2-propynyl butyl carbamate (IPBC). The solvent used in formulating the preservative solution shall meet the requirements of AWPA hydrocarbon solvent Type C, Standard P9, Paragraph 3.1.

   2. For interior application use low odor mineral spirits as solvent.

B. Treatment Methods:
   1. Treated wood shall attain the following net retention requirements: 0.0175 pounds of Chlorpyrifos per cubic foot of wood, 0.035 pound of 3-Iodo-2 propynyl butyl carbamate per cubic foot of wood.

C. Drying:
   1. Before Treatment: All wood treated with oil-borne preservatives shall be kiln-dried to an average moisture content of 12% to 15% per AWPA standards.

   2. After Treatment: Wood shall be thoroughly dried and virtually odor-free prior to installation.

2.04 PRESERVATION BY DIP TREATMENT

A. Treating Solution:
   1. Any of the Oil-Borne Preservatives listed above.

   2. A solution of 1 quart chlopyrifos in 55 gallons of a 0.50 percent IPBC solution.

B. Treatment Methods:
   1. Immersion treat for a minimum period of 15 minutes.

   2. Do not incise lumber scheduled to be left unpainted or receive a clear finish.

C. Drying:
   1. After Treatment: Wood shall be thoroughly dried and virtually odor-free prior to installation.

2.05 FIELD TREATMENT

A. Treatment Method:
   1. Treat in accordance with AWPA Standard M4-98 using two heavy brush coats of a treating solution.

PART 3 - EXECUTION

3.01 SCHEDULE OF TREATMENTS

A. Species:
   1. Treat all wood species except all-heart redwood.

   2. All water-borne and oil-borne treatment solutions are applicable to douglas-fir and hem-fir species except for CBA-A treatment which is acceptable for hem-fir species only.

B. Application:
   1. Pressure Treatment:
      a. General: Unless otherwise stipulated, all lumber and plywood shall be pressure treated.

      b. Hardwood flooring and exposed lumber 1-1/2" (net thickness) and over that will be unpainted or receive a clear finish shall be and pressure treated with oil-borne preservative. Do not incise lumber.

      c. SBX treated wood shall not be used in areas exposed to direct precipitation (e.g. exposed decking, trellises, fencing, etc.) unless painted or covered with a finish material.

   2. Dip Treatment: All finish lumber under 1-1/2 inch net thickness (except hardwood flooring); finish plywood; and mill work items, such as for cabinet work, shelving and similar wood work that will be exposed to view in the finished work.

3. Field Cuts: Treat end cuts, notches and penetrations into treated lumber or plywood. Exception: Cuts and penetrations made in SBX treated wood 2 inches or less in nominal thickness need not be field treated.

END OF SECTION

SECTION 06100 – ROUGH CARPENTRY

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Framing with dimensional lumber
   2. Engineered wood products
   3. Wood furring, grounds, nailers, and blocking

B. Related Sections
   1. 06070 - Wood Treatment

1.02 REFERENCES

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

A. AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)
   1. AF&PA T101 (2005) National Design Specification (NDS) for Wood Construction

B. AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
   1. AWPA BOOK AWPA Book of Standards
   2. AWPA M2 Standard for Inspection of Treated Wood Products
   3. AWPA M6 Brands Used on Forest Products
   4. AWPA P49 Standard for Fire Retardant FR-1
   5. AWPA P5 Standard for Waterborne Preservatives

C. APA - THE ENGINEERED WOOD ASSOCIATION (APA)
   1. APA E445 (2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)
   2. APA L870 Voluntary Product Standard, PS 1-09, Structural Plywood
   3. APA S350 Performance Standard for Wood-Based Structural-Use Panels

D. ASME INTERNATIONAL (ASME)
   1. ASME B18.6.1 (1981; R 2008) Wood Screws (Inch Series).
   2. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

3. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.03 SUBMITTALS

A. Product Data: Submit six (6) sets for each different wood member, strength classification, accessory, and other manufactured product specified.
   1. Submit documentation verifying that no urea-formaldehyde resins were used.
   2. Submit manufacturer's product data, indicating VOC content.

B. Shop Drawings: Submit six (6) sets of fabrication and installation details for the following:
   1. Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.
   2. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
   3. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store all materials off the ground, to provide protection and ventilation against ground moisture and dampness. Slope materials for drainage to avoid standing water. Cover stored materials with a moisture barrier at both the ground level and a covering forming a well-ventilated enclosure. Adhere to requirements for stacking, lifting, bracing, cutting, notching, □nd special fastening requirements. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.05 GRADING AND MARKING

A. Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870. Surfaces that are to be exposed to view shall not bear grade marks or other types of identifying marks.

B. The Contractor shall be responsible for the quality of treated wood products. Each treated piece shall be inspected in accordance with AWPA M2 and permanently marked or branded, by the producer, in accordance with AWPA M6. The Contractor shall provide Contracting Officer with the inspection report of an approved independent inspection agency that offered products comply with applicable AWPA Standards. The appropriate Quality Mark on each piece will be

accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

C. Mark each piece in accordance with AWPA M6, except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber shall be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of AWPA M6.

1.06 PRESERVATIVE TREATMENT

A. All Rough Carpentry shall be treated in accordance with SECTION 06070.

1.07 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Submit certificates attesting that products meet the grade requirements specified in lieu of grade markings where appearance is important and grade marks will deface material.

PART 2 - PRODUCTS

2.01 Plywood

A. C-D Grade, Exposure 1 durability classification, Span rating of 24/16 or greater, FSC-certified.

B. Exterior Type, C-C (Plugged) Grade. Minimum thickness shall be as listed below except where indicated to have greater thickness.

1. Support Spacing	Minimum Thickness
a. 16 inches	1/2 inch for Group 1 species 19/32 inch for Group 2 and 3 species 23/32 inch for Group 4 species
b. 24 inches	23/32 inch for Group 1 species 7/8 inch for Group 2 and 3 species 1 inch for Group 4 species

2.02 ROUGH HARDWARE

A. Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be hot-dip zinc-coated in accordance with ASTM A153.

2.03 CONNECTIONS

A. Screws for wood-to-steel connections shall be self-drilling, tapping screws in compliance with ASTM C1513 of the type, size and location as shown on the drawings. Electroplated screws shall have a minimum 5 micron zinc coating in

accordance with ASTM F1941. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A123 or ASTM A153 as appropriate. Screws, bolts and anchors shall be hot dipped galvanized in accordance with ASTM A123 or ASTM A153 as appropriate.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install with the grain of the outer plies or long dimension at right angles to supports. Stagger end joints and locate over the centerlines of supports. Allow 1/8 inch spacing at panel ends and 1/4 inch at panel edges. Screw panels at maximum spacing 6 inches o.c. at supported edges and 12 inches o.c. at intermediate bearings. Where the support spacing exceeds the maximum span for an unsupported edge, provide adequate blocking, tongue-and-groove edges, or panel edge clips, in accordance with APA E30.

3.02 CONSTRUCTION TOLERANCES

A. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:
   1. Face of framing members: 1/4 inch in 8 feet from a true plane.

END OF SECTION

DIVISION 7 – THERMAL and MOISTURE PROTECTION

SECTION 07900 - SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Completely close with sealant all joints specified or required to be sealed to a watertight condition.

1.02 SUBMITTALS

A. Submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES.

B. Manufacturer's Data: Submit six (6) sets of manufacturer's product data and specifications for type of sealant required, to the Contracting Officer for approval.

C. Material Safety Data Sheets (MSDS): Submit MSDS for each sealant product.

D. Color Samples: Submit six (6) sets each of color finish samples of sealants.

E. Guaranty: Submit written guaranty as specified in paragraph entitled "GUARANTY" herein below.

1.03 JOB CONDITIONS

A. Examine joint surfaces and backing, and their anchorage to the structure, and conditions under which joint sealer work is to be performed, and notify Contractor in writing of conditions detrimental to proper completion of the work and performance of sealers. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to Installer. On surfaces to be painted, install sealants prior to painting. Coordinate with SECTION 09901 - PAINTING.

B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions. Proceed with the work only when weather conditions are favorable for proper cure and development of high early bond strength.

1.04 PRODUCT HANDLING

A. Delivery: Deliver sealants to the jobsite in sealed containers labeled to show the designated name, formula, or specification number, lot number, color, date of manufacture, shelf life, curing time, manufacturer's directions, and name of manufacturer.

B. Storage: Carefully handle and store all materials to prevent inclusion of foreign materials. Remove from project site all damaged and deteriorated materials and materials exceeding shelf life.

C. All sealant materials shall be installed prior to expiration of shelf life.

1.05 GUARANTY

A. Provide a 2-year guaranty against leaks, air infiltration, cracks and other failures of the installation and materials.

1. Repair or replace sealants to seal leaks caused by faulty materials or workmanship.

2. Repair or replace damage to the building or its finishes, equipment or furniture when occasioned by such leaks.

B. The Surety will not be held responsible beyond two (2) years of the project acceptance date.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sealant Backer Rod: Compressible rod stock of polyethylene foam, polyethylene-jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, nonabsorptive material as recommended for compatibility with sealant by the sealant manufacturer to control the joint depth for sealant placement, to break bond of sealant at bottom of joint, to form optimum shape of sealant bead on back side, and to provide a highly compressible backer which will minimize the possibility of sealant extrusion when joint is compressed. Do not use oakum or other types of absorptive materials as backstops.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer.

C. Masking Tape: Non-staining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

D. Primer for Sealants: Non-staining, as recommended by the sealant manufacturer.

E. Sealants at Exterior and Interior Vertical and Overhead Moving Joints: One-part polyurethane-based sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25, Use NT. Provide one of the following, or approved equal:
   1. Dymonic; Tremco, Inc.

   2. Chem-Calk 900; Bostik Construction Products Div.

   3. Sikaflex 1a; Sika Corp.

   4. Dynatrol I; Pecora Corp.

   5. NP-1; Sonneborn.

F. Sealants at Interior Vertical and Overhead Non-Moving Joints: Non-Elastomeric Sealant; acrylic-emulsion type, conforming to ASTM C 834. Provide one of the following, or approved equal:
   1. AC-20 Acrylic Latex: Pecora Corp.

   2. Tremco Acrylic Latex 834; Tremco, Inc.

   3. Chem-Calk 600; Bostik Construction Products Div.

4. Sonolac; Sonneborn.

G. Silicone Sealant: At Perimeter of All Plumbing Fixtures and Fittings: One-part mildew-resistant silicone sealant conforming to ASTM C 920, Type S, Grade NS, Class 25, Use NT, formulated with fungicide; intended for sealing interior joints with non-porous substrates. Provide one of the following, or approved equal:
   1. Dow Corning 786; Dow Corning Corp.
   2. SCS 1702 Sanitary; General Electric Co.
   3. Tremsil 600 White; Tremco, Inc.
   4. Omni Plus; Sonneborn.
   5. 898 or 893, No. 345; Pecora Corp.

H. Bedding Compound: For installation of thresholds and similar items indicated to be bedded in sealant, use a preformed butyl-polyisobutylene sealant tape. Size of tape as required for the specific application. Provide one of the following, or approved equal:
   1. Extru-Seal; Pecora Corp.
   2. 440 Tape; Tremco, Inc.
   3. Chem-Tape 40; Bostik Construction Products Div.

I. Acoustical Sealant: ASTM C 920, Type S or M, Grade NS, Class 12.5, Use NT.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

3.02 EXAMINATION

A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

3.03 JOINT PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
   1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust, paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer, oil, grease, waterproofing, water repellants, water, and surface dirt.

2. Clean concrete, masonry, and similar 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 sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Steel Surfaces in Contact with Sealant: Scrape and wirebrush to remove loose mill scale. Remove dirt, oil, or grease by solvent cleaning, and wipe surfaces with clean cloths.

5. Clean metal and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.04 INSTALLATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Do not apply sealant on wet surfaces or when the surface temperature exceeds 130 degrees F.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.

      b. Do not stretch, twist, puncture, or tear joint fillers.

      c. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.

3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.

D. Primer: Immediately prior to application of the sealant, clean out all loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete, masonry units, wood, and other porous surfaces in accordance with compound manufacturer's instructions. Do not apply primer to exposed finish surfaces.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer. Provide concave joint configuration per Figure 5A in ASTM C 1193.

3.05 CLEAN UP

A. Immediately scrape off fresh sealant compound that has been smeared on masonry or porous surfaces and rub clean with a solvent as recommended by the compound manufacturer. Upon completion of sealant compound application, remove all remaining smears and stains resulting therefrom and leave the work in a clean, uniform, and neat condition.

