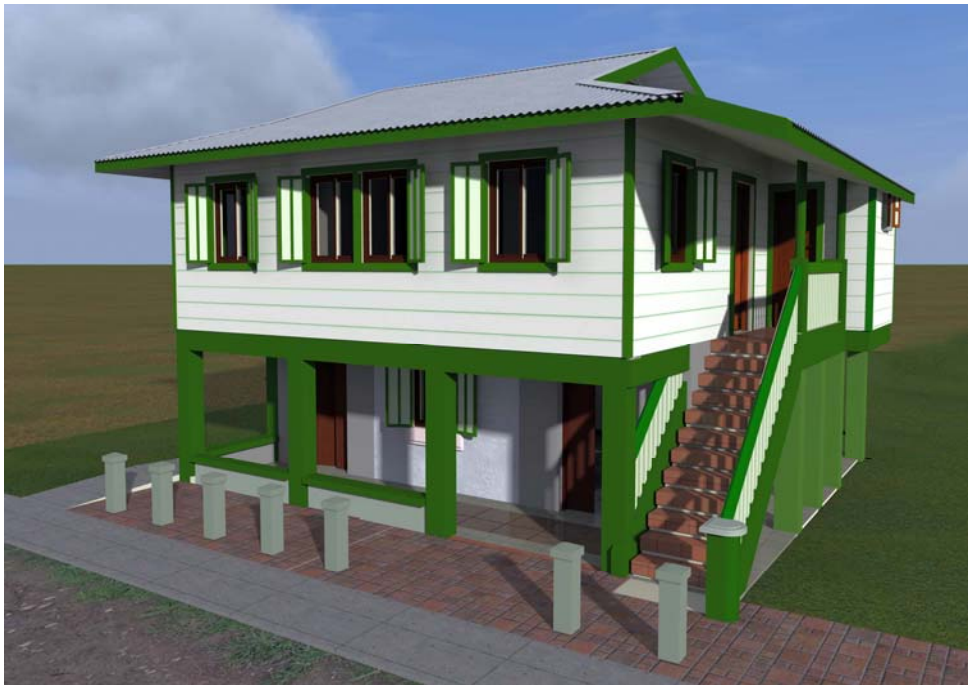
Project Specifications for

Reconstruction of Chargualaf House, Lot 66

Bid Submittal



Prepared for:

GUAM INANGOKKON PRESERVATION INADAHI GUAHAN TRUST

March 2015

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SECTION 00100

NOTICE TO BIDDERS

Project Name	:	Reconstruction of Chargualaf House
Project Location	:	Historic District of Inarajan, Guam
Lot Number	:	
Name of Owner	:	Guam Preservation Trust
Address	:	Historic Lujan House 157 Padre Palomo Street Hagatna, Guam 96910
Name of Architect	:	Providó • Tan • Jones Architects Inc
Address	:	Post Office Box 6463, Tamuning, Guam 96931 USA Tel : 671 646 1361 Fax: 671 646 2767

CONDITIONS FOR BIDDING

Bidding for the above project by the General Contractor shall be open to the public by advertisement. If requested by Owner and/or Architect, the Bidder shall provide proof of company past performances of similar type projects in the last 5 years, corporate structure including resumes of key project managers/field supervisors, company brochures and a referral list of Owners/Architects of the Contractor's previous projects.

Drawings/Specifications, Contract Documents, Bid Documents and any other detailed instructions will be on file at the Guam Preservation Trust Office. A non-refundable deposit of **$100.00** per set is required from those bidders wishing to take out the above documents.

Pre-bid Conferences, shall be held to answer questions regarding the project and other related items for interested participating bidders. Attendance is important since items will be publicly discussed and addenda, if any, shall be issued. The schedule for the Pre-Bid Conference are as follows:

Pre-Bid Conference No.1: A pre-bid conference will be scheduled for August 17, 2015, 9:00 a.m. at the Guam Preservation Trust Office.

Clarifications to Bidders: Request for Clarifications shall be submitted no less than 7 working days from the scheduled Bid Date. No verbal clarification and/or statements made by either the Owner or the Architect nor any written record of such verbal statements as may be made, shall be deemed to have the effect of adding to, modifying, or otherwise varying from the written provisions of the bid documents.

Bid Date: Sealed Lump Sum Bids will be received at the Office of Guam Preservation Trust on the Bid Date of **3rd, September, 2015 by 2.00 p.m.** Bids will be publicly opened. When a successful bid has been selected, all participating bidders will be notified of the bid amounts through a bid abstract format.

The Bidder guarantees that there shall be no revisions or withdrawal of the total bid amounts (base bid + all alternates) of a period of not less than forty five (45) working days after the bid date.

CONSTRUCTION CONTRACT TIME
The number of calendar days to substantially complete the project will be listed on the Contractor's Bid Form, Section 00300. It shall be established by the General Contractor after fully reviewing the project conditions**.**

Consequential Damages: The Conditions governing consequential damages shall be listed in the Supplementary Conditions Section 00900.

BONDING REQUIREMENTS
A bid bond is required. Proof of a Labor/Material/Payment and Performance bond for the entire value of the construction cost shall be provided as part of the bid documents. The Owner shall reserve the right to waiver the requirements of a labor/material and performance bond after the bid opening.

OWNER'S RIGHTS OF AWARD AND/OR REJECTION OF BIDS
The Owner reserves the right to accept and/or reject any and/or all bids (Base Bid as well as any and/or all Alternate Bids) for any reasons. The Trust also reserves the right to waiver any and/or all irregularities and/or non-complying requirements of the bids. The Owner also reserves the right to defer the acceptance and/or rejection of any and/or all the bids for any reasons within the period of not less than forty five (45) working days after the bid date.

Acceptance of Bid: No bidder shall consider himself under the contract until the "Standard Form of Agreement between the Owner and the Contractor Contract" is signed by all parties, and compliance therewith has been made.

BIDDER'S LIST OF SUBCONTRACTORS, SURETY COMPANY AND SPECIALITY SUPPLIERS
The Bidder shall submit a list of all relevant Subcontractors, Surety Company and Specialty Suppliers as part of the bid documents for the Owner's review of the bidder's construction management proposal. If requested by the Owner, the bidder shall submit subcontractor's/ specialty suppliers qualifications for the Owner's further review.

If Subcontractor's/ Specialty Suppliers qualifications are not acceptable to the Owner for any reason whatsoever, the Bidder shall provide other Subcontractor/ Specialty Supplier to the satisfaction of the Owner and make the corresponding changes in the bid. If Subcontractor's/ Specialty Suppliers qualifications are not acceptable to the Owner for any reason whatsoever, the Owner reserves the right to nominate Subcontractors/Specialty Supplier for the Bidder's consideration. If the Bidder accepts the nominated Subcontractor/ Specialty Supplier, the Bidder shall make the corresponding changes in the bid.

The format of the list is attached after the end of this section.

END OF SECTION 00100

GENERAL
CONTRACTOR:_____

PROJECT MANAGER:_____

TEL NO:_____

CONTRACTOR'S LIST OF SUBCONTRACTORS, SURETY COMPANY & SPECIALITY SUPPLIERS

If the trade is performed by the Contractor's own employees, write "in-house". If the trade is not applicable to the Project , write " N.A.". If needed, provide additional sheets with the same format.

SURETY COMPANY
a) Performance Bond :
_____

b) Labor/Material/
Payment Bond :
_____

c) Other Insurance
(per Section 00900) :
_____

SUBCONTRACTORS
a) Termite Treatment :
_____

b) Civil :
_____

c) Waterproofing :
_____

d) Building Shell :
_____

d) Doors/Windows :
_____

e) Woodwork :
_____

f) Millwork :
_____

g) Plumbing :
_____

h) Air-conditioning :
_____

i) Electrical :
_____

j) Material Testing :
_____

k) Others :
_____

_____

SPECIALITY SUPPLIER

a) Exterior Coatings :

_____

b) Others :

_____

_____

_____

SECTION 00300

CONTRACTOR'S BID FORM

For the General Construction Work on the:

Project Name		:	Reconstruction of Chargualaf House
Project Location		:	Historic District of Inarajan, Guam
To:	OWNER	:	Guam Preservation Trust
	Address	:	Historic Lujan House 157 Padre Palomo Street Hagatna, Guam, 96910.
	ARCHITECT	:	Providó • Tan • Jones Architects Inc
	Address	:	Post Office Box 6463 Tamuning, Guam 96931.

Dear Sirs/Madam:

The undersigned acknowledges the receipt of the following bidding documents for the above Project dated Day, Month, 1999 and affirms that all costs (disclosed and/or concealed) associated to ensure the timely completion of the above Project are included in the applicable base bid sum, and alternate bid amounts:

a) Notice to Bidders
b) Contractor's Bid Form
c) Specification Section 00400:
    1. Standard Form of Agreement between Owner and the Contractor for Construction
    2. General Conditions of the Contract between Owner and the Contractor
d) Specification Section 00900:
    1. Supplementary Conditions (Refer to Spec. Section 00900)
e) Project Manual/Specifications
f) Drawings as identified in the List of Drawings or Drawing List of Drawing Sheet T-1.

The undersigned further acknowledges receipts of the Addenda/Addendum as listed below and affirms that any addition and/or modifications to, and /or deletions from the Work called for in these Addenda/Addendum, are included in the Base Bid Amount and Alternate Bid Amounts if affected thereby. (Note: If no Addenda has been received, write in "NONE")

ADDENDA NO: Date of Addenda

_____ _____

_____ _____

DECLARATION:
By executing this Proposal, the Undersigned affirms that:
1) This proposal shall remain valid, for acceptance by the Owner for a period of not less than forty five (45) working days from the bid date.

2) All requirements concerning licensing and all other applicable government laws have been and/or will be fully complied with and that no legal requirements will be violated in the execution of the work if the proposal is accepted. The Owner shall be indemnified of all and/or any violations or wrongdoing that arises directly from the construction of this project.
3) No person or persons or company other than the firm listed below or otherwise indicated hereinafter, have any undeclared interest and/or conflict of interest whatsoever in the proposal or the Contract that may be entered as a result thereof. This proposal is submitted in good faith, without collusion and/or fraud for the sole purpose of providing the general construction work for the above project.
4) The person or persons signing this proposal is/are fully authorized to sign on behalf of the company.

CONTRACT AMOUNT:
The undersigned having inspected the project site and familiarized himself with all the conditions likely to be encountered affecting the cost and schedule of the work, and having examined all the bidding documents, hereby proposes to furnish all labor, materials, tools, equipment, services, transportation, licenses, fees, permits, etc., required to perform all the work necessary for the completion of the project in strict accordance with the bidding documents for the Sum of :

AMOUNT
(All monies shall
be in U.S. Dollar)

A. CHARGUALAF HOUSE BASE BID SUMMARY

DESCRIPTION		TOTAL
Div 1	General Requirements	
Div 2	Site & Demolition	
Div 3	Concrete	
Div 4	Masonry	
Div 5	Metals	
Div 6	Wood & Plastics	
Div 7	Thermal & Moisture Prot	
Div 8	Doors & Windows	
Div 9	Finishes	
Div 10	Specialties	
Div 11	Equipment	
Div 12	Furnishing	
Div 15	Mechanical	
Div 16	Electrical	
	Prime contractor's subtotal	
	Prime contractor's O/P	
	Prime contractor's 4% GRT	
	Insurance/Bonding	
	Archaeological Work (Refer to Attachment 1)	
	BASE BID	

ADDITIVE ALTERNATES		
1	Supply/Install A/C Minisplit Units	
2	Kitchen Equipment	**NIC**
	Prime contractor's subtotal	
	Prime contractor's O/P	
	Prime contractor's 4% GRT	
	Insurance/Bonding	
	TOTAL	

B. BASE BID BREAKDOWN: *(Delete items that are not applicable, and add all other items not noted but required for the complete installation of the Work)*

1) DIVISION 1: GENERAL REQUIREMENTS
   a) Mobilization/Demobilization (Erosion Control, Temporary Utilities, etc)
   b) Temporary Facilities (Portable Toilets, Construction Fence, etc)
   c) Heavy Equipment Rental
   d) Material Testing
   e) Insurance / Bonds
   f) Gross Receipt Tax
   g) Permit /Other Fees
   h) Contractor's Overhead (Specify: % of Direct Construction Cost –Item 18a)
   i) Contractor's Profit (Specify: % of Direct Construction Cost)-Item 18a)
   j) Other items not noted above but required for the complete installation of the Work.
      Please list: _____
      _____

2) DIVISION 2: SITE WORK
   a) Site Selective Demolition
   b) Clearing, Grubbing, Excavation, Dewatering if any, and Disposal
   c) Fill, Backfill, Compaction and Grading
   d) Site Utilities (Water, Sewer, Stormwater, etc)
   e) Hardscape (Walkways, Bollards, Retaining Walls, Low Walls, Chain Link Fences, Curbs/Gutters, etc)
   f) Asphalt paving
   g) Termite Treatment
   h) Landscape/Irrigation
   i) Other items not noted above but required for the complete installation of the Work.
      Please list: _____