3.06 PROTECTION

A. Protect areas adjacent to joints from compound smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

B. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of project acceptance. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

END OF SECTION

DIVISION 8 – DOORS and WINDOWS

SECTION 08330 – OVERHEAD COILING DOORS

PART 1- GENERAL

1.01 SUMMARY

Provide manual overhead rolling doors and related components as indicated herein.

1.02 REFERENCES: The latest 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.

A. ASME International (ASME)

ASME B29.400 – Combination, "H" Type Mill Chains, and Sprockets

B. ASTM International (ASTM)

ASTM A 153/A 153M – Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 27 – Steel Castings, Carbon, for General Application

ASTM A 307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

ASTM 36 – Carbon Structural Steel

ASTM A 48 – Gray Iron Castings

ASTM A 53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 653 – Steel Sheet, Zinc-Coated (Galvanized) or Zin-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 666 – Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

ASTM A 780 – Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A 924 – General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 209 – Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 – Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profile, and Tubes

ASTM D 2000 – Rubber Products in Automotive Applications

ASTM E 330 – Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

ASTM F 568 – Carbon and Alloy Steel Externally Threaded Fasteners

C. National Fire Protection Association (NFPA)

NFPA 70 - National Electrical Code

NFPA 80 - Fire Doors and Fire Windows

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's catalog data.

B. Shop Drawings: Submit drawings for manual overhead rolling doors showing types, sizes, locations, metal gages, hardware provisions, installation details, and other details of construction.

C. Manufacturers Instructions: Submit manufacturer's currently recommended installation procedures for doors along with the shop drawings.

D. Certificates: Attest that the doors and accessories conform to all requirements of this specification and withstand loads derived from 105 mph wind speed.

E. Operations and Maintenance Data: Submit aluminum coiling service door operations and maintenance manuals.

1.04 DELIVERY AND STORAGE

A. Protect manual overhead rolling service doors and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name. Store roll-up shutters in dry locations with adequate ventilation, free from dust and water, and in such a manner as to permit access for inspection and handling. Handle manual overhead rolling doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: ISO 9001:2000 registered and a minimum of five years of experience producing doors of the type specified.

2. Installer Qualifications: Manufacturer's approval.

1.06 WARRANTY

A. Provide warranty against defects arising from faulty workmanship or material up to 5 years from the Project Acceptance Date. Warranty shall not cover physical abuse or neglect maintenance.

B. Standard Warranty: Contractor's Surety shall not be liable for all damages 2-years after Project Acceptance Date.

PART 2 - PRODUCTS

2.01 COILING SERVICE DOORS

A. Spring counterbalanced, overhead coiling type, and shall be designed for use on exterior openings, as indicated. Doors shall be operated manually with hand chain. Doors shall be complete with guides, hardware, fastenings, operating mechanisms, and accessories. Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position. Doors, hardware, and anchors shall be designed to withstand a wind pressure of 55 pounds per square foot of door area without damage. Exterior doors shall be mounted as indicated on interior side of walls.

B. Curtain:
   1. Slats No. 5F, 18 gauge, grade 40 steel, ASTM A653 galvanized steel zinc coating.

   2. bottom Bar: Two 2x2x1/8 inch structural steel angles.

   3. fabricate interlocking sections with high strength nylon endlocks on alternate slats each secured with two ¼" rivets. Provide windlocks as required to meet specified wind load.

   4. Slat Finish:
      a. GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color to match the inside color of the wall panels. A minimum 2.5 mils cured film thickness, ASTM D-3363 pencil hardness; H or better.

   5. Bottom Bar Finish:
      a. Steel: Phosphate treatment followed by baked-on polyester powder coat, color OSHA YELLOW. A minimum 2.5 mils cured film thickness, ASTM D-3363 pencil hardness; H or better.

C. Guides:
   1. Fabricate with structural steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

   2. Top 16 ½" of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.
      a. Finish: Steel: Phosphate treatment followed by baked-on polyester powder coat, color to match the inside color of the wall panels.
      A minimum 2.5 mils cured film thickness, ASTM D-3363 pencil hardness; H or better.

D. Counterbalance Shaft Assembly:
   1. Barrel: Steel pip capable of supporting curtain load with maximum deflection of 0.03 inches per foot of with.

   2. Spring Balance: Oil-tempered, heat-treated steel helical tension spring assembly designed for proper balance of door to ensure that maximum effort to operate will note exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

E. Brackets:
   1. Fabricate from minimum 3/16 inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.

   2. Finish:
      a. Phosphate treatment followed by bake-on polyester powder coat. Color, to match the inside color of the wall panels. A minimum 2.5 mils cured film thickness, ASTM D-3363 pencil hardness; H or better.

F. Hood:
   1. 24 gauge with reinforced top and bottom edges. Provide minimum ¼ inch steel intermediate support brackets as required to prevent excessive sag.

   2. Finish:
      a. GalvaNex™ Coating System and phosphate treatment followed by bake-on polyester powder coat, Color, to match the inside color of the wall panels. A minimum 2.5 mils cured film thickness, ASTM D-3363 pencil hardness; H or better.

G. Weatherstripping:
   1. Bottom Bar: Replaceable, bulb-style, compressible EDPM gasket extending into guides.

   2. Lintel Seal: Nylon brush seal fitted at door header to impede air flow.

2.02 ACCESSORIES

A. Locking: Manual Chain Hoist, Padlockable slide bolt on coil side of bottom bar at each jamb extending into slots in guides. The locking device shall be of type to receive a padlock with a 5/16-inch diameter shackle. Contractor to provide Padlock match key system.

2.03 OPERATION

A. Manual Chain Hoist: Provide chain hoist operator with endless steel chain, chain pocket wheel and guard geared reduction unit, and chain keeper secured to guide.

2.04 FINISH ON SURFACES

A. Comply with NAAM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Noticeable variations in the same metal component are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

2.05 BITUMINOUS PAINT

A. ASTM D 1187. Protect the surfaces with a coat of bituminous paint to prevent galvanic or corrosive action. Coating shall be applied in two coats, 9 mils dry film thickness each coat.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install doors in accordance with approved shop drawings and manufacturer's directions. Locate anchors and inserts for guides, brackets, hardware, and other accessories accurately.

3.02 PROTECTION

A. Protect doors from damage when installed. Restore doors that are damaged prior to completion and acceptance to the original condition or replace.

3.03 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, adjust doors for ease of operation, free from warp, twist, or distortion.

3.03 CLEANING

A. Upon completion of installation, thoroughly clean surfaces of doors in accordance with recommended procedure of the door manufacturer. Do not use abrasive, caustic, or acid cleaning agents.

3.04 DEMONSTRATION

A. Demonstrate proper operation to Contracting Officer.

B. Instruct contracting Officer in maintenance procedures.

END OF SECTION

DIVISIONS 9 – FINISHES

SECTION 09901 - PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes surface preparation, caulking and field painting of exposed **new** exterior and interior surfaces, and areas damaged by the Contractor's operations.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint new exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Contracting Officer will select from standard colors and finishes available.
   1. New Interior and Exterior surfaces scheduled to be finished.

   2. Non Ferrous metals, plated or factory finished items specifically noted to be painted or when such items occur as accessories and appurtenance to surfaces required to be painted.

   3. Pipes, conduit, ducts, support apparatus and other exposed mechanical and electrical items in areas to be painted. Exterior mechanical and electrical equipment and items on the roof or building exterior.

   4. Touch-up paint areas damaged by the Contractor's operations.

C. Surfaces not to be finished, unless otherwise indicated.
   1. Concrete floors, paving walks stairs and sidewalk concrete. Other concrete surfaces scheduled not to be painted.

   2. Finish hardware, unless prime coated.

   3. Acoustical ceilings, unless scheduled to be painted.

   4. Lighting fixtures, and electrical device plates.

   5. Concealed surfaces include walls or ceilings generally inaccessible spaces.

   6. Finished metal surfaces include the following:
      a) Anodized aluminum.
      b) Copper and copper alloys.
      c) Bronze and brass.

   7. Operating parts include moving parts of operating equipment.

   8. Labels: Do not paint over UL, FMG, or other code required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 RELATED SECTIONS

A. Division 16, identification marking of painting of electrical equipment and apparatus.

1.03 REFERENCES: The latest 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.

A. ASTM International (ASTM)
ASTM D 16 – Definition of terms relating to Paint, Varnish, Lacquer and Related Products

ASTM D 2092 - Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting

ASTM D 3273 - Resistance to Growth of Mold on the Surface of Interior Coating in and Environmental Chamber

ASTM D 3274 - Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation

B. Master Painters Institute (MPI)
MPI 5 – Prime, Alkyd/Oil for Exterior Wood

MPI 10 – Exterior Latex, Flat

MPI 11 – Exterior Latex, Semi-Gloss

MPI 50 - Interior Latex, Primer Sealer

MPI 52 - Interior Latex, Gloss Level 3

MPI 54 - Interior Latex, Semi-Gloss

MPI 72 - Polyurethane, Two Component, Pigmented, Gloss

MPI 79 - Marine Alkyd Metal Primer

MPI 80 - Vinyl Wash Primer

MPI 101 - Cold Curing Epoxy Primer

MPI 108 - High Build Epoxy Marine Primer

MPI 110 - Interior/Exterior High Performance Acrylic

MPI 119 – Exterior Latex, Gloss

C. Painting and Decorating Contractors of America (PDCA)
PDCA - Architectural Specification Manual

D. Steel Structures Painting Council (SSPC)
SSPC PA 3 - Safety in Paint Application

SSPC-SP 1 - Solvent Cleaning

SSPC-SP 6 - Commercial Blast Cleaning

1.04 DEFINITIONS AND ABBEVIATIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

B. DFT: Dry film thickness, the film thickness of the fully cured, dry paint or coating.

C. DSD: Degree of Surface Degradation, the MPI system of defining degree or surface degradation. Five levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

D. EPP: Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

E. EXT: MPI short term designation for an exterior coating system.

F. INT: MPI short term designation for an interior coating system.

G. Micron/microns: The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

H. Mil/mils: The English measurement for 0.001 inch or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

I. mm: The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

J. MPI Gloss Levels: MPI system of defining gloss. Seven gloss levels (G1 to G7) Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6. Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat	0 to 5	10 maximum
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 minimum
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

K. REX: MPI short term designation for an exterior coating system used in repainting projects over existing coating system.

L. RIN: MPI short term designation for an interior coating system used in repainting projects over existing coating system.

1.05 SUBMITTALS

A. Product Data:
   1. Materials List: Provide an inclusive list of required patching and coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
      a. For products with premixed colors, provide manufacturer's standard color chips for selection by Contracting Officer.

   2. Manufacturer's Information: Provide data on all listed materials, including:
      a. Thinning and mixing instructions
      b. Application instructions and required mil film thicknesses.
      c. Manufacturer's Material Safety Data Sheets.

B. Certifications: Provide a letter certifying paints and coatings are free of asbestos, lead, zinc-chromate, strontium chromate, cadmium, mercury, crystalline silica and other EPA regulated and hazardous materials. Provide a letter certifying the amounts of mildewcide added by both the paint manufacturer and paint supplier.

C. Schedule of Finishes: Provide finish schedule including paint spread rates required to achieve final dry film thickness indicated in the schedule.

D. Schedule of Operations: Provide a work schedule showing sequence of operation and installation dates.

E. Samples:
   1. Submit color and finish samples, at manufacturers normal paint chip size illustrating range of colors and textures available for each surface finishing product scheduled.

   2. After color and finish sample are returned, submit paint finish samples, 8.5" x 11" in size illustrating selected colors and textures for each selection. Divide sample in horizontal strips showing prime and overlapping second and finish coats. Show coat tinting. Prepare transparent finish samples on same material as that on which coating will be applied. Identify each sample.

F. Manufacturer's Instructions: Indicate special surface preparation procedures, and substrate conditions requiring special attention.

G. Samples for Initial Selection: For each type of finish coat material indicated.
   1. After color selection, Contracting Officer will furnish color chips for surfaces to be coated.

   2. Submit 3 samples on the following substrates for Contracting Officer's review of color and texture only:
      a. Painted Wood: 8-inch-square. Samples for each color and material on hardboard.
      b. Ferrous Metal: 3-inch- square samples of flat metal and 6-inch- long samples of solid metal for each color and finish.

H. Delivery Receipts: Provide 3 copies of the delivery receipt, signed by the School's Custodian, attesting to delivery of extra paint as required under Paragraph 1.10

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
   1. Exception: Alkali resistant primers if compatible with the intermediate coat paint products.

1.07 REGULATORY REQUIREMENTS

A. Comply with State OSHL (Occupational Safety and Health Law) and pollution control regulations of the State Department of Health, City and County of Honolulu, and the U.S. Environmental Protection Agency

B. Safety methods used during coating application shall comply with the requirements of SSPC-PA Guide 3.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's brand name and lot number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions and coverage.
   7. Color name and number.
   8. VOC content.

B. Storage
   1. Non-flammable Materials: Store materials not in use in tightly covered containers in a well ventilated area. Maintain storage containers in a clean condition, free of foreign materials and residue.

2. Flammable Materials:
   a. Store in such a manner as to prevent damage. No paint material, empty cans, paint brushes and rollers may be stored in the building(s). Store these items in separate storage facilities away from the building(s). Contractor may furnish a separate job site storage structure, if the structure complies with the requirements of the local Fire Department. Keep the storage area shall clean. Lock any storage structures when not in use or when no visual supervision is possible.

   b. All rejected materials shall be removed from the job site immediately.

1.09 PROJECT CONDITIONS

A. Do not apply materials when surfaces and ambient temperatures are outside the ranges required by the paint product manufacturer. Do not apply exterior coatings during rain or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

B. Protect public, pedestrians and tenants from injury. Provided, erect and maintain safety barricades around scaffolds, hoists and where constriction operations create hazardous conditions.

C. Completed Work: Provide necessary protection for wet paint surfaces.

D. Protective Covering and Enclosures: Provide and install clean sanitary drop cloth or plastic sheets to protect furniture, equipment, floor and other areas that are not scheduled for treatment. Remove any paint applied to surfaces not scheduled for treatment.

E. Fire Safety: Contractor and its employees shall not to smoke in the vicinity of the paint storage area. Exercise precautions against fire at all times and remove waste rags, plastic (polyester sheets), empty cans, etc. from the site at the end of each day.

1.10 EXTRA MATERIALS

A. Provide extra paint in each of the different colors, types and surface textures of exterior and interior paint to the Contracting Officer upon completion of the project. Paint shall be in unopened one gallon containers and labeled with color, type, texture, room locations, and date in addition to manufacturer's label.
   1. Provide 1 gallon of each color for paint used.

1.11 WARRANTY

A. Provide a two year guarantee that the work performed under this section conforms to the contract requirements and is free of any defect of material or workmanship.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under

conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Mildewcide
   1. Except for metal primers, paint shall contain the maximum amount of mildewcide permitted per gallon of paint by the manufacturer without adversely affecting the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfiguration rating or 8 or greater when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Mercurial mildewcide shall not be used in interior paint. Insecticide shall not be used in paint

C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names in the Color Schedule indicated to designate colors or materials, is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed products to be used.

   2. Equivalency: Equivalent products to the specified products are listed in the Master Painter's Institute's "Architectural Painting Specification Manual."

   3. Substitution: Requests for substitution of a product or product if a manufacturer is not on the "Approved Product List" will be evaluated for equivalency based on product test results per the test criteria of the Master Painter's Institute.

D. Colors: Colors shall match adjacent painted surfaces.

E. EPA Regulated and Hazard Materials: Do not use paint or paint products containing lead, mercury, zinc chromates, strontium chromate, cadmium or the EPA regulated or hazard materials.

F. Human Carcinogens: All paints shall not contain confirmed human carcinogens or suspected human carcinogens as determined by the American Conference of Governmental Industrial Hygienist.

2.02 MISCELLANEOUS MATERIALS

A. Provide patching, caulking, sealant and repair materials. Compatible with paint finishes and substrates. Use weather resistant materials for exterior surfaces and surfaces exposed to moisture.

B. Accessories
   1. General: Provide other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2. Thinners: Thinning of paint shall be done using material recommended by the manufacturer. Mix proprietary products according to manufacturer's requirements. Do not use compound thinner, mineral oil, kerosene, refined linseed oil, or gasoline for thinning.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
   1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
      a) Ensure that concrete and masonry surfaces are cured and dried to meet paint manufacturer's recommendations.

   2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Contracting Officer about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove dust, oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.

D. Surface Preparation Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

1. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.

2. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

3. Touch up bare areas and shop applied prime coats that have been damaged. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat. Spot priming specified here shall be in addition to full prime painting scheduled in Part 3 below.

E. Surface Preparation Galvanized Surfaces: Clean galvanized surfaces with non-petroleum based solvents so surface is free of oil and surface contaminants in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brushed-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized." If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 2092, Appendix X2, and remove by one of the methods described therein. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

F. Surface Preparation Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

   2. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.

   3. If transparent finish is required, backprime with spar varnish.

   4. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.

   5. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

G. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

H. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.

   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

   3. Provide finish coats that are compatible with primers used.

   4. The term "exposed surfaces" includes areas visible when permanent or built in fixtures, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

   5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only unless otherwise noted.

   6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

   7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

   8. Sand lightly between each succeeding enamel or varnish coat.

   9. Ensure primers are top coated within the times required by the paint manufacturers. Top coats not applied within the recoating window may be rejected.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

4. Be aware of the requirements for, and restrictions on, spray painting contained in PROJECT CONDITIONS Paragraph.

C. Application Procedures: Apply paints and coatings by brush, roller, or other applicators according to manufacturer's written instructions.
   1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.

   2. Rollers: Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
   1. Uninsulated metal piping.

   2. Uninsulated plastic piping.

   3. Pipe hangers and supports.

   4. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.

   5. Duct, equipment, and pipe insulation having "all service jacket" or other paintable jacket material.

   6. Mechanical equipment that is indicated to have a factory primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:
   1. Panel boards.

2. Electrical equipment that is indicated to have a factory primed finish for field painting.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL TESTING

A. Inspection and Approvals: Obtain written approval upon completion of each phase of work (phases of work are: surface preparation and spot prime, prime, first finish coat, second finish coat) before proceeding into the next phase or work. For any particular area of work that deviates from the submitted work schedule, notify the Contracting Officer one day (24 hours minimum) in advance when completing any phase of work. Provide access to areas to be inspected.
   1. Failure to obtain approval of any phase of work for a work area may result in redoing the operation at no cost to the State.

   2. Right of Rejection: Non conforming work will be rejected by the Contracting Officer. Remove rejected material from the job site immediately. Redo rejected work at no cost to the State.

B. Thickness Testing: The Contracting Officer will require all paints and their applied thickness tested determine compliance with the Contract Documents. The State will select a laboratory, and the cost of testing shall be borne by the Contractor.
   1. Where the required paint thickness is deficient, provide additional coats to the affected surface(s) to meet the required paint thickness.

C. Moisture Testing: Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.

D. Alkalinity Testing: Measure pH Level of surface to be painted. Notify Contracting Officer if alkalinity level is below the maximum permitted by the paint or primer manufacturer.
   1. Tests shall be paid by Contractor.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Contracting Officer.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
   1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 SCHEDULE OF FINISHES

A. Structural Steel, purlins, and girts
   a. Stripe Coat welds, fasteners, hard corners, and other areas of concern: Amercoat 240 @ 8 -12 mils DFT
   b. Full Prime Coat: Amercoat 240 @ 8 -12 mils DFT
   c. Finish Coat: PSX 700 @ 5-7 mils DFT

B. Metal Accessories, conduits, etc.
   a. Prime coat: Pittech DTM Primer 90-712
   b. Two finish Coats: Pittech Industrial Gloss Enamel 90-374

C. Incidental/Miscellaneous PVC items
   a. Prime coat: Int/Ext , PPG SEALGRIP, Acrylic Universal Prime Sealer
   b. Two finish coats: SpeedHide, Interior Latex Enamel, Semi-Gloss

D. New Metal Doors and Frames:
   a. Prime coat: PPG Glidden, LIFEMASTER, Acrylic Interior No-VOC Primer
   b. Two finish coats: PPG Glidden, LIFEMASTER, Acrylic Interior No-VOC, Semi-Gloss

E. New Concrete Slab and Curbs
   a. Finish coats: Pecora KlereSeal 9100-S, VOC compliant

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 10140 – SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY
A. Section Includes: All labor, tools and equipment necessary to install all signage and miscellaneous related work as called for, or required by the drawings and specifications.

1.02 REFERENCES
A. The latest 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.

ASTM International (ASTM).

ADA Standards for Accessibility Design.

ADAAG 2010 ADA Standards for Accessible Design.

1.03 GENERAL REQUIREMENTS
A. Coordinate with Section 09250 – GYPSUM BOARD.

B. Coordinate with Section 09310 – CERAMIC TILE.

1.04 SUBMITTALS
A. Submit in accordance with SECTION 01330 – SUBMITTAL PROCEDURES.

B. Manufacturer's Catalog Data: Submit catalog data for each type of sign specified, include descriptions of materials, finishes, color, fastening and anchoring devices and appurtenances.

C. Samples: Submit three (3) representative sample of each type of signs specified for finish and workmanship for approval.

1.05 DELIVERY AND STORAGE
A. Deliver materials to the site in unopened containers, labeled with the manufacturer's names and brands, ready for installation. Store signs and accessories in safe, dry locations until needed for installation.

1.06 WARRANTY
A. The Contractor shall execute to the State a 2-year written warranty after the Project Acceptance Date that the installations of the Signs and Accessories are in accordance with the manufacturer's requirements. Any damages which develop during that period which are not due to improper use or willful damage will be repaired at no cost to the State. The guarantee shall provide the following at no cost to the State.

1.07 ADAAG SIGNAGE REQUIREMENTS
A. General: Unless otherwise indicated or specified, signs shall comply with 703. Where both visual and tactile characters are required either one sign with both visual and tactile

characters, or two separate signs, one with visual and one with tactile characters, shall be provided.

B. Raised Characters: Raised characters shall comply with ADAAG 703.2 and shall be duplicated in Braille complying with ADAAG 703.3. Raised characters shall be installed in accordance with ADAAG 703.4.
   1. Depth ADAAG 703.2.1: Raised characters shall be 1/32 inch (0.8 mm) above their background.

   2. Case ADAAG 703.2.2: Characters shall be upper case.

   3. Style ADAAG 703.2.3: Characters shall be sans serif, Characters shall not be italic, oblique, script, highly decorative, or other unusual forms.

   4. Character Proportions ADAAG 703.2.4: Characters shall be selected from fonts where the width of the uppercase letter "O" is 55 percent and 110 percent maximum of the height of the uppercase "I".

   5. Character Height ADAAG 703.2.5: Character height measured vertically from the baseline of the character shall be 5/8 inch (10 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase "I".

   6. Stroke Thickness ADAAG 703.2.6: Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character.

   7. Character Spacing ADAAG 703.2.7: Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spaces between individual raised characters shall be 1/8 inch (3.2 mm) minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch (1.6 mm) minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8 inch (3.2 mm) minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch (9.5 mm) minimum.

   8. Line Spacing ADAAG 703.2.8: Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.

C. Braille: Braille shall be contrasted (Grade 2) and shall comply with ADAAG 703.3 and 703.4.

D. Installation Height and Location ADAAG 703.4: Signs with tactile characters shall comply with ADAAG 703.4.

E. Visual characters ADAAG 703.5: Visual characters shall comply with ADAAG 703.5.

F. Pictograms ADAAG 703.6: Pictograms shall comply with ADAAG 703.6.

G. Symbols of Accessibility ADAAG 703.7: Symbols of accessibility shall comply with ADAAG 703.7.

H. Finish and Contrast ADAAG 703.5.1:
   1. Characters and background of sign shall have matte or non-glare finish.

   2. Characters and symbols shall contrast with their background, either light characters on dark background or dark characters on a light background.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials and Fabrication: Tactile signs with raised letters shall be fabricated of photo polymer laminated to acrylic backing for a total thickness of 1/4" to match signs in layout and size, but copy is raised 1/32". Grade II Braille will be used as specified for compliance, ADAAG 703.2. Finish colors on sign face and finished edges. Each sign shall be secured to wall on the latch side of the door as indicated on drawings or as directed by the Contracting Officer. Signs shall be fastened with one-way, tamper-proof, non-corrosive fasteners. Shields shall be provided as required to suit the mounting conditions. The lettering of signs shall be as directed in schedule shown on drawings. All room signage shall conform to the ADAAG 2010 ADA Standards for Accessible Design, Section 703.5.1. Background and letter/character colors shall be contrasting. Colors shall be as selected by the Contracting Officer.