_____

3) DIVISION 3: CONCRETE
   a) Formwork
   b) Concrete (Specify Quantities: _____ Cubic Yard)
   c) Reinforcing (Specify Quantities: _____ Tons)
   d) Anodic Protection
   e) Other items not noted above but required for the complete installation of the Work. Please list: _____
      _____

4) DIVISION 4: MASONRY
   a) Reinforced Concrete Masonry Unit Work
   b) Historic Manposteria Masonry Repair

5) DIVISION 5: METALS
   a) Structural Steel (if any)
   b) Miscellaneous Steel (Handrails, Guardrails, Plates, etc)
   c) Corrugated Roof Panels

6) DIVISION 6: WOOD / PLASTICS
   a) Millwork
   b) Wood Doors/Windows

7) DIVISION 7: THERMAL / MOISTURE PROTECTION
   a) Elastomeric Waterproof Membranes
   b) Metal Flashing
   c) Roof Accessories
   d) Below Grade Waterproofing
   e) Vapor Barrier
   f) Fluid Applied Waterproofing
   g) Batt Insulation
   h) Semi-rigid Insulation

8) DIVISION 8: DOORS AND WINDOWS
   a) Interior Doors
   b) Interior Windows
   c) Aluminum Doors /Windows /Storefronts /Louvers /Hardware
   d) Door hardware (for Interior Doors/Windows)

9) DIVISION 9: FINISHES
   a) Gypsum Drywall Partition / Ceiling
   b) Tile
   c) Paint
   d) Exterior Special Coating Membranes
   e) Vinyl Composition Tile and Base
   f) Cement Plaster
   g) Lime Plaster

10) DIVISION 10: SPECIALTIES
   a) Toilet Accessories
   b) Signage

11) DIVISION 11: EQUIPMENT
   a) Electric Kitchen Equipment

12) DIVISION 15: MECHANICAL
   a) Air-condition Mini-Split Systems
   b) Plumbing Lines (water, hotwater, vent, rainwater/overflow conductor, sleeves, etc)
   c) Plumbing Fixtures (lavatories, water closets, hose bibbs, kitchen sinks/disposal, Floor Sinks, Roof Drains,etc)
   g) Plumbing Equipment (hot water heater, reverse osmosis, softener, etc)
   h) Other items not noted above but required for the complete installation of the Work.
   Please list: _____

13) DIVISION 16: ELECTRICAL
   a) Electrical Sitework (Power/Telephone/CATV Hookup, Area /Street /Pedestrian Lighting, etc)
   b) Power System (Transformers, Main Distribution Panels, Panelboards, Disconnects, Feeders/Circuits, etc)
   c) Lighting Fixtures
   d) Lighting Controls
   e) Fire-Protection (Fire/Smoke Detection, etc)
   f) Telephone System (PABX, Telephone Panels, Telephone conduits, etc)
   g) Cable TV
   j) Other items not noted above but required for the complete installation of the Work.
   Please list: _____
   _____

14) DIVISION 17: MISCELLANEOUS
   a) Labor for Owner Furnish Contractor Install (OFCI) Items
   b) Other items not noted in all the Divisions above but required for the complete installation of the Work.
   Please list: _____
   _____

18) SUBTOTALS
   a) Direct Construction Cost (Add all subtotals of Division 2 through 17)

   b) Base Bid (Add all subtotals of Division 1 through 17)

CONTRACT TIME:
Having carefully examined the bidding documents and all the conditions affecting the project construction schedule, we propose to fully complete the Project within _____ calendars days from the later date of either the Notice to Proceed or the date of issuance of the Building Permit, based upon the Construction Schedule with consequential damages clauses and/or adverse days as noted in Section 00900.

ADDITIVE / DEDUCTIVE ALTERNATE BID:

(Added to Base Bid :+) *(Deducted from Base Bid :-)*	*Amount Added to/ Deducted from* Base Bid	*No of Calendar Days Added to/* Deducted from Contract Time

a) ALTERNATE BID NO.1
b) ALTERNATE BID NO.2
c) ALTERNATE BID NO.3

VALUE ENGINEERING (VE) ALTERNATES (Optional)
Please Describe VE alternate as recommended by each Contractor:

VE-1 :
VE-2 :
VE-3 :

i) ALTERNATE BID NO. VE-1
ii) ALTERNATE BID NO. VE-2
iii) ALTERNATE BID NO. VE-3

All alternate bids shall include all labor, materials, tools, equipment, services, transportation, licenses, permits, fees, etc. required to perform the work as well as all modifications of the base bids work to ensure the complete installation of the work associated with the alternate bid. The amount shall be an addition to or a deduction from the Base Bid.

The Owner, for all and/or any reasons whatsoever, can select any combination of various alternate bids with the base bid. The Owner also, for all and/or any reasons whatsoever, reserves the right to waiver any and/or all irregularities that is found in the alternate bids.

PROJECT BONDING:
The Undersigned agrees to furnish a Performance Bond, and a Labor/Material, Payment Bond from a Surety Company acceptable to the Owner. The Surety Company shall be

SUBMITTED THIS:_____Day of the Month _____ of Year _____

Name of Company :
_____

Business Address :
_____

_____(City) _____ (State) _____ (Zip Code)

Contractor License No: _____ License Expiration Date:_____

Responsible Managing Employee :
_____

OPERATING AS:(Check applicable option, and fill out complete description in the blank spaces)

☐ A Corporation under the Laws of the _____

☐ A Partnership: Full Names of All Partners are:

a) _____

b) _____

c) _____

d) _____

☐ Others: Specify _____

SIGNATURE: _____

Name: _____

Title: _____ Date :_____

Seal
(If a Corporation):

SECTION 00400

CONTRACT AGREEMENT & GENERAL CONDITIONS

1.1 SUMMARY

A. Documents incorporated into the Contract:
1. Contract Agreement
2. General Conditions

1.2 CONTRACT AGREEMENT

A. AIA Document A101-2007, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment is a Stipulated Sum, is hereby incorporated into this contract and forms the basis of agreement between Owner and Contractor. Refer to Exhibit A.

1.3 GENERAL CONDITIONS

A. AIA Document A201-2007, General Conditions of the Contract for Construction, is hereby incorporated into this contract and forms the General Conditions of the Contract. Refer to Exhibit B.

1.4 SUPPLEMENTARY CONDITIONS

A. Refer to Specification Section 00900 for modifications to AIA Document A201-2007 General Conditions.

END OF SECTION 00400

SECTION 00900

SUPPLEMENTARY CONDITIONS

The following supplements modify the "General Conditions of the Contract for Construction, AIA Document A201-2007 (Hereby referred to as "General Conditions.") Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 1: GENERAL PROVISIONS

1.2.1 EXECUTION, CORRELATION AND INTENT

SUBPARAGRAPH 1.2.1: Add the following Clauses 1.2.1.1 and 1.2.1.2 to Subparagraph 1.2.1:

1.2.1.1 In the event of conflicts or discrepancies among the Contract Documents, interpretations shall be based on the following priorities:

1. The Addenda to the Agreement between Owner and Contractor, with those of later date having precedence over those of earlier date
2. The Agreement between Owner and Contractor
3. The Supplementary Conditions
4. The General Conditions of the Contract for Construction
5. The Drawings, Specifications and Addendum's to the Drawings/Specifications.

1.2.1.2 In the event of conflict, discrepancies and inconsistency between the Drawings, Specifications, and Addendum's to the Drawings/Specifications, the better quality and/or greater quantity and/or greater cost of the Work shall be provided in accordance to the Architect's interpretation.

In the event of conflict, discrepancies and inconsistency within the Drawings, Specifications, and Addendum's to the Drawings/Specifications, the better quality and/or greater quantity and/or greater cost of the Work shall be provided in accordance to the Architect's interpretation.

ARTICLE 2: OWNER

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

SUBPARAGRAPH 2.2.5: Delete Subparagraph 2.2.5 in its entirety and substitute with the following:

2.2.5 The Contractor shall be furnished , free of charge, 1 PDF copy of the Drawings and Project Manual after the execution of the Agreement between the Owner and Contractor. The cost of all other subsequent sets and copies shall be paid by the Contractor.

ARTICLE 3: CONTRACTOR

3.1 GENERAL

SUBPARAGRAPH 3.1.4: Add the following New Subparagraph 3.1.4:

3.1.4 Contractor's obligations to the Architect: Additional and/or unanticipated expenses and time incurred by the Architect for the following items beyond the scope of work of the Architect to the Owner, shall be paid by the Contractor:

a. Review of Shop Drawings and/or Product Literature/Samples beyond the Second Submittal.
b. Site Visits beyond the bi-weekly (once per two weeks) site visits for the purposes of observation.
c. Project Progress Meetings beyond the bi-weekly (once per two weeks) meetings (to coincide with site visits)
d. Review of Substitution Proposals that is submitted after the earlier date of either the first payment period or the conditions set forth in the General Requirements (Division 1 of the Project Manual.)

The additional and/or unanticipated expenses and time shall be based on the Architect's chart of hourly rate billings and shall be due before the earlier date of either the issuance of the Certificate of Substantial Completion or the last final payment.

3.4 LABOR AND MATERIALS

SUBPARAGRAPH 3.4.2: Delete Subparagraph 3.4.2 in its entirety and substitute with the following:

3.4.2 After the Contract has been executed, the Owner and the Architect shall consider a formal and written request for the substitution of Work in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Project Manual). In the formal and written request for substitution of the Work, the Contractor shall certify the following:

.1 That the Contractor has thoroughly investigated the proposed substitution and has determined that it meets all the requirements of the Drawings/Specifications as well as is equal or superior in all respects to that specified.
.2 That the Contractor shall provide warranty for the proposed substitution equal or superior in all respects to the warranty of that specified.
.3 That the cost data is complete and includes all related costs including Architect's Redesign cost (if design modifications have to be made as a result of the substitution) and waivers all claims for additional costs (including unforeseen circumstances) directly and/or indirectly related to the substitution.
.4 That the Contractor shall fully coordinate the proposed substitution with all aspects of the Work, and that the proposed substitution will be in accordance to the Architect's interpretation.

If the request for substitution is submitted after the first payment period, the Contractor shall comply with the conditions of Subparagraph 3.1.4.

3.13 USE OF SITE

SUBPARAGRAPH 3.13.1 : Add the following new Subparagraph 3.13.1:

3.13.1 Unless noted otherwise, the Contractor shall not allow any commercial and/or political campaign signs and/or advertisements of any kind on the project site except for the project sign and other cautionary and/or safety signs required by governing agencies.

ARTICLE 4: ARCHITECT

4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

SUBPARAGRAPH 4.2.2: Delete the words "at intervals appropriate to the stage of construction" at the first sentence and substitute with "at a limit of 2 site visit per week or if required by the project conditions, at intervals appropriate to the stage of construction…"

SUBPARAGRAPH 4.2.2: Add the following at the end of the last sentence: "When the Architect is required by the project conditions, to visit the site at a more frequent interval, exceeding the limit of 4 site visit per 2 week, the site visits shall be subjected to the requirements of Subparagraph 3.1.4."

SUBPARAGRAPH 4.2.2: Add the following new Clause 4.2.2.1:

4.2.2.1 If the Owner and the Architect agree, the Architect shall be present at the Project Progress Meetings set forth by the General Requirements (Division 1 of the Project Manual) and not exceeding the limit of 2 project meeting per 2 weeks. When the Architect presence in these meetings exceeds 2 meeting per 2 weeks, the project meetings shall be subjected to the requirements of Subparagraph 3.1.4.

SUBPARAGRAPH 4.2.7: Add the following to the last sentence: Review of Contractor's Submittals such as Shop Drawings, Product Data and Samples beyond the second submittal shall be subjected to the requirements Subparagraph 3.1.4.

SUBPARAGRAPH 4.2.9: Delete the word "conduct inspections" at the first sentence and substitute with "conduct site visits".

ARTICLE 5: SUBCONTRACTOR

5.2.1 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

SUBPARAGRAPH 5.2.3: Add the following New Clause 5.2.3.1:

5.2.3.1 The Owner reserves the right to nominate a Subcontractor to perform construction or operations related to the Project after the review of the Contractor's list of each person and/or entities proposed for each principal portion of the Work. If the Contractor makes a reasonable objection to the nominated Subcontractor, the Contractor shall not be required to contract with the nominated Subcontractor. However, the Owner reserves the right to terminate that portion of the Work from the Contract under the conditions set forth in Article 14. After that termination, the Owner also reserve the right to perform construction and/or to award that portion of the Work to a separate Contract under conditions set forth in Article 6.