B. International Symbol of Accessibility (ISA) and Symbols of Accessibility Signs:
   1. ISA signs and Symbols of Accessibility signs shall be the same type as room signs except that the ISA and Symbols of Accessibility portion of the signs shall be 6" x 6" with proportionate raised handicap symbol. Conform with ADAAG, Section 703.6.

2.02 FABRICATION

A. All signs shall be fabricated according to specifications of approved construction drawings and submittals and will conform exactly to approved construction submissions in quality, fabrication and material.

B. All fasteners used to secure photo polymer laminated to acrylic backing pieces shall be inserted into drilled and tapped holes. Allow a minimum of l/8-inch over depth to prevent bottoming of fasteners. National coarse machine threads shall be used throughout.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrates are the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Exposed fasteners shall be fastened with one-way, tamper-proof, non-corrosive fasteners. Shields shall be provided as required to suit the mounting conditions. Installed location and height of signs as indicated. Protect exposed surfaces of signs with strippable plastic or by other approved means until the installation is accepted. Coordinate sign manufacturer's mounting details with other trades as their work progresses, and with installation requirements of ADAAG 216 and 703. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

B. Signs ADAAG 703: Signs shall comply with ADAAG 703.

3.03 PROTECTION AND CLEANING

A. Check and clean all signage, replace damaged products before substantial completion.

B. At the completion of his work, the Contractor shall clean up and remove from the premises, all rubbish, debris and unused materials. He shall also clean and protect installed products until completion of project.

END OF SECTION

DIVISION 13 – SPECIAL CONSTRUCTION

SECTION 13340 – FABRICATED ENGINEERED STRUCTURES – METAL BUILDING SYSTEMS

PART 1 – GENERAL

1.01 **SUMMARY**

A. Structural Performance: Provide metal building systems capable withstanding the effects of gravity loads and the following loads and stresses within the limits and conditions indicated.

1. Engineering: Design metal building systems conforming to procedures described in MBMA MBSM

2. Design Loads: Conform to the requirements of MBMA MBSM, ASCE 7-10, and the 2015 International Building Code (IBC).

3. Live Loads: Include all vertical loads induced by the building occupancy indicated on the drawings, as well as loads induced by maintenance workers, materials and equipment for roof live loads.

4. Wind Loads: Include horizontal loads induced by a wind criteria as indicated on the drawings.

5. Collateral Loads: Include additional dead loads other than the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and ceilings.

6. Auxiliary Loads: None

7. Load Combinations: Design metal building systems to withstand the most critical effects of load factors and load combinations as required by MBMA MBSM, ASCE 7, and the IBC.

8. Deflection Limits: Engineer assemblies to withstand design loads with deflections no greater than the following:
   a. Purlins and Rafters; vertical deflection of 1/240 of the span.

   b. Girts; horizontal deflection of 1/240 of the span.

   c. Metal Roof Panels; vertical deflection of 1/240 of the span.

   d. Metal Wall Panels; horizontal deflection of 1/240 of the span.

   Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings. Provide metal panel assemblies capable of withstanding the effects of loads and stresses indicated, based on testing according to ASTM E1592.

B. Seismic Performance: Design and engineer metal building system capable of withstanding the effects of earthquake motions determined according to ASCE 7, AISC 341, and the IBC.

C. Thermal Movements: Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss as follows:
   1. Temperature Change (Range); 120 degrees F, ambient; 180 degrees F, material surfaces.

D. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 at test-pressure difference of 2.86 lbf/sq.ft.

E. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq.ft. and not more than 12 lbf/sq. ft.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with ASCE 7.

1.02 SYSTEM DESCRIPTION

A. General: Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, metal roof panels, metal wall panels, and accessories complying with requirements indicated.

   Provide metal building system of size and with spacing, slopes, and spans indicated.

B. Primary Frame Type
   1. Rigid Clear Span: Solid-member, structural-framing system utilizing tapered columns and beams, without interior columns.

C. Secondary Frame Type: Provide manufacturer's standard purlins and joists and partially inset-framed or exterior-framed (bypass) girts to accommodate the requirements indicated.

D. Eave Height: Eave height as indicated on drawings.

E. Bay Spacing: Bay spacing as indicated on drawings.

F. Roof Slope: Roof slope as indicated on drawings.

G. Roof System: See Section 2.03 E.

H. Exterior Wall System: See Section 2.03 F.

I. Metal Door and Frame: See Section 2.06

J. Door Finish Hardware: See Section 2.07

K. Metal Weather Louver: See Section 2.08

L. Insulation/ Insulation Support System see Sections 2.09/2.10

1.03 SUBMITTALS

A. Descriptive Data: Submit descriptive data on all materials to be provided under this section. Data shall be sufficient to indicate conformance to all specified requirements.

B. Shop Drawings: Submit shop drawings, to include instructions and diagrams as necessary to erect the building and install all components. Shop drawings shall be stamped and signed by a structural engineer licensed in the State of Hawaii. As a minimum, shop drawings shall contain:

1. Anchor bolt layouts and sizes
2. Structural connections
3. Roof System and siding connections
4. Exterior Wall Systems
5. Joint sealing and caulking
6. Flashings
7. Accessory installation
8. Metal doors and frames
9. Finish hardware
10. Metal Louvers
11. All details and instructions necessary for complete assembly

C. Certificates of Conformance or Compliance: Submit certificates from the manufacturer attesting that all materials conform to all requirements of this specification and of referenced.

D. Product Data

E. Colors: Submit one sample of each color indicated for verification that products match the colors indicated. Where colors are not indicated, submit not less than 3 different samples of manufacturer's standard colors for selection by the Owner.

Design Calculations: Submit engineering design calculations and stress diagrams of the following components: Main frame, purlins, girts, end frame, columns and bracing. Submit all column reactions required for footing design. Calculations shall be prepared and stamped by a structural engineer licensed in the State of Hawaii.

1.04 DELIVERY STORAGE AND HANDLING

A. Prefabricated components, panels and other manufactured items shall be delivered, stored, handled and erected in such a manner that they will not be damaged or deformed. Materials stored on the site before erection shall be stacked on platforms or pallets and covered with tarpaulins or other suitable weather-tight covering. All metal sheets or panels shall be stored so that water which might have accumulated during transit or storage will drain off; the sheets or panels shall not be stored in contact with materials that might cause staining.

B. Upon arrival on the job site, the sheets or panels shall be inspected; if found wet, the moisture shall be removed and the sheets or panels shall be restacked and protected until used.

C. Where used in exposed wall construction, any unit with exposed face or faces having chips, cracks, or other imperfections more than 1-inch in dimension shall be rejected.

1.05 WARRANTY

A. Building System Warranty: Furnish manufacturer's no-dollar-limit warranty for the metal building system. The warranty period is to be no less than 10 years of materials and workmanship and 20 years for finish starting from the date of acceptance of the work and be issued directly to the Owner. The warranty must provide that if within the warranty period, the metal building system shows evidence of deterioration, correcting of any defects is the responsibility of the metal building system manufacturer. Repairs that become necessary because of defective materials and workmanship while metal building system is under warranty are to be performed within 72 hours after notification, unless additional time is approved by the Owner. Failure to perform repairs within 72 hours of notification will constitute grounds for having emergency repairs performed by others and will not void the warranty.

B. Roof System Weather-Tightness Warranty: Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than 10 years from the date of acceptance of the work and be issued directly to the Owner.

The warranty is to provide that if within the warranty period the roof panel system shows evidence of corrosion, perforation, rupture, lost of weather-tightness or excess weathering due to deterioration of the panel system resulting from

defective materials and correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

Repairs that become necessary because of defective materials and workmanship while roof panel system is under warranty are to be performed within 72 hours after notification, unless additional time is approved by the Owner. Failure to perform temporary repairs within 72 hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty. Immediate follow-up and completion of permanent repairs must be performed within 14 days from date of notification.

C. Roof and Wall Panel Finish Warranty: Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than 20 years from the date of acceptance of the work and be issued directly to the Owner.

The warranty is to provide that if within the warranty period the metal panel system shows evidence of checking, delaminating cracking, peeling, chalk in excess of a numerical rating of eight, as determined by ASTM D4214 test procedures; or change colors in excess of five CIE or Hunter units in accordance with ASTM D2244 or excess weathering due to deterioration of the panel system resulting from defective materials and finish or correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

Liability under this warranty is exclusively limited to replacing the defective coated materials.

Repairs that become necessary because of defective materials and workmanship while roof and wall panel system is under warranty are to be performed within 72 hours after notification, unless additional time is approved by the Owner. Failure to perform repairs within 72 hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Structural Steel W-Shapes: ASTM A992, Grade 50.

B. Structural Steel Channel, Angles, M-Shapes and S-Shapes: ASTM A36.

C. Plate and Bar: ASTM A36.

D. Steel Pipe: ASTM A53, Grade B, weight class STD standard.

E. Hollow (HSSx) Structural Sections: ASTM A500, Grade B.

F. Metallic-Coated Steel Sheet: ASTM A653, ASTM A606.

G. Metallic-Coated Steel Sheet Pre-painted with Coil Stock Coating: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, and ASTM A123.

   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792 and ASTM A463.

H. High-Strength Bolts, Nuts, and Washers: All high-strength bolt assemblies shall be high strength tension control "twist-off" bolts per ASTM F1852 (A325TC) Type 1, unless otherwise indicated; ASTM A563 DH carbon-steel nuts; and ASTM F436 Type 1 hardened carbon-steel washers on each face.
   1. Finish: Mechanical deposited zinc coating, ASTM B695 class 55 Type 1.

   2. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, heavy-hex-head steel structural bolts with spline.

I. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, ASTM A563, and ASTM F844.
   1. Finish: ASTM A153.

J. Anchor Rods: ASTM F1554, Grade 55.
   1. Configuration: Straight.

   2. Nuts: ASTM A563 heavy hex carbon steel.

   3. Plate Washers: ASTM A36 carbon steel.

   4. Washers: ASTM F436 hardened carbon steel.

   5. Finish: Hot-dip zinc coating, ASTM A153.

K. Threaded Rods: ASTM A36.
   1. Nuts: ASTM A563 heavy hex carbon steel.

   2. Washers: ASTM F436 hardened carbon steel.

   3. Finish: Hot-dip zinc coating, ASTM A153.

L. Primer: SSPC-Paint 15, Type I, red oxide.
M. Insulation

2.02 FABRICATION

A. General: Comply with MBMA MBSM - "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

2.03 STRUCTURAL FRAMING

A. General: Clean all framing members to remove loose rust and mill scale.

Provide 1 shop coat of primer to an average dry film thickness of 1 mil according to SSPC SP 2. Balance of painting and coating procedures must conform to SSPC Paint 15 and SSPC Painting Manual.

B. Primary Framing: Manufacturer's standard structural primary framing system includes transverse and lean-to frames; rafter, rakes, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing designed to withstand required loads and specified requirements. Provide frames with attachment plates, bearing plates, and splice members. Provide frame span and spacing indicated.

   Shop fabricate framing components by welding or by using high-strength bolts to the indicated size and section with base-plates, bearing plates, stiffeners, and other items required. Cut, form, punch, drill, and weld framing for bolted field erection.

   1. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.

   2. Exterior Column and Beam Type: Tapered.

   3. Rafter Type: Uniform depth.

C. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet pre-painted with coil coating, unless otherwise indicated.

   Shop fabricate framing components by roll-forming or break-forming to the indicated size and section with base-plates, bearing plates, stiffeners, and other plates required for erection. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

   1. Purlins: C or Z-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes; minimum depth as required to comply with system performance requirements.

   2. Girts: C or Z-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange minimum depth as required to comply with system performance requirements.

   3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.

   4. Flange Bracing: Structural-steel angles or cold-formed structural tubing to stiffen primary frame flanges.

5. Sag Bracing: Structural-steel angles.

6. Base or Sill Angles: Zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from zinc-coated (galvanized) steel sheet or structural-steel sheet.

9. Framing for Openings: Channel shapes; fabricated cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.

10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

D. Bracing: Provide adjustable wind bracing as follows:
   1. Rods: ASTM A36; ASTM A572; or ASTM A529 threaded a minimum of 12 inches at each end.

   2. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.

   3. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

   4. Bracing: Provide wind bracing using methods specified above, at manufacturer's option. Refer to drawings.

E. Panel Material
   1. Roof Panel: VSR Roof System (Butler) or equal.
      a. Standing seam panels minimum 24 gage, 50,000 psi yield in either G90 zinc-coated (galvanized sheet or aluminum-zinc alloy coated (AZ50 or AZ55) steel.

      b. Standing seam panel shall be minimum 16 inches width coverage with 2 inch high ribs (3 inches including the seam) that can be used on a minimum roof slope of 1/2 to 12.

      c. Standing seam panel assembly shall meet or exceed a Class 90 Wind Uplift rating by Underwriter's Laboratories when tested in accordance with UL580. Roof panels shall also be tested in accordance with Air Infiltration, ASTM E1680 and Water Penetration, ASTM E1646. The roof panel shall have a Class A fire rating when tested in accordance with test procedure ASTM E108.

   2. Wall Panel
      a. Corrugated metal panels (Butlerib II Wall System) or equal minimum 24

gage, 80,000 psi yield or 22 gage, 50,000 psi yield in either G90 zinc-coated (galvanized) steel or aluminum-zinc alloy coated (AZ50 or AZ55) steel.

b. Corrugated metal panels shall be minimum 36 inches coverage with 1-1/4 inch ribs at 12 inches centers reinforced between the ribs of added strength.

c. Corrugated metal panels shall meet or exceed a Class 90 Wind Uplift rating by Underwriter's Laboratories when tested in accordance with test procedure UL580. Wall panels shall also be tested in accordance with Air Infiltration, ASTM E283 and Water Penetration, ASTM E331. The wall panel shall have a Class A fire rating when tested in accordance with test procedure, ASTM E108.

3. Sheet Metal Accessories: Of same material and finish as used for adjacent wall or roof covering, except as specified otherwise herein.
   a. Caps, Strips and Plates: Ridge caps, eave and edge strips, fascia strips, miscellaneous flashings and miscellaneous sheet metal accessories, unless specified otherwise herein, shall be formed from the same material and gage as the roof covering. Wall plates, base angles or base channels and other miscellaneous framing members may be standard structural steel shapes, or they may be formed from galvanized steel not lighter than 18 gage.

   b. Continuous Gravity (Ridge) Roof Ventilators: Ventilators shall be provided complete with exterior wind band, integral rain cone, braces, chain-operated dampers and bird screening. The ventilators shall be provided in sections 8 or 10 feet long, and shall be braced at 4- or 5-foot intervals. Ventilators shall be fabricated from Kynar finished aluminum with a thickness sufficient to provide the necessary rigidity to insure smooth operation. The sections shall be joined together with splice plates of the same material as the sections, and the joints shall be formed in a manner that assures weather-tightness. Where intermittent installation is indicated, end closures for each section shall be provided. Throat size (vent opening) shall be 12 inches. Ventilators shall be screened with 3 by 3 mesh per square inch woven aluminum or stainless steel wire bird screening.

F. Finish: All panels are to receive a factory-applied Kynar 500/Hylar 5000 finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following
   1. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough drying.

   2. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a

dry film thickness of 0.20 plus 0.05 mils. This prime coat must be oven cured prior to application of finish coat.

3. Exterior Finish Coating: Apply the finish coating over the primer by roll coating to dry film thickness of 0.80 plus 5 mils for a total dry film thickness of 1.00 plus 0.10 mils. This finish coat must be oven-cured.

4. Interior Finish Coating: Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. The wash-coat must be oven-cured.

5. Color: The exterior finish chosen from the manufacturer's color charts and chips. Color to be selected by the Owner.

6. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:
   a. Chalking: ASTM DEFONLINE

   b. Color Change and Conformity: ASTM D2244

   c. Weatherometer: ASTM G152, ASTM G153 and ASTM D822

   d. Humidity: ASTM D2247 and ASTM D714

   e. Salt Spray: ASTM B117

   f. Chemical Pollution: ASTM D1308

   g. Gloss at 60 degrees: ASTM D523

   h. Pencil Hardness: ASTM D3363

   i. Reverse Impact: ASTM D2794

   j. Flexibility: ASTM D522

   k. Abrasion: ASTM D968

   l. Flame Spread: ASTM E84

G. Repair of Finish Protection: Repair paint for color finish enameled metal panel must be compatible paint of the same formula and color as the specified finish furnished by the metal panel manufacturer, conforming to ASTM A780.

H. Polyethylene Vapor Retarder: Install polyethylene vapor retarder membrane over entire wall and roof surface. Use fully compatible polyethylene tape to seal the edges of the sheets to provide a vapor tight membrane. Lap sheets not less than 6 inch. Provide sufficient material to avoid inducing stresses in sheets due to stretching or binding. All tears or punctures visible in the finished surface, at

anytime during the construction process, must be sealed with polyethylene tape.

I. Rubber Closure Strips: Closed-cell, expanded cellular rubber conforming to ASTM D1056 and ASTM D1667; extruded or molded to the configuration of the specified metal panel and in lengths supplied by the metal panel manufacturer.

J. Metal Closure Strips: Factory fabricated aluminum or steel closure strips to be the same gauge, color, finish and profile of the specified roof and wall panel.

K. Joint Sealants
   1. Sealants: Sealants are to be an approved gun type for use in hand or air-pressure caulking guns at temperatures above 40 degrees F(or frost-free application at temperatures above 10 degrees F with minimum solid content of 85 percent of the total volume. Sealant is to dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

      Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the metal panel manufacturer.

   2. Shop-Applied: Sealant for shop-applied caulking must be an approved gun grade, non-sag one component polysulfide or silicone conforming to ASTM C920, Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

   3. Field-Applied: Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to ASTM C920, Type II. Color to match panel colors.

   4. Tape Sealant: Pressure sensitive, 100 percent solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the metal panel manufacturer.

2.04 FASTENERS

A. General: Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 1 inch with other properties required to fasten miscellaneous metal framing members to substrates in accordance with the metal panel manufacturer's and ASCE 7 requirements.

B. Exposed Fasteners: Fasteners for metal panels to be corrosion resistant coated steel, aluminum, stainless steel, or nylon capped steel compatible with the sheet panel or flashing and of a type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories to be the manufacturer's standard. Provide an integral metal washer matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick.

C. Screws: Screws to be corrosion resistant coated steel, aluminum and/or

stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

D. Rivets: Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

E. Attachments Clips: Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A653 or Series 300 stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

2.05 MISCELLANEOUS METAL FRAMING

A. General: Cold-formed metallic-coated steel sheet conforming to ASTM A653.

B. Fasteners for Miscellaneous Metal Framing: Refer to the paragraph 2.4 FASTENERS.

C. Gutters and Downspouts: Aluminum material roll formed in 20-foot lengths and coated with Kynar material.

D. Touch-up Kits: Provide 4 one-quart containers of touch up material for the panel finish. Deliver the containers to the Owner. Material damage during construction will be replaced with new material, not touched up by the Contractor.

2.06 METAL DOORS AND FRAMES

A. Series 700 Door System by **EXPI**-DOOR systems Inc. or equal. Heavy-duty commercial type door. Provide door top cap, bottom channel and prepped for exit device. Refer to drawings for size.

B. Frame for 700 Door System: Sub frame to match PEMB wall system. Metal door frame to match 700 Door System by **EXPI**-DOOR systems Inc. or equal.

2.07 FINISH HARDWARE

A. Series 700 Door System by **EXPI**-DOOR system or equal.
   1. Standard exit device (Panic) with lever x Escutcheon Trim Von Duprin 99L-996L x US 26D, Match existing keying system.

   2. Closure: LCN 4041 Extra Heavy-Duty Closure.

   3. Single door 1 ½ pair Hager Hinge Co. Model #BB1191 4.5x4.5 SST Hinges.

   4. Series 700 Standard Weather-Seal

   5. Standard ADA compliant Threshold

2.08 METAL LOUVERS

A. Mettalic Products Aluminum fixed Stormproof bade Louvers or equal.
   1. .080 aluminum frame, 4" nominal depth.

   2. Extruded aluminum .080 J-type blade, 45 degree angle.

3. Expanded 18-16 aluminum insect screen in removable/rewireable frame.

4. Mill finish.

5. Architecturally styled, all aluminum construction for low maintenance and high resistance to corrosion. Color to be selected from manufacturer's standard color selector.

2.09 INSULATION

A. Back-fill Insulation: Owens-Corning Fiberglas unfaced "Pink Building Insulation Plus . Vapor retarder, two layers of batt insulation vinyl faced on the exposed side.

B. Vapor retarder

C. Roof Insulation
   1. Certified R-Value: R-19 and R-11. Batt insulation with spacer block between R-19 and R-11

D. Wall Insulation: NONE

E. Roof and Wall Insulation Facing: WMP-50.
   1. 0.0015-inch thick, UV-stabilized, white polypropylene film laminated to 30-pound Kraft paper/metalized polyester, reinforced with glass-fiber and polyester scrim.

   2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.

   3. Assembly of Insulation Blanket and Facing:
      a. Flame Spread rating: Less than 25.
      b. UL label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.02.

2.10 INSULATION SUPPORT SYSTEM

A. Insulation Support System: Butler Manufacturing Sky-Web II or equal.

B. Description:
   1. Compatible with roof system.

   2. Limit to "over-the -purlin' type insulation systems

   3. Knotted Mesh
      a. Grid: Nominal 2-3/4 inches by 2-3/4 inches.

      b. Material: Twisted twine of DuPont nylon Type 6-6 fiber or equal.

      c. Mesh Covering Interior Bays: 21-pound twine.

1. Five-Foot Strip Along Edge: #30 twine, with edge color coded for identification.

4. Double Selvage along the 2 edges in machine direction.

5. Furnish up to 60 feet wide by building width
   a. Cover 1 or 2 bays of building length.

   b. Extend eave-to-eave across building.

C. Physical Properties:
   1. Minimum Tensile strength:
      b. #30 Twine: 265 Pounds.

   2. Runnage:
      a. #30 Twine: 605 feet per pound.

   3. Cord Used to Make Mesh-to-Mesh Edge Connections: #36 DuPont nylon Type 6-6 White braided twine.
      a. Minimum Tensile Strength: 360 pounds.

      c. Runnage:533 feet per pound.

   4. Mesh Weight: 0.012 pounds per sq ft.

D. Fasteners and Attachment Hardware:
   1. Connections to Eave and Gable Members:
      a. 1/8-inch-diameter wire clips looped through 20-gauge steel V-straps.

      b. Steel V-straps: Fasten to framing with self-drilling screws.

   2. Mesh-to-Mesh edge Connections:
      a. Lace #36 nylon cord through edges of pieces of mesh being connected.

      b. Edge Connections: Plastic cable ties.

F. Fire-Hazard Classification:
   1. UL Fire-Hazard Classification Ratings, UL 723:
      a. Flame spread: 3 or less:
      b. Smoke Developed: Less than 10

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before erection proceeds examine with the erector present the concrete foundation dimensions, concrete and/or masonry bearing surfaces, anchor bolt size and placement, survey slab elevation, locations of bearing plates, and other embedment's to receive structural framing with the metal building manufacturer's

templates and drawings before erecting any steel components for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Examine primary and secondary framing to verify that rafters, purlins, angles, channels, and other structural and metal panel support members and anchorages have been installed within alignment tolerances required by metal building manufacturer, UL, ASTM, ASCE 7 and as required by the building code for the IBC.

Examine roughing-in for components and systems penetrating metal roof or wall panels to verify actual locations of penetrations relative to seam locations of metal panels before metal roof or wall panel installation.

Submit to the Owner a written report, endorsed by Erector, listing conditions detrimental to performance of the Work.

Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide temporary shoring, guys, braces, and other supports during erection to keep the structural framing secure, plumb, and in alignment against temporary construction loading or loads equal in intensity of the building design loads. Remove temporary support systems when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

Miscellaneous Framing: Install sub-purlins, girts, angles, furring, and other miscellaneous support members or anchorage for the metal roof or wall panels, doors, windows, ventilators and louvers according to metal building manufacturer's written instructions.

3.03 ERECTION

A. Erection of building shall be in accordance with the manufacturer's approved instructions and diagrams, approved shop drawings and other erection documents in accordance with MBMA MBSM – "Metal Building Systems Manual". Defects or errors in the fabrication of building components shall be corrected in an approved manner. Defects or errors in fabrication of components which cannot be corrected in an approved manner shall be replaced by non-defective members. Columns and rigid frames shall be plumbed in both directions, guyed and stayed, and all framing elements shall be accurately spaced to assure the proper fitting of prefabricated wall and roof.

Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer and the Owner.