ARTICLE 7: CHANGES IN THE WORK

7.3.1 CONSTRUCTION CHANGE DIRECTIVES

CLAUSE 7.3.3.2: Add the following to the last sentence of Clause 7.3.3.2:

"…The Contractor shall submit a Schedule of Unit Prices as required in Project Manual (Division 1 – General Requirements) for all relevant scope of work as a possible basis to determine adjustments to the Contract Sum. Unless waived by the Architect in writing, the schedule of Unit Prices shall be submitted prior to the execution of the Contract Agreement for Construction between the Owner and the Contractor. This Schedule of Unit Prices shall include the costs of

Labor, Materials and the General Requirements (Overhead, Profits, Equipment Rental, Taxes, Insurance, Permit Fees, Bonds, etc) and all other related cost for each specific scope of work. Where the change in the work involves the scope of work not covered by the Schedule of Unit Prices, the Contractor, at the Owner and/or Architect's request, shall submit additional Unit Prices for the specific work involved as a possible basis to determining the adjustments to the Contract Sum."

ARTICLE 8: TIME

8.2 PROGRESS AND COMPLETION

SUBPARAGRAPH 8.2.4: Add the following New Subparagraph 8.2.4:

8.2.4 Liquidated Damages for Time Delay Not Caused by the Owner: The Contractor and/or the Contractor's surety, if any, shall be liable for each calendar of delay beyond the time period set by the Contract Time. The Contractor and/or the Contractor's surety shall pay the Owner the sums hereinafter stipulated as Consequential Damages for Time Delay for each calendar day of delay not caused by the Owner until the Work in substantially completed:

$100 for the first 30 calendar days of delay, and after the first 30 calendar days of delay, **$500** per calendar day for each calendar day of delay thereafter.

The total amount of damages based on the calendar days of delay above shall be deducted from the payment due or to become due to the Contractor. This amount shall not be taken from the retainage amount or contingency funds but from actual payment due to the Contractor.

Administrative Fee: The Contractor shall pay the Architect an amount of **$75** per calendar day of delay for extra project administrative fee beyond the Contract Time. This amount shall be paid to the Architect prior to the issuance of the Certificate of Substantial Completion.

Waiver of Claim: Unless noted otherwise, the Contractor shall waiver all other claims including but not limited to direct overhead and loss including rental and wages, finance charges, loss of business and reputation, loss of anticipated income arising directly from the Work ,..etc resulting from the Time Delay not caused by the Owner. This waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14.

SUBPARAGRAPH 8.2.5: Add the following New Subparagraph 8.2.5:

8.2.5 Liquidated Damages for Time Delay Caused by the Owner. The Owner shall be liable for each calendar of delay beyond the time period set by the Contract Time. The Owner shall pay the Contractor the sums hereinafter stipulated as Consequential Damages for Time Delay for each calendar day of delay caused by the Owner until the Work in substantially completed:

$1.00 per calendar day for each calendar day of delay

The total amount of damages based on the calendar days of delay above shall be added to the payment due or to become due to the Contractor. This amount shall not be added to the retainage amount or contingency
funds but to actual payment due to the Contractor.

Waiver of Claim: Unless noted otherwise, the Contractor shall waiver all other claims including but not limited to extended overhead and loss including wages, direct overhead and loss including wages, main office rent, finance charges, loss of business and reputation, loss of profit except anticipated profits arising directly from the Work, etc resulting from the Time Delay caused by the Owner. This waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14.

ARTICLE 9: PAYMENTS AND COMPLETION

9.3 APPLICATIONS FOR PAYMENT

SUBPARAGRAPH 9.3.2: At the end of the last sentence of Subparagraph 9.3.2, add the following new sentence:

9.3.2 "For both materials stored off-site and on-site, proof of coverage of theft insurance policy for the full amount of the materials as well as transportation, and other fees shall be provided. "

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

10.3 HAZARDOUS MATERIALS

SUBPARAGRAPH 10.3.2: Delete the word "Owner" in the first sentence of Subparagraph 10.3.2 and substitute with "Contractor".

ARTICLE 11: INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

SUBPARAGRAPH 11.1.1: Add the following New Clause 11.1.1.9:

11.1.1.9 Claims under liability insurance shall include all major divisions of coverage and shall be on a
comprehensive basis to include the following:

a. Premise Operation (including X, C, U coverage where applicable)
b. Independent Contractor's Protective
c. Products and Completed Operations
d. Personal Injury Liability with Employment Exclusion deleted
e. Owned, non-owned and hired motor vehicles
f. Broad Form Property Damage including Completed Operations.

SUBPARAGRAPH 11.1.1: Add the following New Clause 11.1.1.10:

11.1.1.9 When the General Liability coverage are provided by a commercial General Liability Policy on a claims-made basis, the policy date or Retroactive date shall predate the Contract. The termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverage required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.

11.1 CONTRACTOR'S LIABILITY INSURANCE

SUBPARAGRAPH 11.1.5: Add the following New Subparagraph 11.1.5:

11.1.5 The insurance coverage when required by Subparagraph 11.1.1 shall be written for not less than the following limits, or greater than the following limits if required by prevailing laws.

Contractors Liability Insurance (Combined Single Limit Insurance Coverage)

A. Worker's Compensation:
   1. State Statutory

2. Applicable Federal (e.g. Longshoremen
   Harbor work, Work at our outside US boundaries) Statutory
3. Maritime
4. Employer's Liability $100,000.00
5. Benefits Required by Union Labor Contracts As applicable

B. Comprehensive General Liability (Including Premises-Operations; Independent Contractor's Protective Products and Completed Operations; Broad Form Property Damage):

1. Bodily Insurance (Deductible on policy coverage is limited to 5%): Limited to
   $1,000,000.00 for Each Occurrence
   $1,000,000.00 Aggregate, Products, and Completed Operations

2. Property Damage (Deductible on policy coverage is limited to 5%): Limited to
   $1,000,000.00 for Each Occurrence
   $1,000,000.00 Aggregate

3. Products and Completed Operations Insurance shall be maintain for a minimum period of (X) 1 year ( ) 2 years after the issuance of the final payment. The Contractor shall continue to provide evidence of such coverage to the Owner during the aforementioned period.

4. Property Damage Liability Insurance (Deductible on policy coverage is limited to 5%). Depending on the situation of risk of the project, the following hazards shall be covered:
   (X) X (Explosion)
   (X) C (Collapse)
   ( ) U (Underground)

5. Contractual Liability (Hold Harmless Coverage)
   a. Bodily Injury Limited to $1,000,000.00 for Each Occurrence
   b. Bodily Injury Limited to $1,000,000.00 Aggregate

6. Personal Injury with Employment Exclusion deleted: Limited to
   a. $1,000,000.00 Aggregate

C. Comprehensive Automobile Liability (Owned, non-owned, hired)
1. Bodily Injury: Limited to
   $1,000,000.00 for Each Person
   $1,000,000.00 for Each Accident

2. Property Damage: Limited to
   $1,000,000 for Each Occurrence

SUBPARAGRAPH 11.1.6: Add the following New Subparagraph 11.1.6:

11.1.6 Deductibles: In the event of a settlement of an insurance claim, the Contractor shall incur the cost of the balance amount not recovered because of the final settlement amount and deductibles.

11.2 PROPERTY INSURANCE

SUBPARAGRAPH 11.3.1: Delete "Unless otherwise provided, the Owner" in the first sentence of Subparagraph 11.3.1 and substitute with "The Contractor".

SUBPARAGRAPH 11.3.1: Add the following after the last sentence of Subparagraph 11.3.1:

"..The form of policy for this coverage shall be Completed Values. If the Owner is inconvenienced and/or damaged in any way by the failure of the Contractor to maintain such insurance, then the Contractor shall bear all costs to the Owner as a direct and/or indirect result of this failure.

Deductibles: In the event of a settlement of an insurance claim, the Contractor shall incur the cost of the balance amount not recovered because of the settlement amount and deductibles."

CLAUSE 11.3.1.2: Delete Clause 11.3.1.2 in its entirety.

SUBPARAGRAPH 11.3.4: Delete Subparagraph 11.3.4 in its entirety.

SUBPARAGRAPH 11.3.6: Delete Subparagraph 11.3.6 in its entirety and substitute with the following:

11.3.6 Before an exposure to loss may occur and before the Commencement Date of the Project, the Contractor shall file with the Owner two copies of each policy that includes insurance coverage required by this Paragraph 11.4. Each Policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 calendar days' prior written notice has been given to the Owner.

SUBPARAGRAPH 11.3.7: Delete the words "Owner as fiduciary" and substitute with "Contractor as fiduciary" at the end of the first sentence of Subparagraph 11.4.7.

SUBPARAGRAPH 11.3.8: Delete the words "Owner's property insurance" and substitute with "Contractor's property insurance" in the first sentence. Delete the words "Owner as fiduciary" and substitute with "Contractor as fiduciary" at the Subparagraph 11.4.8.

SUBPARAGRAPH 11.3.9: Delete the words "Owner as fiduciary" and substitute with "Contractor as fiduciary" in the first sentence. Delete the word "Owner" where appears and substitute with "Contractor" except for the word "Owner" in the last sentence.

SUBPARAGRAPH 11.3.10: Delete the words "Owner as fiduciary" and substitute with "Contractor as fiduciary" where appears. Delete the word "Owner" where appear in the first sentence and substitute with "Contractor".

11.3 PERFORMANCE BOND AND PAYMENT BOND

SUBPARAGRAPH 11.4.3: Add the following New Subparagraph 11.4.3:

11.4.3 The Owner shall require the Contractor to furnish bonds covering the faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Agreement Form for Construction Between Owner and Contractor. The amount of each bond shall match 100% the total amount of Contract Sum which shall also includes the cost of bonds. The bonds shall be provided from an insurance carrier licensed to do business in the project location for the task involved and is covered by the reinsurance policy. The insurance carrier shall have to be acceptable to both the Owner and the Owner's source of financing.

The Contractor shall deliver two copies of the bonds to the Owner no later than the Date of Commencement of the Work as stipulated in the Notice to Proceed.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

SUBPARAGRAPH 14.1.1: Delete the words “30 consecutive days” in the first sentence of Subparagraph 14.1.1 and substitute with “60 consecutive days”.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

SUBPARAGRAPH 14.4.1: Add the following New Sub-subparagraph 14.4.1.1 at the last sentence:

14.4.1.1 The Owner may, with a written notice of 7 calendar days, terminate any of the portions of the Work in the Contract for the Owner’s convenience and without cause. Within the 7 calendar days, the Contractor shall submit a Change Order incorporating all the entitlements of the Contractor including the requirements of Article 6.

SUBPARAGRAPH 14.4.3: Delete the words “, along with reasonable overhead and profit on the Work not executed.” at the last sentence and add the following sentence: “The Owner shall be entitled to receive all of the expenses of overhead, profit and other General Requirements of the portion of the Work not executed.”

15.1.5 CLAIMS FOR ADDITIONAL TIME

SUB-SUBPARAGRAPH 15.1.5.:Add the following New Clause 15.1.5.3:

15.1.5.3 This Provision provides the definition and the determination of an adverse weather day as the
basis of a Claim for additional time found in Clause 15.1.5.2:

The Contract Time shall take into consideration a certain number of anticipated adverse weather days. No adverse weather related time extension shall be allowed unless the actual number of adverse weather days in a given month exceeds these anticipated days in that same given month. The listing below defines the anticipated adverse weather days for the each month for the geographical location of the project site:

LIST OF MONTHLY ANTICIPATED ADVERSE WEATHER DAYS

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5	5	4	4	5	5	8	9	9	7	7	7

The Contractor shall record on a calendar day basis (from the first to the last day of each month) all adverse weather days (including weekends and holidays). For our purposes, an adverse weather day is defined as a day where one of the following abnormal or adverse weather conditions have occurred:

a. Precipitation is equal to or greater than 5/8” for a given day (as recorded by National Weather Service)
b. Sustained surface winds with speeds equal to or greater than 45 miles per hour for a period of 1 hour (as recorded by National Weather Service).

Once the number of recorded adverse weather days that fall on working days exceed the number of anticipated adverse weather days as defined by the List of Monthly Anticipated Adverse Weather Day, the Architect shall examine those additional unanticipated adverse weather days to determine whether the Contractor is entitled to a time extension. In order for a time extension to be considered, these additional unanticipated must prevent work for 50% or more of the Contractor’s workday or prevent work that is shown to be on the critical path of the project.

Any consideration for claims for time extension together with all supporting documents, shall be submitted together with the Progress Payment Request for the time period covered by the Progress Payment Request. The Contractor shall waiver his right to a claim for time extensions for that particular time period if he fails to submit the claim for time extension together with the Progress Payment Request for the same time period.