Set structural framing accurately in locations and to elevations indicated and according to AISC 325 specifications. Maintain structural stability of frame during erection.
Clean and roughen concrete and masonry bearing surfaces prior to setting

plates. Clean bottom surface of plates.

Align and adjust structural framing before permanent bolt-up and connections. Perform necessary adjustments and alignment to compensate for changes or discrepancies in elevations.

Maintain erection tolerances of structural framing in accordance with AISC 360.

B. Dissimilar Materials: Where aluminum surfaces come in contact with ferrous metal or other incompatible metals, the aluminum surfaces shall be kept from direct contact by one of the following methods:
   1. Method (a): Painting the incompatible metal with a coating of heavy-bodied bituminous paint conforming to Federal Specification TT-C-520.

   2. Method (b): An approved non-absorptive gasket.

   3. Method (c): An approved caulking placed between the aluminum and the incompatible metal.

C. Rigid Frames, Column Bases and Sill Members: Set accurately, using a non-shrinking grouting mortar if needed to obtain uniform bearing on the concrete and to maintain a level base line elevation. Anchors and anchor bolts for securing rigid frames, columns, or sill members to foundations shall be steel, unpainted, set accurately to templates, and of proper size to adequately resist all applicable design loads at the base. Grouting mortar shall be a mixture of one part of blended portland cement to two parts of well-graded fine aggregate, and enough water to provide a maximum water-cement ratio of 0.50. The blended portland cement shall be a mixture of cement with 1/4 ounce of aluminum powder to each sack of cement. Surfaces to receive the mortar shall be cleaned and moistened thoroughly immediately before placement of mortar. Exposed surfaces of mortar shall be water cured with wet burlap for 7 days.

D. Wall Construction: All panels shall be applied with the configurations in a vertical position. Panels shall be supplied in full wall heights, from base to eave, with no horizontal joints except at the junctions of door frames, window frames and similar locations. All side and end laps shall be sealed with the joint sealing material specified hereinbefore. All walls shall be flashed and/or sealed at the base, at the top, around windows, door frames and all other similar openings. The placement of closure strips, flashing and sealing material shall be accomplished in an approved manner that will assure complete weather-tightness. Flashing will not be required where approved "self-flashing" sheets or panels are used. Minimum end laps for all types of panels shall be 2-1/2 inches. Minimum side laps for all types of panels shall be one corrugation or one configuration.

E. Roof Construction: All roofing panels shall be applied with the configurations parallel to the slope of the roof. The roofing panels shall be supplied in the longest lengths obtainable with end laps occurring only at structural members with no transverse joints except at the junction of ventilators, skylights and similar openings. All side laps shall be laid away from the prevailing wind, and all

side and end laps shall be sealed with the joint sealing material specified hereinbefore. The roof shall be flashed and sealed at the ridge, at eaves and rakes, at projections through the roof, and elsewhere as necessary. The placement of closure strips, flashing and sealing material shall be accomplished in an approved manner that will assure complete weather-tightness. Minimum side lap shall be one corrugation, configuration, or interlocking rib. End laps shall be not less than 8 inches, and shall occur only over purlins.

F. Metal Panel Fastener Installation: Anchor metal panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

G. Flashing, Trim and Closure Installation
   1. Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

   2. Sheet metalwork is to be accomplished to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

H. Door and Frame Installation: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturer's written instructions. Coordinate installation with metal panel flashings and other components. Caulk and seal perimeter of each door frame with elastomeric sealant compatible with metal panels.

I. Window Installation: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fastened in place according to manufacturer's written instructions. Coordinate installation with metal panel flashings and other components. Caulk and seal perimeter of each window frame with elastomeric sealant compatible with for metal panels.

J. Accessory Installation
   1. General: Install accessories with positive anchorage to building and weather-tight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

   2. Gutters and Downspouts: Comply with performance requirements, manufacturer's written installation instructions, and install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA 1793 recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system. Color shall be selected from the manufacturer's standard color selector.

   3. Roof and Wall Accessories and Specialties: Install roof and wall accessories

and specialties complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports as specified in Division 07 - THERMAL AND MOISTURE PROTECTION, unless otherwise indicated.

K. Clean-Up and Protection

1. Structural Framing: Clean all exposed structural framing at completion of installation. Remove metal shavings, filings, bolts, and wires from work area. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

2. Metal Panels: Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area. Remove protective coverings/films, grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

3. Touch-Up Painting: After erection, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories. Clean and touch-up paint with manufacturer's touch-up paint.

L. Waste Management: Separate waste in accordance with the Waste Management Plan, placing copper materials, ferrous materials, and galvanized sheet metal in designated areas for reuse. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

Collect and place scrap/waste debris in containers. Promptly dispose of scrap/waste debris. Do not allow scrap/waste debris to accumulate on-site; transport scrap/waste debris from government property and legally dispose of them.

M. Warranty

1. Manufacturer's Warranty: Submit all manufacturers' signed warranties to Owner prior to final commissioning and acceptance.

Contractor's Warranty for Installation: Submit contractor's warranty for installation to the Owner prior to final commissioning and acceptance.

END OF SECTION

DIVISION 16 - ELECTRICAL

SECTION 16011 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This section covers the requirements for furnishing and installing all electrical work.

1.02 WORK INCLUDED

A. The Contractor under this Division shall provide all labor, materials, equipment, supervision and services required for the construction of the electrical systems. The finished installations shall be complete, operable and shall include all work specified herein and shown on the Drawings.

B. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All systems shall be properly adjusted and in working order at the time of final acceptance.

C. All painting and other finishing work shall conform to the applicable requirements of the specifications as prescribed in appropriate sections.

D. It is the intent of these Specifications and other Contract Documents to require an installation complete in every detail. Consequently, the Contractor will be responsible for minor details or for any special construction which may be found necessary to properly furnish, install, adjust, test, and place in successful and continuous operation, the entire electrical system, and the cost of same shall be included in the contract price.

1.03 DESCRIPTION OF WORK

A. Work specified in this Division shall include, but not be limited to the following:
   1. Complete electrical service including cutout switches, transformer, feeder, metering equipment and panel.
   2. Complete power and lighting systems, including outlets, wiring devices, light fixtures, and wiring.
   3. Testing.
   4. As-built drawings.

1.04 REFERENCES

A. Comply with the applicable requirements of the following standards unless otherwise indicated:
   1. Comply with National Electrical Code; applicable regulations of the National Board of Fire Underwriters; specifications of ANSI, NEMA, UL, and IPCEA; and the latest rule and regulations of the Federal Government.

2. In the event of conflict between pertinent codes and regulations, and the requirements of the referenced standards, or those indicated in Specifications and on Drawings, the provision of the more stringent shall govern.

1.05 RELATED WORK

A. DIVISION 1 - GENERAL REQUIREMENTS.

B. SECTION 16400 - ELECTRICAL WORK.

1.06 PERMITS AND INSPECTION

A. All permits required by local ordinances shall be obtained and paid for by the Contractor.

B. After completion of the work, the Contracting Officer shall be furnished a certificate of final inspection and approval from the Government.

1.07 COORDINATION

A. Refer to all project Drawings and to all Sections of the project Specifications. Coordinate and fit all work accordingly so that all electrical outlets and equipment will be properly located and readily accessible. The Drawings indicate the relation of wiring and connections and must not be scaled for exact locations. Verify all construction dimensions at the project and make changes necessary to conform to the building as constructed. Work improperly installed due to lack of construction verification shall be corrected at the Contractor's expense.

B. Work shall be scheduled to avoid delays, interferences, and unnecessary work. If any conflicts occur necessitating departures from the Drawings and Specifications, details of departures and reasons therefore shall be submitted immediately for consideration by the Contracting Officer.

1.08 SUBMITTALS

A. Submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES.

B. Product Data: Submit manufacturer's product data of the equipment and products identified in each Division 16 technical section for approval in accordance with Submittals section of these specifications. Each submittal shall be prepared with a summary sheet attached to each copy identifying all items included in the submittal. Incomplete submittals and those without summary sheets will be returned without review.

C. Warranty: Submit warranty as noted under item entitled "WARRANTY" hereinbelow.

1.09 WARRANTY

A. Installation shall be complete in every detail as specified and ready for use. Any items supplied by the Contractor developing defects of design, construction, or quality within one (1) year of final acceptance by the Contracting Officer shall be replaced by such new materials, apparatus or parts to make such defective portion of the complete system conform to the true intent and meaning of the Drawings and Specifications at no additional cost to the Government.

B. The warranty shall be countersigned by the Contractor.

1.10 DELIVERY, HANDLING AND STORAGE

A. Deliver all materials of this Division in manufacturer's original unopened packages or containers with label intact and legible.

B. Use means necessary to protect the materials of this section before, during and after installation; to protect the installed work and materials of all other trades; and to protect the original structure, work and materials of the Government.

C. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Contracting Officer and at no additional cost to the Government.

PART 2 - PRODUCTS

2.01 MATERIALS AND WORKMANSHIP

A. All materials shall conform to the latest issue of all applicable standards as established by NEMA, NFPA, ANSI, IEEE, ASTM and Underwriters' Laboratories, and shall bear the manufacturer's name, trade name and when available, the Underwriters' Label.

B. Within twenty (20) days after the contract has been awarded, or as otherwise directed, forward to the Contracting Officer a complete list of all materials and equipment proposed for installation. The intent to use the exact makes specified does not eliminate the responsibility of submitting such a list. List shall include sufficient information to permit ready and complete identification. After the work is completed, Contractor shall provide Drawings showing the as-built conditions.

C. Neat appearances in the finished work will be required. Only experienced qualified person per N.E.C. and experienced electrical workers shall be employed for the electrical installation.

D. All work not installed and completed in accordance with the latest rules and regulations of the NEC, OSHA, NESC, and all local ordinances shall be removed and reinstalled correctly at the Contractor's expense.

PART 3 - EXECUTION

3.01 GENERAL

A. Install all electrical materials and equipment in accordance with manufacturer's recommendations and as approved by the Contracting Officer.

B. Electrical devices shall be flush mounted and wiring shall be concealed unless otherwise noted. Cut, break, drill and patch as required to install electrical system. Repair any surface damaged or marred by notching, drilling or any other process necessary for installation of electrical work. Patch any damaged surfaces to match the adjacent surface and paint to match surroundings.

C. The Electrical Contractor shall coordinate his work with other trades on campus to avoid conflicts.

3.02 JOB CONDITIONS

A. These specifications are accompanied by construction drawings including plans showing locations of all wiring, outlets, devices, and other electrical equipment. The locations are approximate and before installing, study adjacent structural and architectural details and make installation in most logical manner. Any device may be relocated within 10 feet-0 inches before installation at direction of the Contracting Officer without additional cost to the Government.

B. Before installing, verify all dimensions and sizes of equipment.

C. Verify that electrical system may be installed in strict accordance with the original design, the Drawings and Specifications and the manufacturer's recommendations.

D. In the event of discrepancy, immediately notify the Contracting Officer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.03 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEMS

A. Submit written certification that electrical systems are complete and operational. Submit certification with Contractor's request for final review.

B. At the time of final review of electrical work, demonstrate the operation of electrical systems. Provide labor, apparatus and equipment for systems demonstration. The various tests shall be under the direction and supervision of the Contracting Officer.

C. The Contractor shall perform start-up and all tests as required to obtain final field acceptance from the Government. All tests shall be conducted in the presence of the Contracting Officer or his representative.

D. The Contractor shall be responsible for all tests. Testing shall be performed by and under the immediate supervision of the Contractor.

E. A visual inspection of all electrical equipment, to check for foreign material, tightness or wiring and connection, proper grounding, matching nameplate charts with specification, etc., shall be made prior to actual testing.

END OF SECTION

SECTION 16400 - ELECTRICAL WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all labor and materials required to complete all electrical work indicated on the drawings and/or as specified.

B. In general, the following work is included:
   1. Complete electrical service including cutout switches, transformer, feeder, metering equipment and panel.
   2. Complete power and lighting systems, including outlets, wiring devices, light fixtures, and wiring.
   3. Testing.
   4. As-built drawings.

C. The term "wiring" shall include raceways, outlets, conductors, fixtures, and devices.

D. Wiring and connecting of all electrical equipment supplied for installation and use in this contract and not specifically listed as work by others.

E. Test complete installation and correct all defects and malfunctions of material and workmanship at no additional charge to the Government.