Time extension due to unanticipated adverse weather days is executed through the Change Order with a change in Contract Time. Both the Owner and the Contractor shall waiver claims against each other for consequential damages arising out of this time extension due to unanticipated adverse weather days. This mutual waiver includes but not limited to the following:

a. damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
b. damages incurred by the Contractor for principal and/or field office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, for rental expenses, for losses of profit except anticipated profits arising directly from the Work.

SUBPARAGRAPH 15.1.5: Add the following New Clause 15.1.5.4:

15.1.5.4: The Contractor shall, at all times, provide protection against the weather including but not limited to rain, winds, storms, salt spray, etc so as to maintain all work, materials, apparatus and fixtures free from damage or injury. At the end of the day's work, all work shall be protected and secured. At Typhoon Condition 2 as announced by GOVGUAM, the Contractor shall secure all work including but not limited to both permanent and temporary facilities, on the jobsite and remove any loose debris that may become a potential threat to the surrounding properties and neighbors. The Contractor shall resume work immediately after Typhoon Condition 4 has been announced by GOVGUAM, and proceed with cleanup as well as hookup of emergency power, etc as required to restore normal operations of the jobsite.

END OF SECTION 00900.

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 through 16 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of Reconstruction of Chargualaf House
   1. Project Location: Historic District of Inarajan, Guam
   2. Owner: Guam Preservation Trust

B. Contract Documents, dated November 2014, were prepared for the Project by PROVIDO • TAN • JONES ARCHITECTS INC, Post Office Box 6463, Tamuning, Guam 96931.

C. The Work consists of Reconstruction of Chargualaf House involving hardening of historic structures registered with the National Historic Register with concrete and masonry, salvage and reuse historic ifit materials (if any), replace with new merbau (fit) finish hardwood, upgrade doors and windows, preserve historically significant early reinforced concrete walls identified to remain.

D. Unless noted otherwise, the Work will be constructed under a single prime contract.

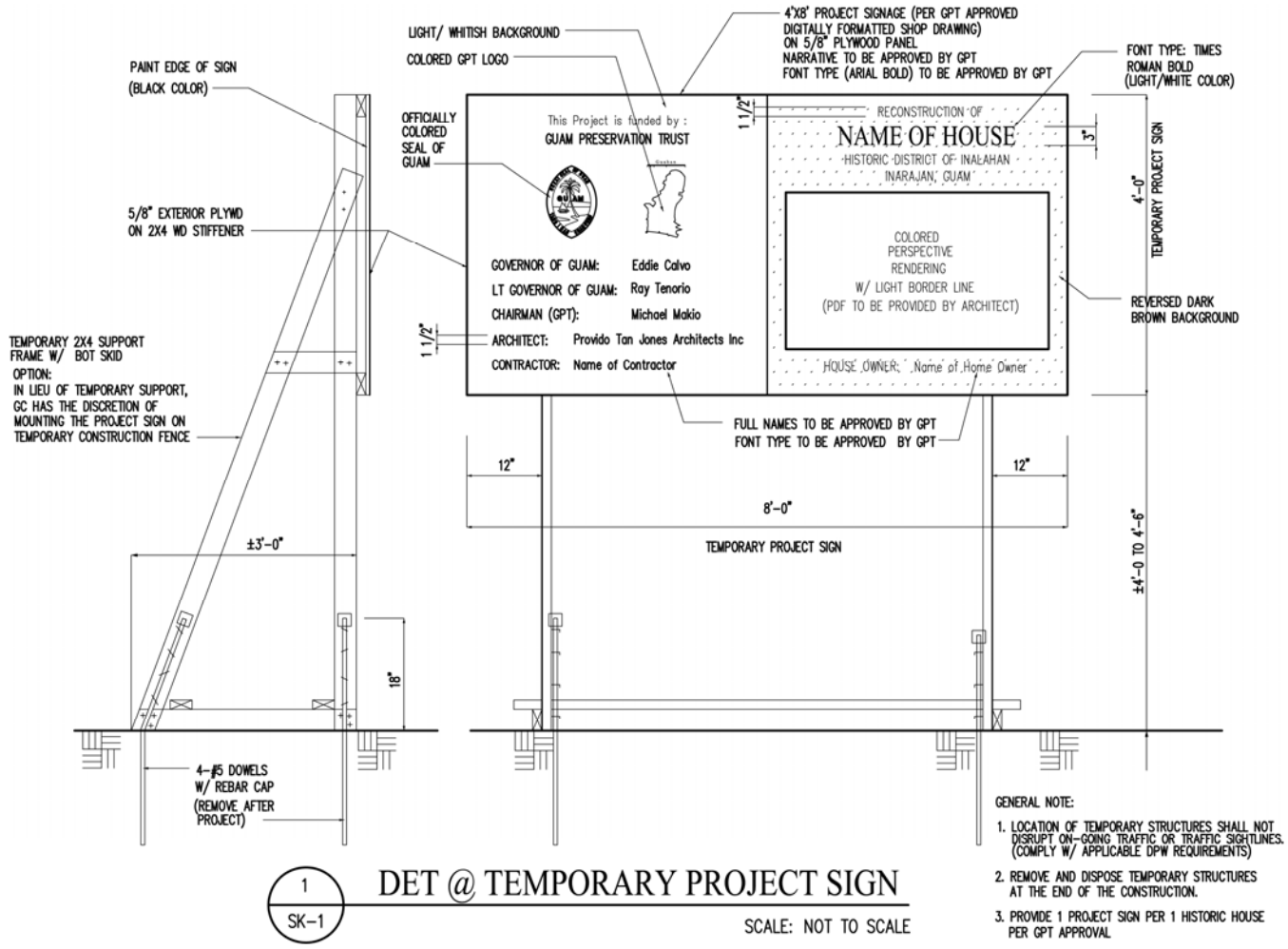
1.3 WORK UNDER OTHER CONTRACTS

A. Separate Contract: The Owner has awarded a separate contract for performance of certain construction operations at and/or off the site. Those operations will be conducted simultaneously when the work under this Contract begins. That separate Contract includes the following:
   1. Archaeological Monitoring

B. Coordinate and cooperate fully with separate contractors and/or Owner so that work under those separate contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate and provide line items for these work to be carried out in the Construction Schedule. Where occurs, highlight the Work to be performed under other contract that falls on the critical path of the Construction Schedule including the critical delivery dates of ETA on the jobsite for the Owner-Furnish Contractor-Install items and bring it to the Owner's attention.

1.4 PROJECT SIGN

The Contractor shall provide construction project signs at each project location according to the following format:



1.5 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site, for the purposes of the construction of the project. The Contractor's use of the premises is limited by the Owner's right to perform work or to retain other contractors on portions of the Project.

B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
1. Security Temporary Fence: When the project site is not being used by the Contractor, the Contractor shall provide a Security Temporary Fence with a secured entry gate.
2. Other uses of the Site other than for the construction and/or construction related purposes of the above project is not allowed without a prior written permission of the Owner.

C. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage caused by construction operations. Take

all precautions necessary to protect the building and its occupants during the construction period.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01010

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 through 16 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required from Division 1 through 16 Specification Sections for performance of the Work, including the following:
   1. Contractor's construction schedule.
   2. Submittal schedule.
   3. Daily construction reports.
   4. Shop Drawings.
   5. Product Data.
   6. Samples.
   7. Quality assurance submittals.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
   1. Permits.
   2. Applications for Payment.
   3. Performance and payment bonds.
   4. Insurance certificates.
   5. List of subcontractors and suppliers.

1.3 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

3. Identify products and materials with their intended location by including using roomnames and numbers, gridline symbols, and other symbols as indicated in the Drawings.
4. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
   a. Allow 2 weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
   b. If an intermediate submittal is necessary, process the same as the initial submittal.
   c. Allow 2 weeks for reprocessing each submittal.
   d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
2. Include the following information on the label for processing and recording action taken.
   a. Project name.
   b. Date.
   c. Name and address of the Architect.
   d. Name and address of the Contractor.
   e. Name and address of the subcontractor.
   f. Name and address of the supplier.
   g. Name of the manufacturer.
   h. Number and title of appropriate Specification Section.
   i. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor.
1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
2. Transmittal Form: Use AIA Document G810.
3. Transmittal Form: Use the sample form at the end of this Section for transmittal of submittals.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule with a highlighted Critical Path of job tasks that will adversely impact the schedule if not performed in the time schedule indicated. Submit within 30 days after the date established for "Commencement of the Work."
1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
7. Provide a schedule of “OFCI” items to be delivered to the Jobsite. Provide and highlight exact datelines for “OFCI” items that are located on the critical path and that will adversely impact the construction scheduleif not performed.
8. Provide a schedule of work “by Others” to fit into the construction schedule. Provide and highlight the part of schedule that are located on the critical path and that will adversely impact the construction schedule if not performed.
9. For the purposes of the special structural inspections, provide a schedule of concrete/CMU grout pours and the corresponding schedule of reinforcing bar /welding inspections prior to pouring. At least 72 hours prior the the special inspection, confirm the schedule with the Architect and the party directly involved in the special structural inspections.

B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner affect the sequence of Work.

C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparation of payment requests.
   1. Refer to Division 1 Section "Applications for Payment" for cost reporting and payment procedures.

F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
   1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

G. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.
   1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
   2. Prepare the schedule in chronological order. Provide the following information:
      a. Scheduled date for the first submittal.

b. Related Section number.
c. Submittal category (Shop Drawings, Product Data, or Samples).
d. Name of the subcontractor.
e. Description of the part of the Work covered.
f. Scheduled date for resubmittal.
g. Scheduled date for the Architect's final release or approval.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Architect at weekly intervals:
1. List of subcontractors at the site.
2. Approximate count of personnel at the site.
3. High and low temperatures, general weather conditions including factors that affect the considerations of an adverse weather day.
4. Accidents and unusual events.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, and losses.
7. Meter readings and similar recordings.
8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

1.8 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
1. Dimensions.
2. Identification of products and materials included by sheet and detail number including using gridline symbols, and other symbols as indicated in the Drawings.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm).
7. Initial Submittal: Submit one correctable, translucent, reproducible print and one blue- or black-line print for the Architect's review. The Architect will return the reproducible print.

8. Initial Submittal: Submit 2 blue- or black-line prints for the Architect's review. The Architect will return one print.
9. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where required for maintenance manuals. The Architect will retain 2 prints and return the remainder.
10. Final Submittal: Submit 3 blue- or black-line prints and 2 additional prints where required for maintenance manuals, plus the number of prints needed by the Architect for distribution. The Architect will retain 2 prints and return the remainder.
    a. One of the prints returned shall be marked up and maintained as a "Record Document."

11. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.9 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
    a. Manufacturer's printed recommendations.
    b. Compliance with trade association standards.
    c. Compliance with recognized testing agency standards.
    d. Application of testing agency labels and seals.
    e. Notation of dimensions verified by field measurement.
    f. Notation of coordination requirements.
2. Identification of products and materials and their corresponding location by using room numbers, gridline symbols, and other symbols as indicated in the Drawings.
3. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
4. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
5. Submittals: Submit 4 copies of each required submittal. The Architect will return two copes marked with action taken and corrections or modifications required.
    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
6. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
    a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
    b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:

a. Specification Section number and reference.
b. Generic description of the Sample.
c. Sample source.
d. Product name or name of the manufacturer.
e. Compliance with recognized standards.
f. Availability and delivery time.

2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
   a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
   b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
   c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
   d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.
   a. The Architect will review and return preliminary submittals with the Architect's notation, indicating selection and other action.
4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Architect will return one set marked with the action taken.
5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
   b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
   1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
      a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
   1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.12 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return 2 copies promptly.
   1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:
   1. Final Unrestricted Release: When the Architect marks a submittal "Approved" or “Without Exceptions” the Work covered by the submittal may proceed provided it complies with full requirements of the Contract Documents with any exceptions. Final payment depends on that compliance.
   2. Final-But-Restricted Release: When the Architect marks a submittal "Approved as Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
   3. Returned for Resubmittal: When the Architect marks a submittal "Not Approved, Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
      a. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
   4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."

C. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01300

SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 APPLICABLE PUBLICATIONS

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D3666-81	Inspection and Testing Agencies for Bituminous Paving Materials
D3740-80	Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock Used in Construction
E 329	Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
E 543-80	Inspection and Testing Agencies, Recommended Practices to Determine the Qualifications
E 548-79	Testing and Inspection Agencies, Recommended Practices for Generic Criteria for Use in Evaluation

1.2 DEFINITIONS

1.2.1 Factory Tests

Tests made on various products and component parts prior to shipment to the job site, including, but not limited to such items as transformers, air conditioning equipment, and electrical equipment.

1.2.2 Field Tests

Tests or analyses made at, or in the vicinity of, the job site in connection with the actual construction.