1.02 SUBMITTALS

A. Submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES.

B. Product Data: Submit six (6) sets of manufacturer's product data of the following equipment and resubmit until approval is received before placing order:
   1. Transformer.
   2. Metering equipment.
   3. Cutout switches.
   4. Electric panelboard.
   5. Light fixtures and photometric data.
   6. Wiring devices.
   7. Raceways, wires and cables.
   8. Any built-to-order equipment.

C. Substitute Materials: Submit shop drawings and catalog cuts for substitute materials. Substitute materials shall clearly specify compliance with and/or deviation from specified material. Approval of shop drawings and catalog cuts shall not release Contractor from complying with intent of specifications and drawings. Any deviations from approved shop drawings shall have prior approval by the Contracting Officer.

D. Guarantee: Submit guarantee as noted under item entitled "GUARANTEE" hereinbelow.

E. As-Built Drawings: Submit as-built drawings as noted under item entitled "DRAWINGS" hereinbelow.

1.03 RULES AND PERMITS

A. The entire installation to be made in strict accordance with applicable provisions of 2014 edition of the National Electrical Code, and latest rules and regulations of the Government.

B. Contractor shall obtain and pay for electrical permit as required by local rules and regulations. He shall arrange for periodic inspection by local authorities as work progresses so that certificates of completion and inspection may be turned over to the Contracting Officer as stipulated in INTERIM GENERAL CONDITIONS.

1.04 GUARANTEE

A. All work and material executed under this Section shall be guaranteed to be free from defects of materials and workmanship for one (1) year from date of final acceptance of a project as a whole, except lamps shall be guaranteed for 50 percent of rated life as published by the manufacturer. All work of repair and replacement required, including other work damaged by this work's defects shall be performed without cost to the Government.

1.05 DRAWINGS

A. Specifications are accompanied by Architectural drawings of building, site plans, and diagrammatic electrical plans showing locations of ductlines, pullboxes, outlets, fixtures, switches, devices and other electrical equipment. Locations are approximate. Before installing, study adjacent construction details and make installation in most logical manner. Any device or equipment may be relocated within 10 feet - 0 inches before installation at direction of the Contracting Officer without additional charge to the Government.

B. Before installing, verify all dimensions and sizes of equipment at jobsite. Circuit and conduit routing is typical and may be altered in any logical manner; however, all changes shall be approved by the Contracting Officer and shown on "as-built" drawings. See SECTION 01770 - CLOSEOUT PROCEDURES for "As-Built" drawing requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials shall be new and of best quality available in their respective kinds, free from all defects and shall conform to standards of Underwriters' Laboratories, Inc., NEMA, ANSI, ASTM, and IEEE. Materials and equipment listed by Underwriters' Laboratories shall bear "U.L." label of approval. Brand names, manufacturer's names, and catalog numbers indicate standards of design and quality required. Substitute materials other than those listed in each paragraph will not be solicited unless indicated with "or approved equal". Substitute materials may be used by pre-qualified written permission from the Contracting Officer. List of substitute material together with qualifying data shall be submitted for approval as provided in the INTERIM GENERAL CONDITIONS Section. Failure to obtain approval of substitute materials prior to bidding shall mean that materials as specified shall be provided.

Example:

Item	Manufacturer and Catalog No. Specified	Substitute Manufacturer and Catalog Number
Cable	Joe Doe - No. 3200	King - No. 2200

Qualifying data shall include cuts, shop drawings, and specifications to show equality with materials specified herein and in drawings.

B. Raceways:
   1. Rigid Steel: Hot dipped galvanized inside and outside, round bore, 3/4 inch diameter, except as noted.

   2. Electrical Metallic Tubing (EMT): Thin walled steel tubing, zinc-coated, 3/4 inch minimum diameter.

   3. Polyvinyl Chloride (PVC): Schedule 40, round bore conduit. 3/4" minimum diameter.

   4. Flexible Conduits: Flexible steel, zinc-coated, 1/2 inch minimum, and used with factory approved fittings. In wet locations, use liquid-tight type jacketed with polyethylene.

C. Outlet Boxes:
   1. Concealed boxes shall be pressed from NEC gauge steel, galvanized 4 inch square x 1-1/2 inches deep minimum.

   2. Exposed boxes shall be galvanized cast iron or alloyed aluminum with threaded hubs for conduit connections.

   3. Extension or raised rings for pressed boxes pressed from NEC gauge steel and galvanized.

D. Device and Cover Plates: Device plates for interior construction shall be satin finished 302 high nickel stainless steel, 1 percent chrome, 8 percent nickel with suitable hole for device. Pass & Seymour, Hubbell, General Electric, Leviton or approved equal.

E. Wires and Cables:
   1. Feeder cables shall be stranded copper, 600 VAC, NEC XHHW-USE or THW-USE. Conductors shall be 7 or 19 strands.

   2. Conductors for branch circuits shall be copper, 600 volts, No. 12 AWG minimum (No. 14 minimum, fire alarm system). Conductors in wet, damp moist or exterior locations shall be NEC Type XHHW, RHW or THWN. Conductors No. 10 and smaller, solid and round. Conductors No. 8 and larger, 7 or 19 strands. Conductors No. 8 and smaller shall be NEC Type THHN and THWN. Conductors No. 6 and larger shall be NEC Type THHN or XHHW. Wiring fixtures and fixture wiring channels shall be Type RHH or THHN.

   3. Color Coding:

      208Y/120V

Black	insulation material - Phase "A"
Red	insulation material - Phase "B"
Blue	insulation material - Phase "C"
White	insulation material - Neutral
Green	insulation material - Ground

      Color coding shall be maintained throughout entire system.

F. Wiring Devices:
   1. Duplex Receptacle, Heavy Duty, Industrial Grade: Ivory phenolic molded body, duplex NEMA 5-20R, 20A, 125V, 2-pole, 3-wire, grounded, back and side wiring, U-shaped grounding slot, parallel double wipe phosphor bronze spring tensioned contacts, heavy-duty corrosion resistant wrap-around body bridge strap with grounding screws and automatic grounding clip, back wiring holes for feed through wiring and rated engraved on body. Install in outlet box with appropriate device or cover plate. Manufacture and install according to NEC Articles No. 210 and 406. Hubbell No. 5362-I.

   2. Light switch shall be non-mercury, number of poles required, quiet operating, rated for 20A, 120-277 volts, one piece heavy-duty toggle handle which makes continuous contact with spring contact arms, two piece heavy-duty body bolted to bridge strap, large binding head screws for terminating conductors silver cadmium oxide contacts, high conductivity and fatigue resistant contact arms, spring loaded cam mechanism, back and side wiring, with ground terminal, heavy-duty bridge strap, premium specification grade, U.L. labeled, and rated for 10,000 cycles of operation. Manufacture and install according to NEC Articles No. 100 and 380. Device shall be installed in outlet box complete with device plate. Hubbell No. 1221-I series.

Switches shall be color matched according to device plate, single, double pole, 3-way, or 4-way and locking type as required. Switches for direct motor control shall be horsepower-rated for the motor being controlled and shall be manual motor starter type, except when used only as disconnect or controller.

3. Equal devices by Arrow Hart, Bryant, Leviton, Pass & Seymour, or General Electric are approved.

G. Outdoor Exposed Raceways: Raceways shall be hot dipped galvanized inside and outside, round bore, 3/4 inch diameter, except as noted.

H. Indoor Exposed Raceways: Raceways installed exposed indoors shall be thin walled steel tubing, zinc-coated, 3/4 inch diameter, except as noted.

I. Hardware, Support, Backing, etc: Provide all hardware, supports, backing, and other accessories necessary to install electrical equipment. Wood materials shall be termite treated, iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze. All wood screws shall be brass or galvanized steel.

J. Junction Boxes: Junction boxes, unless otherwise specified, shall be NEMA 1 for interior locations and NEMA 4X (stainless steel) for exterior locations exposed to rain and splashing water. NEMA 1 junction boxes shall be fabricated from galvanized steel. NEMA 4X junction boxes shall be fabricated from a stainless steel material with latches and hinges made of the same material. Prime paint and enamel finish according to NEMA specifications. Manufacture and install according to NEC Article 314.

K. Lighting: Lighting system shall be complete with all necessary mounting hardware and accessories, lamps ballasts, modifications and accessories to provide a complete system in accordance with NEC Article No. 410 and the intent of the contract.
   1. Fixtures manufactured from sheet steel shall be die formed, embossed for strength, welded for permanent rigidity, corrosion protected by process bonding phosphate material to metal, finished after fabrication with baked white enamel having minimum of 88 percent reflectivity in all light reflecting surfaces and of baked white enamel for all other surfaces. All unpainted parts and hardware shall be dip zinc plated. When subjected to 300 hours salt spray testing, the fixture shall not show corrosion deterioration. Light-tight construction and sealing gaskets of resilient neoprene seals at openings shall be provided. Ballast and lamp compartments shall be isolated from each other. Provide separate wiring channel for through wiring.

   2. Fixtures manufactured from aluminum shall be cast or extruded. Corrosion protection shall be provided by anodizing process. Color of finish shall be dark bronze unless otherwise specified in fixture description.

   3. Plastic lens of fluorescent fixtures shall be virgin acrylic, Type K12, .125 inch minimum thickness.

4. LED fixtures shall be composed of an LED light engine and an LED driver. Light engines shall consist of multiple LED modules mounted on an aluminum heat sink. Rated life of light engine shall be 50,000 hours minimum at 70 percent lumen maintenance. LED drivers shall be solid state electronic type with current rating appropriate for fixture. Units shall be UL listed, temperature rated for the ambient anticipated by the fixture manufacturer and rated for system voltage.

5. Emergency battery lighting units or battery pack modifications to standard lighting fixtures shall use sealed maintenance free pure lead-acid battery. Nickel cadmium battery shall not be accepted. Battery units shall be installed in ambients that do not exceed the maximum ambient temperatures allowed by the manufacturer. Emergency battery shall provide minimum of 1900 lumens.

L. Time Switch: Fully automatic, motor driven movement, 7 day, 2 circuit, DPST type. Unit shall be 40 amperes, contacts, voltage as indicated on drawing, and enclosed in NEMA 1 steel enclosure. Provide with 16 hours spring driven reserve power. Tork 7200L. Sangamo and Paragon or approved equal.

M. Pad Mounted Transformer:
1. Furnish liquid filled compartmental type outdoor pad mounted transformer as follows:

Ratings:

kVA	30 (as shown on plans)
Phase	3
Frequency	60 Hz
Primary Voltage	Dual rated for 7.2 KV and 12.47KV Delta 95 BIL
Taps	4 - 2-1/2%, FCBN and 2 - 2-1/2% FCAN
Secondary Voltage	208Y/120V Wye, 3-Phase, 4-Wire
Impedance	%5.0
Temperature Rise	65 deg. above a 30 deg. Average ambient with a maximum ambient not to exceed 40 deg. C.
Coolant	Insulating Oil, R-Temp or Silicone high fire point, dielectric coolant

2. Standards: The transformer shall comply with the latest applicable standards of the National Electrical Manufacturers Association (NEMA) and the American National Standards Institute (ANSI).
   a. Construction: The transformer shall be compartmental type, self-cooled, tamper resistant and weather protected for mounting on a pad. The transformer enclosure shall be corrosion resistant stainless steel construction grade 304L with a factory supplied (Federal color number 10045) dark brown color. Tank and fins shall be corrosion resistant stainless steel construction grade 304L. There shall no be exposed screws, bolts or other fastening devices which are externally removable.

The transformer shall be of the sealed tank construction of sufficient strength to withstand a pressure of 7 psi without permanent distortion. The transformer will remain effectively sealed for a top oil temperature range of -5°C to -150°C. Lifting eyes and jacking pads shall be provided.

A tap changing mechanism shall be provided for accurate voltage adjustment without opening the transformer tank. The top changing mechanism shall be externally operated and shall be for de-energized operation only.

The high and low voltage compartments shall be located side-by-side separated by a steel barrier. When facing the transformer, the low voltage compartment shall be on the right. Terminal compartments shall be full height, air filled with individual doors. The high-voltage door fastenings shall not be accessible until the low voltage door has been opened. The low voltage door shall have a 3-point latching mechanism with a cabinet handle having provisions for a single padlock. The doors shall be equipped with lift-off type stainless steel hinges and door stops to hold the doors open when working in the compartments. The front sill of the compartment shall be removable to allow the transformer to be rolled or skidded into position over conduit stubs. ANSI tank grounding provisions shall be furnished in each compartment.

b. High Voltage Terminations and Equipment: The high voltage terminations and equipment shall be dead front and conform to ANSI C57.12.26 requirements. Provide universal type bushing wells, one piece integrated bushings for use with elbow terminators and parking stands for mounting accessory equipment. Bushings of wells shall be externally clamped.