1.2.3 Product

The term "product" includes the plural thereof and means a type or a category of manufactured goods, constructions, installations, and natural and processed materials or those associated services whose characterization, classification, or functional performance determination is specified by standards.

1.2.4 Person

The term "person" means associations, companies, corporations, educational institutions, firms, government agencies at the Federal, State, and Local level, partnerships, and societies, as well as divisions thereof, and individuals.

1.2.5 Testing Laboratory

The term "testing laboratory" means any "person", as defined above, whose functions include testing, analyzing, or inspecting "products, as defined above, and/or evaluating the designs or specifications of such "products" according to the requirements of applicable standards.

1.2.6 Certified Inspection Reports

Reports signed by approved inspector, attesting that the items inspected meet the specification requirements other than any exception included in the report.

1.2.7 Manufacturer's Certificate of Conformance

A certificate signed by an authorized manufacturer's official attesting that the material or equipment delivered meets the specification requirements.

1.3 SUBMITTALS

Prepare in accordance with Section 01330-Submittal Procedures.

1.3.1 Formwork, Falsework, and Erection Procedures Certification

When the Contractor is required to submit a design certification for formwork, falsework erection procedures, daily inspection reports must indicate that the work has been inspected by a Professional Civil or Structural Engineer registered in any jurisdiction for conformance to the design certification. A specific statement for these items rather than a general statement is required.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 QUALITY CONTROL REQUIREMENTS

The Contractor shall inspect and test all work under the contract and maintain records of the inspections and tests. Approvals, except those required for field installations, field applications and field tests, shall be obtained before delivery of materials and equipment to the project site. Surveillance of the inspection system will be performed by the Contracting Officer.

3.1.1 Factory Tests

Unless otherwise specified, the Contractor shall arrange for factory tests when they are required under the contract.

3.1.2 Factory Inspections by Contractor

Unless otherwise specified, the Contractor shall arrange and perform all factory inspections specifically required in the technical sections of the specifications. These inspections shall be reported in the Daily Report to the Inspector.

3.1.3 Masonry, Structural Steel Bolting, Welding Inspections & Tests

These inspections and tests shall be considered specialty inspections to be performed and submitted as certified test and inspection reports by an approved testing laboratory.

3.1.4 Approval of Testing Laboratories

All laboratory work under this contract shall be performed by a laboratory, whether the laboratory is employed by the Contractor, or is owned and operated by the Contractor. The basis of approval includes the following:

a. Testing laboratories performing work in connection with concrete and steel, shall comply with ASTM E 329 and ASTM D 3666, respectively.

b. Testing laboratories performing work not in connection with concrete, steel, bituminous materials, soils and nondestructive testing shall comply with ASTM E 548.

c. Laboratory Inspection

Prior to approval the laboratory shall submit in writing the following:

(1) Functional description of the laboratory's organizational structure, operational departments, and support departments and services.

(2) A list of resume of the personnel assigned to the proposed testing, including the person charged with engineering managerial responsibility.

(3) Affidavit of compliance with the applicable ASTM publication test procedures and certification that the equipment is calibrated at prescribed intervals to insure the validity of the test and inspection data.

(4) A copy of any recent certification of inspection report of the laboratory by a nationally recognized agency, including a statement of corrections made based on the findings of the agency. In the absence of inspection by a nationally recognized agency, the laboratory will be subject to inspection by the Contracting Officer upon receipt of all the above information and 30 days before the required approval of the testing laboratory.

3.1.5 Repeated Tests and Inspection

The Contractor shall repeat tests and inspections after each correction made to non-conforming materials and workmanship until tests and inspections indicate the materials, equipment, and workmanship conform to the contract requirements. The re-testing and re-inspections shall be performed at no additional cost to the Government.

END OF SECTION 01451

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 through 16 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.
B. Temporary utilities include, but are not limited to, the following:
   1. Water service and distribution.
   2. Temporary electric power and light.
   3. Ventilation.
   4. Telephone service.
   5. Storm and sanitary sewer.
C. Support facilities include, but are not limited to, the following:
   1. Field offices and storage sheds.
   2. Temporary roads and paving.
   3. Temporary enclosures.
   5. Temporary project identification signs and bulletin boards.
   7. Waste disposal services.
   8. Rodent and pest control.
   9. Other Construction aids and miscellaneous services and facilities.
D. Security and protection facilities include, but are not limited to, the following:
   1. Temporary fire protection.
   2. Barricades, warning signs, and lights.
   3. Enclosure fence for the site.
   4. Environmental protection.

1.3 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
   1. Building code requirements.
   2. Health and safety regulations.
   3. Utility company regulations.
   4. Police, fire department, and rescue squad rules.
   5. Environmental protection regulation
   6. Mayor’s office, municipal planning councils and visitor’s beautification bureau, if any.
B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
   1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

C. Temporary Facilities shall be able to withstand the seismic and wind load forces for the project area. Secure temporary facilities prior to an impending typhoon storm and no later than when the project area is declared a Typhoon Condition “2”.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."
1. For job-built temporary offices, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thicknesses indicated.
3. For fences and vision barriers, provide minimum 3/8-inch- (9.5-mm-) thick exterior plywood.
4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch- (16-mm-) thick exterior plywood.

C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.

D. Paint: Comply with requirements of Division 9 Section "Painting."
1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer. Color: To be determined by Architect.
2. For sign panels and applying graphics other than the Project sign, provide exterior-grade alkyd gloss enamel over exterior primer.
3. For interior walls of temporary offices, provide 2 coats interior latex-flat wall paint.

E. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

F. Water: Provide potable water approved by local health authorities.

G. Open-Mesh Fencing: Provide 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chainlink fabric fencing 6 to 8 feet (as noted by governing authorities: Police Department, Public Works, etc.) (2 m) high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Generator Units: Provide temporary all weather generator (quiet-type) that have been tested and labeled by UL, FM, or another recognized trade association related with adequate capacity to provide power to all power tools /field office equipment/air conditioning unit and with adequate fuel capacity for two days.

G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.

4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
   1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
   1. Install electric power service underground, except where overhead service must be used.
   2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching. Provide more temporary lighting when temporary lighting is not sufficient as indicated by the Architect.
   1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

E. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities. Install telephone on a separate line for each temporary office and first-aid station.
   1. Separate Telephone Lines: Provide additional telephone lines for the following:
      a. Provide a cellular phone for the Project Manager.
      b. Provide a dedicated telephone line for a fax machine in the field office.
   2. At each telephone, post a list of important telephone numbers.

F. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
   1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

G. Toilets: Use of the Owner's existing toilet facilities will not be permitted. In the event that these toilet facilities are used, they shall be cleaned and maintained in a condition acceptable to the Owner. At Substantial Completion, restore these facilities to the condition prevalent at the time of initial use.

H. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.

I. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
   1. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

N. Sewers and Drainage: If sewers are available and upon approval from governing authorities, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
   1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.

2. Connect temporary sewers to the municipal system, as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.

O. Provide earthen embankments, sand bagss, filter fabrics and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains and around catch basins and trenchsto prevent the fines from entering the catch basins and trenches.

3.3 SUPPORT FACILITIES INSTALLATION

A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet (9 m) of building lines. Comply with requirements of NFPA 241.

C. Field Offices: Provide insulated, weathertight air-conditioned temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep the office clean and orderly for use for small progress meetings.

D. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.

E. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.
1. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
2. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
3. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
4. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision, and control dust .

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

J. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.

K. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

L. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

M. Rodent and Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

N. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.
2. Provide plywood fence, 8 feet (2.5 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, and preservative-treated wood posts spaced not more than 8 feet (2.5 m) apart.

G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
   1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

H. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, the environmental protection plan as well as the erosion control plan drawing, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Provide sandbags, riprap, silt fencing and drainage swales as necessary to mitigate the possibility of flooding, erosion and contamination of incorporated structures such as catch basins, infilitrators, trenches, manholes, etc. Provide dust control such as regularly hosing down exposed grade, spraying EPA approved dust control covers, for unpaved sites.

I. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

J. Provide other temporary facilities such as temporary barrier and warning signs when required by emergency situations such as uncovering of ordinance or explosive devices or remnant of archeological significance.

3.5 TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

B. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
   2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
   3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
      a. Replace air filters and clean inside of ductwork and housings.
      b. Replace significantly worn parts and parts subject to unusual operating conditions.
      c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01500

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 through 16 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operation and maintenance manual submittal.
   4. Submittal of warranties.
   5. Final cleaning.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
      a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   2. Advise the Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
   4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra stock, and similar items.
   7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
   9. Complete final cleanup requirements, including touchup painting.
   10. Touch up and otherwise repair and restore marred, exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   1. The Architect will repeat inspection when requested and assured that the Work is substantially complete.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
   1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
   2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
   3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
   4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
   5. Submit consent of surety to final payment.
   6. Submit a final liquidated damages settlement statement.
   7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.
   1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   2. If necessary, reinspection will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
   1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
   2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
   3. Note related change-order numbers where applicable.
   4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
   1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
3. Note related record drawing information and Product Data.
4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.
1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations. Provide a log of all Product Names, their suppliers and their contact numbers to facilitate the Owners maintenance program.
2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.

G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch (51-mm), 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions.
2. Name of Ceritified installers/maintenance technicians for each product and their contact numbers.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Maintenance manuals.
2. Record documents.

3. Spare parts and materials.
4. Tools.
5. Cleaning.
6. Warranties and bonds.
7. Maintenance agreements and similar continuing commitments.

3.2 FINAL CLEANING

A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 1 Section "Construction Facilities and Temporary Controls."

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
      a. Remove labels that are not permanent labels.
      b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
      c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
      d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
      e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
   1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 01700

SECTION 01740

WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 through 16 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
   1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
   2. Certifications and other commitments and agreements for continuing or extended services to Owner that are requested by the Owner during the construction.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime contractor is responsible for warranties related to its own contract.

1.3 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
   1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
   1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

D. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

E. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
   1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
   2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
   3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 LIST OF WARRANTIES

A. Schedule: Provide warranties on products and installations as specified in the following:
   1. Termite Control Treatment.
   2. Elastomeric and other waterproofing membranes.
   3. Stile Wood Doors.
   4. Aluminum Windows/Storefronts.

5. Door Hardware
6. All architectural finishes
7. All Plumbing Fixtures
8. All lighting fixtures

END OF SECTION 01740

SECTION 02102

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 PROCEDURES

Areas in which clearing and grubbing is to be accomplished shall be as indicated on the drawings either specifically or incidental part of the work. The procedures shall provide for the safe conduct of the work, careful removal and disposition of materials to be removed, protection of property which is to remain undisturbed and coordination with other work involved.

1.2 EXPLOSIVES

Use of explosives will not be permitted.

1.3 PROTECTION OF EXISTING STRUCTURES, UTILITIES AND OTHER ITEMS OF PROPERTIES

a. Existing structures, utilities, and other items of properties designated to remain not identified to be removed, shall be protected from damage during clearing and grubbing.

b. In addition, the Contractor shall seek and obtain written clearances from the Owner, prior to undertaking clearing operations. Any damage to existing facilities, structures, utilities or other works shall be repaired by the Contractor, using materials equal to or better than those existing, all at the Contractor's expense.

PART 2 PRODUCTS

None required.

PART 3 EXECUTION

3.1 CLEARING

a. Clearing shall consist of the felling of trees and the satisfactory disposal of surface objects, trees and other vegetation not designated to remain, including mowing, as required.. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off 6 inches below the original ground surface,, except such trees and vegetation indicated or directed to be left standing. Hedges shall be pulled or grubbed in such a manner as to assure complete and permanent removal.

b. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

3.2 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas which shall include those areas coinciding with utility trenching and site improvements. This material, together with logs and other organic or non-

perishable solid objects shall be cut down to root level. Contractor shall not perform any excavation work without approval by the Owner and archaeological monitoring. Depressions made by grubbing shall be filled with suitable material and compacted in accordance with requirements specified in Section 02201 entitled "Excavation, Backfilling, and Compacting for Utilities", to make the surface match with the original adjacent surface of the ground.

3.3 DISPOSAL OF CLEARED AND GRUBBED MATERIALS

All trees, shrub vegetation, and debris shall be removed from the project site and disposed of at an approved location. The Contractor shall make all necessary arrangements with property owners in writing as well as obtain required permits for the use of off-site disposal locations. Woody material may be disposed of by chipping. The wood chips may be used for mulch, slope erosion control or may be uniformly spread over selected areas as directed.

END OF SECTION 02102

SECTION 02201

EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 698	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))
ASTM D 1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))
ASTM D 2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4253	Maximum Index Density of Soils Using a Vibratory

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA M23	PVC Pipe - Design and Installation

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	Safety and Health Requirements Manual

1.2 DEFINITIONS

1.2.1 Backfill

Material used in refilling a cut, trench or other excavation.

1.2.2 Cohesive Materials

Soils classified by ASTM D 2487 as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when fines have a plasticity index greater than zero.

1.2.3 Cohesionless Materials

Soils classified by ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.2.4 Compaction

The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 1557 for general soil types OR ASTM D 4253 (Relative Density) for isolated cohesionless materials, abbreviated in this specification as 95% percent maximum density.

1.2.5 Granular Pipe Bedding

A dense, well-graded aggregate mixture of sand, gravel, or crushed stone (mixed individually, in combination with each other, or with suitable binder soil) placed on a subgrade to provide a suitable foundation for pipe. Granular bedding material may also consist of poorly graded sands or gravels where fast draining soil characteristics are desired.

1.2.6 In-Situ Soil

Existing in place soil.

1.2.7 Lift

A layer (or course) of soil placed on top of subgrade or a previously prepared or placed soil in a fill or backfill.

1.2.8 Porous Fill

A granular soil material having a large void ratio when placed and compacted, allowing a free flow of fluid to or from the surrounding soil, with no more than 10 percent of the material passing the 1/2 inch [No. 100] Sieve.

1.2.9 Refill

Material placed in excavation to correct overcut in depth.

1.2.10 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1 cubic yard in volume. Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production

1.2.11 Topsoil

In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Topsoil may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. Gradation and material requirements specified herein apply to all topsoil references in this contract. The material shall be representative of productive soils in the vicinity.

1.2.12 Unyielding Material

Rock rib, ridge, rock protrusion, or soil with cobbles in the trench bottom requiring a covering of finer grain material or special bedding to avoid bridging in the pipe or conduit.

1.2.13 Unsatisfactory Material

In-Situ soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in the trench without excessive consolidation or loss of stability. Also backfill material which contains refuse, frozen material, large rocks, debris, soluble particles, and other material which could damage the pipe or cause the backfill not to compact. Materials classified as PT, OH, or OL by ASTM D 2487 are unsatisfactory.

1.2.14 Unstable Material

Material in the trench bottom which lacks firmness to maintain alignment and prevent joints from separating in the pipe, conduit, or appurtenance structure during backfilling. This may be material otherwise identified as satisfactory which has been disturbed or saturated.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

a. Shoring and sheeting plan
b. Trenching and excavation plan

1.3.1 Shoring and Sheeting Plan

Describe materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional engineer registered in any jurisdiction. Indicate sequence and method of installation and removal.

1.3.2 Trenching and excavation plan

Verify and locate sewer lateral stub-outs and waterline connections and determine exact extent of trenching required for proper utility hookups. Determine depth and area of excavation work required for proper placement of building foundations. Contractor shall hire archaeologist to monitor trenching and excavation works.

1.3.3 Factory Test Reports

a. Trench backfill material tests

b. Pipe bedding material tests

1.3.4 Field Test Reports

a. Test for moisture-density relation
b. Density and moisture tests

Submit field test data listed above sufficiently in advance of construction so as not to delay work.

1.3.4.1 Test for Moisture-Density Relation

Submit 7 days prior to commencing utility excavation.

1.3.4.2 Density and Moisture Tests

Submit within 14 days of test date.

1.3.5 Certificate of Compliance

a. Warning and Identification Tape

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver and store materials in a manner to prevent contamination, segregation, and other damage.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. That unidentified pipes, conduit and other artificial obstructions will be encountered. It shall be the responsibility of the Contractor to determine the location of underground utilities prior to excavation work.

c. That hard material in the form of consolidated calcareous marine sediments and coralline limestone formation locally known as coral will be encountered. It shall be the responsibility of the Contractor to remove all the materials mentioned in this paragraph without additional compensation regardless of the hardness or difficult in removing such material, notwithstanding that any such material may fall within the definition of hard material as defined above.

d. Blasting will not be permitted.

1.6 PROTECTION

1.6.1 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Excavation made with power-driven equipment is not permitted within four feet of known Government-owned utility or subsurface construction and without archaeological monitoring. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support

uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the authority having jurisdiction and report damage to utility lines or subsurface construction immediately.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Provide soil materials as specified below free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, ice, or other deleterious and objectionable materials.

2.1.1 Backfill

Bring trenches to grade indicated on the drawings using material classified as GM, SM and SC by ASTM D 2487 with a maximum particle size of 3 inches Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. The use of excavated material for backfill is an option, contractor shall consult a geotechnical engineer at no cost tot the government to determine the type of material, the classification of the material, and the particle size of the material. Recommendation by geotechnical engineer shall be submitted to the Contracting Officer for review.

2.1.2 Sand

Clean, coarse-grained sand classified as SW or SP by ASTM D 2487 for bedding and backfilling.

2.1.3 Borrow

Provide materials meeting requirement for pipe bedding, general site fill, fill, special backfill sand, gravel, backfill, granular fill. Obtain borrow materials in excess of those furnished from excavations specified herin from sources off Government property.

2.1.4 Pipe Bedding

Provide bedding for buried piping in accordance with AWWA M23, except as specified herein. Plastic piping shall have bedding to spring line of pipe. Provide ASTM D 2321 material as follows:

a. Class I Angular, 0.25 to 0.75 inches, graded stone or coral.

2.1.5 Gravel

Clean, coarsely graded natural gravel, crushed stone or a combination or having a classification of GW or GP in accordance with ASTM D 2487for backfill. Maximum particle size shall not exceed 3 inches.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Green: Sewer Systems

2.2.1 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheeting

Provide shoring sheeting where required. In addition to Section XXIII A and B of COE EM 385-1-1 and other requirements set forth in this contract, include provisions in the shoring and sheeting plan that will accomplish the following:

a. Prevent undermining of pavements, foundations and slabs.

b. Prevent slippage or movement in banks or slopes adjacent to the excavation.

c. Allow for the abandonment of shoring and sheeting materials in place in critical areas as the work is completed. In these areas, backfill the excavation to the elevation indicated within 3 feet of the finished grade and remove the remaining exposed portion of the shoring before completing the backfill.

3.1.2 Dewatering

Plan for and provide the structures, equipment, and construction for the collection and disposal of surface of water encountered in the course of construction.

3.1.3 Water Removal

Remove water by pumping or other methods to prevent the softening of surfaces exposed b excavation, prevent hydrostatic uplift, and provide a stable trench condition for installation of the utility. Use screens and gravel packs or other filtering systems on the dewatering devices to prevent the removal of fines from the soil.

3.1.4 Stockpiling Soil

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be wasted. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.1.5 Cutting Pavement, Curbs, and Gutters

Saw cut with neat, parallel, straight lines one foot wider than trench width on each side of trenches and one foot beyond each edge of pits.

3.2 GENERAL EXCAVATION AND TRENCHING

Keep excavations free from water while construction is in progress. Make trench sides as nearly vertical as practicable except where sloping of sides is allowed. Sides of trenches shall not be sloped from the bottom of the trench up to the elevation of the top of the pipe. Excavate ledge rock, boulders, and other unyielding material to an overdepth at least 6 inches below the bottom of the pipe unless otherwise indicated or specified. Blasting will not be permitted. Overexcavate soft, weak, or wet excavations as indicated. Use gravel placed in 6 inch maximum layers to refill overdepths to the proper grade. At the Contractor's option, the excavations may be cut to an overdepth of not less than 4 inches and refilled to required grade as specified. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded. Dimension of bell holes shall be as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. Trench dimensions shall be as indicated.

3.2.1 Shoring and Sheeting

Shore and sheet excavations as described in the plan submitted with various member sizes arranged to prevent injury to persons and damage to structures. Arrange shoring and sheeting to preclude injurious caving during removal. Obtain approval from the Contracting Officer prior to removing shoring, sheeting, or bracing in excavations adjacent to on-grade slabs, foundations, or other structural elements.

3.2.2 Trenching

Trenching shall be closed (backfill) within five days, fence all open excavation daily, and place 4" topsoil and seed within 5 days of backfilling. Stockpiles maintained in the housing area must be "eliminated" or "emptied" each Friday. Open trenches shall not exceed 400 ft. in length without the permission of the Contracting Officer.

3.3 BEDDING

Of materials and depths as indicated or specified for utility lines and utility line structures. Place bedding in 6 inch maximum loose lifts. Provide uniform and continuous support for each section of structure except at bell holes or depressions necessary for making proper joints.

3.4 BURIED WARNING AND IDENTIFICATION TAPE

Install tape in accordance with manufacturer's recommendations except as modified herein. Bury tape at the depth indicated. Under pavements and slabs, bury tape 6 inches below top of subgrade.

3.5 BACKFILLING

Construct backfill in two operations (initial and final) as indicated and specified in this section. Place initial backfill in 6 inch maximum loose lifts to one foot above pipe unless otherwise specified. Ensure

that initially placed material is tamped firmly under pipe haunches. Bring up evenly on each side and along the full length of the pipe structure. Ensure that no damage is done to the utility or its protective coating. Place the remainder of the backfill (final backfill) in 9 inch maximum loose lifts unless otherwise specified. Compact each loose lift as specified in the paragraph entitled "General Compaction" before placing the next lift. Do not backfill in freezing weather or where the material in the trench is already frozen or is muddy, except as authorized. Provide a minimum cover from final grade of 2 1/2 feet for water piping and 2 feet for sewer mains. Where settlements greater than the tolerance allowed herein for grading occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities. Testing for the following shall be complete before final backfilling: water distribution sanitary sewer systems. Provide buried warning and identification tape installed in accordance with the manufacturer's recommendation.

3.6 COMPACTION

Use hand-operated, plate-type, vibratory, or other suitable hand tampers in areas not accessible to larger rollers or compactors. Avoid damaging pipes and protective pipe coatings. Compact material in accordance with the following unless otherwise specified. If necessary, alter, change, or modify selected equipment or compaction methods to meet specified compaction requirements.

3.6.1 Compaction of Material in Subcuts or Overexcavations

In soft, weak, or wet soils, tamp refill material to consolidate to density of adjacent material in trench wall. In stable soils, compact to 90 percent of ASTM D 1557 maximum density.

3.6.2 Compaction of Pipe and Conduit Bedding

In rock, compact to 95 percent ASTM D 1557 maximum density.

3.6.3 Compaction of Backfill

Compact initial backfill material surrounding pipes, cables, conduits, or ducts, to 95 percent of ASTM D 1557 maximum density except where bedding and backfill are the same material. Where bedding and backfill are the same material, compact initial backfill to the density of the bedding. Under areas to be seeded or sodded, compact succeeding layers of final backfill to 85 percent of ASTM D 1557 maximum density. For utilities under structures and pavements compact succeeding layers of final backfill.

3.7 SPECIAL EARTHWORK INSTALLATION REQUIREMENTS

3.7.1 Manholes and Other Appurtenances

Provide at least 12 inches clear from outer surfaces to the embankment or shoring. Remove rock as specified herein. Remove unstable soil that is incapable of supporting the structure to an overdepth of one foot and refill with gravel to the proper elevation. Refill overdepths with gravel to the required grade and compact to 95 percent of ASTM D 1557 maximum density.

3.8 FINISH OPERATIONS

3.8.1 Grading

Finish to grades indicated within one-tenth of a foot. Provide sod or topsoil in areas to be seeded. Grade areas to drain water away from structures and to provide suitable surfaces for mowing

machines. Grade existing grades that are to remain but have been disturbed by the Contractor's operations.

3.8.2 Spreading Topsoil

Clear areas to receive topsoil for the finished surface of materials that would interfere with planting and maintenance operations. Scarify subgrade to a depth of 2 inches. Do not place topsoil when the subgrade is frozen, extremely wet or dry, or in other conditions detrimental to seeding, planting, or grading.

3.8.3 Disposition of Surplus Material

Surplus or other soil material not required or suitable for filling, backfilling, or grading shall be removed from Government property. Comply with requirements of Section 01560, " Environmental Protection".

3.8.4 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.8.5 Pavement Repair

Repair pavement, curbs, and gutters as indicated. Do not repair pavement until trench or pit has been backfilled and compacted as specified herein. Provide a temporary road surface of gravel over backfilled portion until permanent pavement is repaired. Remove and dispose of temporary road surface material when permanent pavement is placed. As a minimum, maintain one-way traffic on roads and streets crossed by trenches. Fully open roads and streets to traffic within 5 days.

3.9 FIELD QUALITY CONTROL

Test sand, gravel, bedding, backfill, for conformance to specified requirements. Test backfill to be used under roads and paved areas for conformance to special requirements. Test bedding and backfill for moisture-density relations in accordance with ASTM D 1557 and ASTM D 4253 as specified herein. Perform at least one of each of the required tests for each material provided. Perform sufficiently in advance of construction so as not to delay work. Provide additional tests as specified above for each change of source. Perform final tests on topsoil to ensure adjustment of parameters into the ranges specified. Perform density and moisture tests in randomly selected locations and in accordance with ASTM D 1556, ASTM D 2922 and ASTM D 3017 as follows:

a. Bedding and backfill in trenches: One test per 50 linear feet in each lift.