   The termination and equipment shall be arranged for dual radial feed.

c. High Voltage Switching and Protective Equipment: Provide four position load-break, gang operated, oil-immersed switch rated at 15kV, 95 BIL with a continuous rating of 100 amperes. Switch handle with eye for operation with distribution hot stock shall be located in the high voltage compartment and shall have indexing plate to prevent switching beyond one position per operation.

   Provide Bay-O-Net type oil immersed fuses.

d. Low Voltage Terminations and Equipment: The low voltage bushings shall be provided with blade type spade terminals with standard hole spacing arranged for vertical take-off. The low voltage neutral shall be an insulated bushing grounded to the transformer tank by a removable grounding strap.

e. Accessories: The following accessories shall be provided:

Nameplate in low voltage compartment.
One-inch drain plug with sampling device.
One-inch upper filter press and filling plug.
Liquid level indication (pipe plug at 25 deg. C oil level).
Pressure relief valve.
Dial type thermometer.
Pressure-vacuum gauge.
Pressure relief device (self resealing with indicator).
Mounting provision for low voltage current transformers and potential transformers.
2 - Two position switches for dual radial feed.

N. Panelboards:

1. General: Furnish and install circuit breaker lighting and appliance panelboards where shown on the drawings and as indicated in the panelboards schedule.
   Panelboards shall comply with the following industry standard:
   a. NEMA Standard PB-1

   b. UL Standards; Cabinets and Boxes-UL 50; Panelboards-UL 67

   c. National Electrical Code

   Panelboards shall be labeled as suitable for use as service equipment in accordance with Article 384 of the National Electrical Code.

2. Box: The panel box shall be fabricated from galvanized or galvannealed steel. Box shall have adjustment screws to provide easy alignment. Removable end walls to be blank. Panelboard box is to have separate UL label and minimum wire bending and gutter requirements to meet the NEC and UL standards. Wiring gutters shall be completely free of any part of trim clamp to prevent damaging wire insulation.

3. Interior: All interiors shall be completely factory assembled. The design of the interior shall permit replacement of circuit breakers without disturbing adjacent units and without machine drilling or tapping. All circuit breaker connections shall be in a hole tapped by the manufacturer. Main bus shall be tin finished 55 percent conductivity aluminum. Branch bus shall be tin finished copper only. Sizing of conductor shall be in accordance with UL 67. Bus bars shall be supported by a VO rated, UL recognized, Polymeric material. Bus sequence shall start at the top left phase bus of the interior for both top and bottom fed panels. Panelboards shall be rated 200A maximum. Interiors shall be designed to permit installation of feed-through lugs without increasing the enclosure size. Main and sub-feed breakers shall be bus connected, not cabled. Interior shall be convertible from main lug to main breaker with the addition of an appropriate field-installable kit. Interior shall be changeable from top to bottom feed and vice-versa, while maintaining readability of dead-front labeling.

Dead-front shall be provided with a flange for easy attachment of trim. Incoming cable lugs shall be grouped at one end to separate them from the load side cables. Main lugs shall be lay-in construction to facilitate connections. Neutral bussing shall have a lug for each outgoing branch requiring a neutral connection. For easy wiring and shortest cable run possible, load size neutral connection lugs to be split with each side taking 50 percent of load neutral connections. The interior shall be provided with wing nuts for securing to box without tools.

4. Trim: The panelboard trim shall be surface or flush as indicated on the drawings. It shall be fabricated from cold-rolled steel, painted with an ANSI-61 light gray finish and equipped with concealed hinges, flush lock and a holder for circuit directory card. Trim shall have 2 separate supports designed to engage the box flange to stabilize and secure the trim during installation. Trim screws to be located behind the lockable door for tamper resistance.

5. Description: The panelboards shall be for use with the following system or as indicated on each panelboard schedule:

   208/120 volts, 3-phase, 4-wire

   The panelboard enclosures shall be NEMA Type 1 construction for top or bottom cable entrance and suitable for surface mounting unless otherwise noted on panelboard schedules.

   Short circuit rating shall be 10,000 amperes symmetrical based on the smallest rating on any circuit breaker installed in the panelboard.

   Provide main lug only or main circuit breaker panelboards as shown on panelboard schedules. Also provide branch and sub-feed circuit breakers of the quantity, trip rating and number of poles as shown on schedules.

   Molded case circuit breakers shall be thermal-magnetic, quick-make, quick-break, trip free. Multi-pole breakers shall be common trip. If current limiting circuit breaker mains are indicated on schedules, provide breakers with inverse time delay, instantaneous circuit protection and limit let-through I^2t to a value less than I^2t of one-half cycle wave of the symmetrical prospective current without any fusible elements. All breakers shall be equipped with anti-turn solderless, pressure type connectors. All provisions shall be located at the bottom of the panelboard and be fully bussed complete with all necessary mounting hardware less the breaker.

   Provide sub-feed lugs, feed through lugs, handle blocking devices, padlocking devices, shunt trips and ground bus bars as shown on schedules.

6. Manufacturer: Siemens, Square-D, Cutler Hammer, General Electric or approved equal.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

A. Comply with local ordinances and regulations of the Federal Government. Workmanship subject to approval of the Contracting Officer who shall be afforded every opportunity to determine skill and competency. Concealed work reopened at random during formal inspection by the Contracting Officer without additional charge to the Federal Government.

B. Construction shall conform to construction practices as recommended by American Electricians Handbook by Croft (latest edition), National Electrical Code, National Electrical Safety Code, and applicable instructions of manufacturers of equipment and materials for this project.

3.02 RACEWAYS

A. All conduits within building line shall be rigid steel conduit, PVC conduits, or electrical metallic tubing (EMT). EMT shall be used for concealed rough-in ceiling and wall cavities where allowed by NEC. Where exposed indoors, provide EMT for rough-in work above 8 feet from finished floor; below 8 feet, indoor exposed conduit shall be rigid steel conduit. PVC conduit may be used with ground wire. All conduits below exterior finished grade shall be encased in minimum 3 inch thick concrete. Provide No. 14 galvanized steel pull wire or nylon cord in all empty conduits. Where EMT is to be provided, use compression fittings. No set-screw couplings allowed.

B. Cut raceways square and ream inner edges. Butt together evenly in couplings.

C. Make bends and offsets with hickey or conduit bending machine; do not use vise or pipe tee. Make bends so that interior cross-sectional area will not be reduced. Radius of curve of inner edge of field bend not less than 10 times internal diameter of raceway. Use of running threads not permitted. Where raceways cannot be joined by standard threaded couplings, use approved watertight raceway unions.

D. Provide raceway expansion joints for exposed and concealed raceways and underground ducts with necessary bonding conductor at building expansion joints and between buildings or structures and where required to compensate for raceway or building thermal expansion and contraction. Provide expansion fittings every 200 feet on outdoor underground ducts. Verify locations of expansion joints and other critical locations with Structural drawings.

E. Cap raceways during construction with plastic or metal-capped bushings to prevent entrance of dirt or moisture. Swab all raceways out and dry before wires or cables are pulled in.

F. Mount raceways free from other piping, valves or mechanical equipment.

G. Fish wires, cords, strings, chains, or the like shall not be placed or inserted in the conduit system during installation.

H. Install insulating bushings and 2 locknuts on each end of every run of conduit at enclosures and boxes. Provide grounding bushings as required to grounding receptacles and connect conduits to service ground, per NEC Article 250.

I. Project adequate number of conduit threads through box for bushings.

J. Run exposed conduit or raceway parallel with, or at right angles to, structural or architectural elements.

K. Securely fasten conduits with galvanized pipe straps with screws or bolts spaced not more than 7 feet apart, or with approved beam clamps, or approved single or gang pipe hangers spaced not more than 7 feet apart, as conditions require. Vertical runs supported at intervals not exceeding 5 feet by approved clamp hangers. Conduit runs with one 90 degree bend or equivalent, 150 feet maximum without pullbox. Conduit runs with two 90 degree bends or equivalent, 100 feet maximum without pullbox.

3.03 OUTLET BOXES

A. Provide outlet boxes to suit conditions encountered. Provide flush outlet boxes in walls with extension or raised rings of such depth that edges will be flush with surrounding surfaces of opening. When 2 or more switches are installed at single location, mount in gang box under single device plate. Use gang boxes wherever 3 or more switches are installed at one location. When 2 or more switches on 277 volt circuits are installed in the same box, provide barriers as required by NEC Article 404.8(B). Concealed boxes shall be pressed steel, galvanized, 4 inch square by 1-1/2 inches deep minimum unless otherwise indicated. Exposed boxes shall be square cast metal.

3.04 RECEPTACLE WIRING

A. Receptacles shall be wired to using side screw terminals. Wiring to back spring tension terminals shall be unacceptable.

3.05 CONDUIT FILL IN RACEWAY

A. Conform to NEC Appendix C unless otherwise indicated on the drawings.

3.06 WIRE PULLING

A. Mechanical means for pulling shall be torque-limiting type and not used for No. 2 AWG and smaller wires. Pulling tension shall not exceed wire manufacturer's recommendations. Where necessary, soapstone may be used as a lubricant for drawing wires through conduit. Other means of lubricating allowed with written approval of the Contracting Officer.

3.07 WIRE SPLICING

A. Form wires neatly in enclosures and boxes.

B. Splice in accordance with NEC Article 110.

C. Conductors No. 10 and smaller with solderless-tapeless connectors, "Ideal Wire Nuts" or equal. Splice conductors No. 8 through No. 4/0 with high pressure compression (indent) copper sleeve connectors. Do not use bolt-on connectors. Reinsulate splices and make waterproof.

D. Reinsulate splices according to wire manufacturer's instructions. Splice insulation shall be 150 percent in thickness of original wire insulation and of same electrical and mechanical characteristics.

3.08 SEISMIC REQUIREMENTS

A. The project site is in a seismic design Category D area. All new electrical work and existing electrical items to remain shall be provided with seismic protection. Contractor shall follow FEMA E-74 guidelines for electric panels, light fixtures (recessed, surface mounted and pendant mounted) and raceways.

3.09 FINISHING

A. Patch, repair, and restore all structural and architectural elements cut or drilled for installation of electrical system. Drilling, cutting, patching, repairing, and restoring shall be subject to approval of the Contracting Officer.

B. Attach electrical equipment to wood by wood screws, and attach to concrete by embedded or expansion inserts and bolts. Use powder-driven charge with approval only. Close unused knockouts on boxes or enclosures with metal cap.

C. Wipe clean all exposed raceways and enclosures with rag and solvent. Prime paint and finish all exposed raceways and enclosures. Factory finished enclosures shall not be painted unless specifically called for to be painted.

D. Identify loadcenters by nameplates on door, including voltage and designation. Provide nameplates on front of disconnect switches and junction boxes where wires are terminated for connection to equipment. Designate equipment served, voltage, and phase.

E. Complete all panel directories with typewriter.

F. Nameplates: Laminated plastic, black/white, engraved with 3/16 inch high commercial letters to expose white. Screw mounted. Impression type adhesive tapes not acceptable.

G. After cables have been installed, seal all ducts with mastic compound to prevent entry of water from ductline to termination of ducts in areas below grade.

3.10 GROUNDING

A. Conform to applicable requirements in National Electrical Code, National Electrical Safety Code, and to requirements herein.

B. Provide grounding for entire electrical installation as indicated and specified herein. Following are included as requiring grounding:
   1. Conduits, other conductor enclosures, and loadcenters.

   2. Neutral or identified conductor of interior wiring system.

   3. Non-current carrying metal parts of fixed equipment, such as motors, starter and controller cabinets, lighting fixtures, etc.

   4. Grounding conductor in non-metallic conduits as required by NEC.

C. Manner of Grounding: Sizes and types of ground conductors, ground clamps, bonding jumpers, conduit, fittings, also methods of securing same to obtain electric continuity and effective grounding, when not indicated; as per NEC Article 250.

3.11 TESTS

A. Operating Test: After installation has been completed, and at such time as the Contracting Officer may direct, Contractor shall conduct an operating test for approval. Equipment shall be demonstrated to operate in accordance with requirements of this section of specifications. Test shall be performed in the presence of the Contracting Officer. Contractor shall furnish necessary instruments and personnel required for test. Balance loading on each feeder and test ground fault circuit breakers. The ground fault setting of the main and branch circuit breakers shall be set to 5mA.

END OF SECTION