END OF SECTION

SECTION 02220

BUILDING DEMOLITION

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6	Safety Requirements for Demolition Operations

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline K	Containers for Recovered Fluorocarbon Refrigerants

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61-SUBPART	National Emission Standard for Asbestos
40 CFR 82	Protection of Stratospheric Ozone; Refrigerant Recycling

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Selective demolition and removal of structures.
2. Disconnecting, capping or sealing, and abandoning site utilities in place.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

B. Historical items indicated remain the Owner's property. Carefully remove and salvage each item in a manner to prevent damage and deliver promptly to the Owner.

C. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered during demolition, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1. Coordinate with Owner's archaeologist or historical adviser.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

1.5.1 Product Data

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with EM 385-1-1.

A. Proposed dust-control measures.

B. Proposed noise-control measures.

C. Schedule of demolition activities indicating the following:

1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
2. Dates for shutoff, capping, and continuation of utility services.

D. Inventory of items to be removed and salvaged.

E. Inventory of items to be removed by Owner.

F. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.8 PROTECTION

1.8.1 Existing Work

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have approval by the authority having jurisdiction.

1.8.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent displacement.

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the authority having jurisdiction.

1.10 PROJECT CONDITIONS

Buildings to be demolished will be vacated and their use discontinued before start of Work.

1.10.1 Asbestos

It is not expected that asbestos will be encountered in the course of this Contract. If any materials suspected of containing asbestos are encountered, do not disturb the materials. Immediately notify the Architect and the Owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that utilities have been disconnected and capped. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged. Survey the condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.

a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving structures to be demolished. Arrange to shut off indicated utilities with utility companies.

3.3 PREPARATION

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.

B. Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during demolition operations.

C. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

E. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of buildings to be demolished and adjacent buildings to remain.

1. Strengthen or add new supports when required during progress of demolition.

3.4 EXPLOSIVES

A. Explosives: Use of explosives will not be permitted.

3.5 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not create hazardous or objectionable conditions, such as ice, flooding, and pollution, when using water.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

3.6 DEMOLITION

A. Building Demolition: Demolish buildings as indicated in the drawings and remove from the site. Use methods required to complete Work within limitations of governing regulations and as follows:

1. Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
2. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
3. Demolish concrete and masonry in small sections.
4. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
5. Break up and remove concrete slabs on grade, unless otherwise shown to remain.
6. Remove air-conditioning equipment without releasing refrigerants and surrender to Owner.

B. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

3.7 SALVAGED MATERIALS AND EQUIPMENT

Remove materials indicated to be removed by the Contractor and that are to remain the property of the Owner, and deliver to a storage site as determined by the Owner.

Historical items not deemed salvageable or reusable shall be removed in a manner to prevent damage. The following historical items shall be delivered to the Owner for disposition: Ifit doors, framing, deck flooring.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Burning: Burning of demolished materials will be permitted only at designated areas on Owner's property, providing required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 02220

SECTION 02315

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, abbreviated as percent laboratory maximum density.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Test Reports

a. Testing

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, and stones larger than 3” inches. The Contracting Officer shall be notified of any contaminated materials.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic.

2.1.4 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 25 when tested in accordance with ASTM D 4318.

2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 1-1/2 inches and no more than 2 percent by weight shall pass the No. 4 size sieve.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

The areas within lines 5 feet outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph 3.11, FILLING AND BACKFILLING. Materials removed shall be disposed of in the designated waste disposal areas.

3.2 TOPSOIL

Topsoil shall be stripped to a depth of 12 inches below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified, and shall include trenching for utility and foundation drainage systems to a point 1.5 m 5 feet beyond the building line of each building and structure, excavation for all work incidental thereof. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be replaced with satisfactory material. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced, at no additional cost to the Government, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph 3.11, FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.4.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.

3.5 CLASSIFICATION OF EXCAVATION

Rock excavation shall consist of the removal and disposal of boulders 0.75 cubic meter 1 cubic yard or more in volume; solid rock; materials that cannot be removed without systematic drilling and blasting such as rock material in ledges or aggregate conglomerate deposits that are so firmly cemented as to possess the characteristics of solid rock; and concrete or masonry structures exceeding 1 cubic yard in volume, except sidewalks and paving. Hard and compact materials such as cemented gravel, glacial till, and relatively soft or disintegrated rock that can be removed without continuous and systematic drilling and blasting will not be considered as

rock excavation. Rock excavation will not be considered as such because of intermittent drilling and blasting that is performed merely to increase production. Excavation of the material claimed as rock shall not be performed until the material has been cross sectioned by the Contractor and approved by the Contracting Officer. Common excavation shall consist of all excavation not classified as rock excavation.

3.6 BLASTING

Blasting will not be permitted.

3.7 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 6 inches below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph 3.11, FILLING AND BACKFILLING.

3.8 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property.

3.9 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

3.10 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 12 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 12 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph 3.11, FILLING AND BACKFILLING.

3.11 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm 8 inches in loose thickness, or 150 mm 6 inches when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Backfill shall not be placed in wet areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm 2 feet above sewer lines and 300 mm 1 foot above other utility lines shall be free from stones larger than 25 mm 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 100 mm 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
Fill, embankment, and backfill		
Under structures, building slabs, steps, paved areas, around footings, and in trenches	95	95
Under sidewalks and grassed areas	95	95

3.12 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

3.12.1 In-Place Densities

In-place density and moisture content test results shall be included with the Contractor's daily construction quality control reports.

3.12.1.1 In-Place Density of Subgrades

One test per 2000 square foot or fraction thereof.

3.12.1.2 In-Place Density of Fills and Backfills

One test per 2000 square foot or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than 5 feet in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 100 square feet, or one test for each 50 linear foot of long narrow fills.

3.12.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

3.12.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material, including borrow material to determine the optimum moisture and laboratory maximum density values.

3.13 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.14 GRADING

Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.15 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 2 inches by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 100 to 160 pounds per linear foot of roller. Topsoil shall not be placed when the subgrade is excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.16 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

END OF SECTION 02315

SECTION 02361

SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.1.1 Product Data

a. Pesticide name
b. Pesticide Company name
c. Pesticide Applicator name/Applicator's current license number

1.1.2 Instructions

Submit a copy of manufacturer's label and Material Safety Data Sheet (MSDS)sufficiently in advance of work so as not to delay work.

1.1.3 Statements

Submit data as required in paragraph 1.2 entitled "Qualifications of Pesticide Applicators," prior to commencement of work.

1.1.4 Certification

Provide certification that the pesticide is approved for use on Guam, the area of application and target pest to the AAFB construction QAE.

1.1.5 Records

Submit documents signed by an officer of the Contractor.

a. Application Report

Upon completion of this work, submit application report identifying brand name and manufacturer of pesticide, dilution, and method and rate of application used.

1.2 QUALIFICATIONS OF PESTICIDE APPLICATORS

The pesticide applicator's principal business shall be pest control and the pesticide applicator shall be State certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control, and certified in the State of operation.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver pesticides to the project site in sealed and labeled containers in good condition as supplied by the manufacturer or formulator. Store, handle, and use pesticides in accordance with manufacturer's labels. Labels shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended or appropriate regulations of the host county.

1.4 SAFETY REQUIREMENTS

Formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Draw water for formulating only from sites designated by the Contracting Officer, and fit the filling hose with a backflow preventer meeting local plumbing codes or standards. The filling operation shall be under the direct and continuous observation of a contractor's representative to prevent overflow. Secure pesticides and related materials under lock and key when unattended. Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide application. Dispose of used pesticide containers off Government property.

PART 2 PRODUCTS

2.1 PESTICIDES

Termiticides bearing current registration by the EPA or approved for such use by the appropriate agency of the host country. Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on contractor's licensing, certification, and record keeping. Contact Owner prior to starting work.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

At the time of application, the soil shall have a sufficiently low moisture content to allow uniform distribution of the treatment solution throughout the soil. Do not make applications during or immediately following heavy rains or when conditions may cause runoff and create an environmental hazard.

3.2 APPLICATION

3.2.1 Treatment Area

Apply termiticide to soil material which will be covered by or lie immediately adjacent to the buildings and structures so as to provide a protective barrier against subterranean termites.

a. Under existing slabs-on-grade.

b. Both sides of Foundation surface.

c. Soil within four feet of building perimeter for a depth of one foot.

3.2.2 Treatment Application

Apply termiticide as a coarse spray and in such manner as to provide uniform distribution onto the soil surface. Apply treatment prior to placement of a vapor barrier or waterproof membrane and prior to concrete pouring. Where treated soil or fill material is not to be covered with a vapor barrier or waterproof membrane, exercise adequate precautions to prevent its disturbance. If soil or fill material has been disturbed after treatment, retreat as specified above before placement of slabs or other covering structures. Coordinate treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures with final grading and planting operations so as to avoid disturbance of the treated barriers by such operations. Observe manufacturer's warnings and precautions in the handling and use of such materials. Exercise precaution that these chemicals do not enter water supply systems or potable water supplies or aquifers, and that they do not endanger plants and

animals as well. Notify the Trust Representative at least 48 hours prior to beginning of treatment and perform formulating, mixing, and application in the presence of the representative.

3.2.3 Rates and Methods of Application

Apply in accordance with the pesticide label. Provide maximum application or dosage rates. Resolve conflict between this specification and label direction in favor of the label.

END OF SECTION 02361

SECTION 02510

WATER DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASME/ANSI B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 61	Steam or Valve Bronze Castings
ASTM B 62	Composition Bronze or Ounce Metal Castings
ASTM D 1785	Polyvinyl Chloride (PVC) Plastic Pipe, Schedule 40, 80, and 120
ASTM D 2774	Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM F 402	Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C651	Disinfecting Water Mains
AWWA C800	Underground Service Line Valves and Fittings

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	Bronze Gate, Globe, Angle and Check Valves

1.2 DESIGN REQUIREMENTS

1.2.1 Water Service Lines

Provide water service lines indicated as 1 inch lines from water distribution main to building service at a point approximately 5 feet from building the points indicated. Water service lines

shall be polyvinyl chloride (PVC) plastic pipe pipe. Provide water service line appurtenances as specified and where indicated.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.3.1 Product Data

a. Piping Materials

b. Water service line piping, fittings, joints, valves, and coupling

c. Corporation stops

d. Valve boxes

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

1.3.2 Certificates

a. Water service line piping, fittings, joints, valves, and coupling

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.3.3 Manufacturer's Instructions

a. Installation procedures for water piping

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry, do not drag pipe to the trench. Store plastic piping, jointing materials and rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

PART 2 PRODUCTS

2.1 WATER SERVICE LINE MATERIALS

2.1.1 Piping Materials

2.1.1.1 Polyvinyl Chloride (PVC) Plastic Piping

Provide polyvinyl chloride (PVC) pressure piping conforming to ASTM 1785 and associated fittings.

2.1.2 Water Service Line Appurtenances

2.1.2.1 Corporation Stops

Ground key type; bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME/ANSI B16.26.

2.1.2.2 Curb or Service Stops

Ground key, round way, inverted key type; made of bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow.

2.1.2.3 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Where multiple gooseneck connections are required for an individual service, goosenecks shall be connected to the service line through a suitable approved brass or bronze branch connection; the total clear area of the branches shall be at least equal to the clear area of the service line. Length of goosenecks shall be in accordance with standard practice.

2.1.2.4 Gate Valves on Buried Piping

Gate valves smaller than 80 mm 3 inch size on Buried Piping MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators.

2.1.2.5 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 135 mm 5 1/4 inches as indicated. Cast-iron box shall have a heavy coat of bituminous paint.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirem0ents shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Excavation and Backfill

Perform excavation and backfill operations in accordance with Section 02302, Excavation, Backfilling, and Compacting for Utilities.

3.1.2 Installation of Water Service Piping

3.1.2.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 1.5 m 5 feet from the building line at the points indicated**;** such water service lines shall be closed with plugs or caps.

3.1.3 Special Requirements for Installation of Water Service Piping

3.1.3.1 Installation of Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

a. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D 2855. Make solvent-cemented joints for ABS plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with the recommendations of the pipe manufacturer, as approved. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

b. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.1.4 Disinfection

Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Testing Procedure

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements."

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 375 kPa 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 50 mm 2 inches in diameter, hydrostatic test pressure shall be not less than 1400 kPa 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

END OF SECTION 02510

SECTION 02515

UNIT PAVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Brick pavers set in aggregate setting bed.
2. Concrete pavers set in aggregate setting bed.
3. Brick pavers set in mortar setting bed.
4. Edge restraints for unit pavers.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for the following:

1. Brick pavers.
2. Concrete pavers.
3. Mortar and grout materials.
4. Edge restraints.

C. Samples for initial selection in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of unit paver indicated.

1. Include similar samples of material for joints and accessories involving color selection.

D. Samples for verification in full-size units of each type of unit paver indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. Provide samples with joints grouted and cured, indicating full range of colors to be expected in the completed Work.
2. Include samples of exposed edge restraints.

E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Compatibility and adhesion test reports from latex additive manufacturer indicating that mortar and grout containing latex additives have been tested with pavers for compatibility and adhesion. Include latex additive manufacturer's interpretation of test results relative to mortar and grout performance and recommendations for installation practices needed to obtain adhesion.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Single-Source Responsibility: Obtain each color, type, and variety of unit pavers, joint materials, and setting materials from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying the Work.

C. Preconstruction Compatibility and Adhesion Testing: Submit samples of paving materials contacting or affecting mortar and grout that contain latex additives to latex additive manufacturer for compatibility and adhesion testing as indicated below.

1. Use test methods standard with manufacturer to determine if mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting the paver installation.
2. Submit sufficient number of pavers and other materials involved in installation to allow comprehensive testing.
3. Schedule sufficient time for testing and analysis of results to prevent delaying the Work.
4. Investigate materials failing compatibility or adhesion tests and obtain mortar and grout manufacturer's written recommendations for the use of materials to obtain optimum bond and prevent staining.

D. Mockup: Prior to installing unit pavers, construct mockups for each form and pattern of unit pavers required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work, including same base construction, special features for expansion joints, and contiguous work as indicated.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's acceptance of mockups before start of final unit of Work.
5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

    a. When directed, demolish and remove mockups from Project site.
    b. Accepted mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect unit pavers and aggregate during storage and construction against soilage or contamination from earth and other materials.

1. Wrap pavers in plastic or use other packaging materials that will prevent rust marks from steel strapping.

B. Protect grout and mortar materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed. Protect liquid components from freezing.

1.6 PROJECT CONDITIONS

A. Weather Limitations for Mortar and Grout: Comply with the following requirements:

1. Hot-Weather Requirements: Protect unit paver work when temperature and humidity conditions produce excessive evaporation of setting beds and grout. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brick Pavers:

a. Belden Brick Co.
b. Boral Bricks, Inc.
c. Endicott Clay Products Co.

2. Concrete Pavers:

a. Pavestone Co.
b. Sunny Brook Pressed Concrete Co.
c. Wassau Tile, Inc.; Terra-Paving Div.

7. Aluminum Edge Restraints:

a. BrickStop Corporation.
b. Permaloc Corporation.

8. Latex-Portland Cement Mortars and Grouts:

a. American Olean Tile Co.
b. Custom Building Products.
c. Mapei Corp.
d. Summitville Tiles, Inc.

2.2 COLORS AND TEXTURES

A. Provide materials and products that result in colors and textures of exposed unit paver surfaces and joints complying with the following requirements:

1. Match Architect's samples.
2. Match color and texture indicated by referencing manufacturer's standard designations for these characteristics.
3. Provide Architect's selections from manufacturer's full range of colors and textures for materials and products of type indicated.

2.3 UNIT PAVERS

A. Brick Pavers: Light-traffic paving brick; solid (uncored), unfrogged brick of sizes indicated, complying with ASTM C 902 and the following:

1. Weather Class: SX.
2. Weather Class: MX.
3. Traffic Type: I.
4. Traffic Type: II.
5. Traffic Type: III.
6. Application: PS.
7. Application: PX.
8. Application: PA.
9. Temporary Protective Coating: Precoat exposed surfaces of brick pavers with a continuous film of a temporary protective coating that is compatible with brick and mortar/grout products and can be removed without damaging grout or brick. Do not coat unexposed brick surfaces; handle brick to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces prior to setting brick.

B. Concrete Pavers: Solid, interlocking paving units, ASTM C 936, made from normal-weight aggregates in sizes and shapes indicated.

2.4 ACCESSORIES

A. Aluminum Edge Restraints: Extruded-aluminum edging with loops pressed from face of section at 12 inches (300 mm) o.c., and aluminum stakes 12 inches (300 mm) long for each loop. Type and size of edging as follows:

1. Straight, 3/16 by 4 inches (4.8 by 100 mm).
2. L-shaped, 3/16 by 2-1/4 inches (4.8 by 57 mm).

B. Concrete for Job-Built Edge Restraints: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Subbase: Washed gravel or washed crushed stone complying with ASTM C 33 for Size No. 57.

B. Graded Aggregate for Subbase: Quality-controlled, graded aggregate complying with ASTM D 2940 for subbase material.

C. Graded Aggregate for Base: Washed gravel or washed crushed stone complying with ASTM C 33 for Size No. 8 for coarse aggregate.

D. Graded Aggregate for Base: Quality-controlled, graded, washed gravel complying with ASTM D 2940 for base material.

E. Geotextile: Woven or nonwoven geotextile manufactured from polyester or polypropylene fibers, with a permeability rating 10 times greater than that of soil on which paving is founded and an AOS (apparent opening size) small enough to prevent passage of fines from leveling course into graded aggregate of base course below.

F. Sand for Leveling Course: Fine, sharp, nonplastic aggregate complying with ASTM C 33.

G. Sand for Joints: Fine, sharp, masonry sand with 100 percent passing the No. 16 (1.18 mm) sieve and no more than 10 percent passing the No. 200 (0.075 mm) sieve.

2.6 PORTLAND CEMENT MORTAR SETTING-BED MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Hydrated Lime: ASTM C 207, Type S.

C. Aggregate: ASTM C 144 with a fineness module of 2.25, plus or minus 0.10.

D. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate and not containing a retarder.

1. Latex Additive: Styrene butadiene rubber.
2. Latex Additive: Acrylic resin.

E. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter (50.8 by 50.8 mm by 1.6-mm diameter); comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

F. Water: Potable.

2.7 GROUT MATERIALS

A. Latex-Portland Cement Grout: ANSI A118.6, composition as follows:

1. Packaged, dry grout mix composed of portland cement, graded aggregate, and ethylene vinyl acetate in the form of a reemulsifiable powder to which only water is added at Project site.
2. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, combined at Project site with dry grout mixture, with latex and dry grout mixture as follows:

    a. Latex Additive: Styrene butadiene rubber.
    b. Latex Additive: Acrylic resin.
    c. Dry Grout Mixture: Factory-mixed, sanded grout complying with ANSI A118.6 and recommended by latex manufacturer, in color indicated. Use latex additive without retarder with dry-set grout.
    d. Dry Grout Mixture: As follows, for combining with latex additive (water emulsion).

1) Portland Cement: ASTM C 150, Type I or II, of natural color or white as required to produce color indicated.
2) Aggregate: ASTM C 144, graded to comply with latex additive manufacturer's requirements.

a) White Aggregate: Natural white sand or ground white stone.
b) Colored Aggregate: Ground marble, granite, or other sound stone; selected as required to produce mortar color matching Architect's sample.
c) Colored Mortar Pigments for Grout: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar and grout mixes. Use only pigments that have proved through testing and experience to be satisfactory for use in portland cement grout.

B. Water: Potable.

2.8 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' instructions relative to mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout when they have reached their initial set.

B. Cement-Paste Slush Coat: Mix slush coat to a consistency similar to that of thick cream and consisting of either neat cement and water or cement, sand, and water.

1. For latex-modified portland cement setting-bed mortar, substitute latex admixture for part or all of water per directions of latex additive manufacturer.

C. Portland Cement/Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.

D. Latex-Modified Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, aggregate, and latex additive for setting bed to comply with directions of latex additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.

E. Latex-Modified Portland Cement Slurry Bond Coat: Proportion and mix portland cement, aggregate, and latex additive for slurry bond coat to comply with directions of latex additive manufacturer.

F. Latex-Modified Portland Cement Grout: Add latex additive to dry grout mix in proportion and concentration recommended by latex additive manufacturer.

1. Job-Mixed, Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight. Proportion cement and aggregate to comply with directions of latex additive manufacturer.
2. Job-Mixed, Colored-Aggregate Grout: Produce color required by combining colored aggregates with portland cement of selected color. Proportion cement and aggregate to comply with directions of latex additive manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit pavers. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces as well as horizontal waterproofing. Do not proceed with installation until protection is in place.

3.2 PREPARATION

A. Vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

C. Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Do not proceed with installation of unit pavers until deficient subgrades have been corrected and are ready to receive subbase for unit pavers.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

1. For concrete pavers, a block splitter may be used.

D. Joint Pattern: As indicated.

E. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.

1. Provide cork joint filler, where indicated, at waterproofing that is turned up on vertical surfaces; or if not indicated, provide temporary filler or protection until paver installation is complete.

F. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

G. Tolerances: Do not exceed 1/16-inch (1.5-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

H. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide cork joint filler as backing for sealant-filled joints where indicated. Install cork joint filler before setting pavers. Sealant materials and installation are specified in Division 7 Section "Joint Sealants."

1. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar first. Cut off mortar setting bed at a steep angle so that it will not interfere with aggregate setting bed.

3.4 AGGREGATE SETTING-BED PAVER APPLICATIONS

A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 1557 laboratory density.

B. Place geotextile over prepared subgrade overlapping ends and edges at least 12 inches (300 mm).

C. Place aggregate base and subbase in thicknesses indicated. Compact by tamping with plate vibrator and screed to depth required to allow setting of pavers.

D. Place graded aggregate for subbase and base over compacted subgrade. Provide compacted thickness of base and subbase indicated. Compact subbase and base to 100 percent of ASTM D 1557 maximum laboratory density.

E. Place geotextile over compacted base course overlapping ends and edges at least 12 inches (300 mm).

F. Place sand for leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

G. Treat leveling base with soil sterilizer to prohibit growth of grass and weeds.

H. Set pavers with a minimum joint width of 1/16 inch (1.5 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.

1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.

I. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Perform at least 3 passes across paving with vibrator. Vibrate under the following conditions:

1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
2. Before ending each day's work, fully compact installed concrete pavers within 36 inches (900 mm) of the laying face. Cover the open layers with nonstaining plastic sheets overlapped 48 inches (1200 mm) on each side of the laying face to protect it from rain.

J. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

K. Do not allow traffic on installed pavers until sand has been vibrated into joints.

L. Repeat joint-filling process 30 days later.

3.6 MORTARED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply cement-paste slush coat over surface of concrete subbase about 15 minutes prior to placing setting bed. Limit area of slush coat to avoid its drying out prior to placing setting bed. Do not exceed 1/16-inch (1.6-mm) thickness for cement slush coat.

C. Apply mortar setting bed over cement-paste slush coat immediately after latter has been applied. Spread and screed setting bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

D. Mix and place only that amount of mortar setting bed that can be covered with pavers prior to initial set. Cut back, bevel edge, remove, and discard setting-bed material that has reached initial set prior to placing pavers.

1. Place reinforcing wire fabric over membrane protection course, lapped at joints by at least one full mesh and supported so that the mesh becomes embedded in the middle of setting bed. Do not butt edges against vertical surfaces.

E. Wet brick pavers prior to laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb the water so that they are damp but not wet at the time of laying.

F. Place pavers before initial set of cement occurs. Immediately prior to placing pavers on green or wet setting bed, apply uniform 1/16-inch- (1.5-mm-) thick slurry bond coat to bed or to back of each paver with a flat trowel.

G. Tamp and beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation prior to initial set of mortar; do not return to areas already set and disturb pavers for purposes of realigning finished surfaces or adjusting joints.

H. Spaced Joint Widths: Provide nominal joint width of 3/8 inch (10 mm) with variations not exceeding plus or minus 1/16 inch (1.5 mm).

I. Spaced Joint Widths: Provide nominal joint width indicated with variations not exceeding plus or minus 1/8 inch (3 mm).

J. Grout joints as soon as possible after initial set of setting bed. Force grout into joints, taking care not to smear grout on adjoining pavers and other surfaces. After initial set of grout, finish joints by tooling to produce a slightly concave polished joint, free from drying cracks.

K. Cure grout by maintaining in a damp condition for 7 days except as otherwise recommended by latex additive manufacturer.

3.7 REPAIR, POINTING, CLEANING, AND PROTECTION

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with mortar or grout. Point-up joints at sealant joints to provide a neat, uniform appearance, properly prepared for application of sealant.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

1. Remove protective coating as recommended by protective coating manufacturer and acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

D. Provide final protection and maintain conditions in a manner acceptable to Installer that ensures that unit paver work is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 02515

SECTION 02530

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150	Portland Cement
ASTM C 478/478M	Precast Reinforced Concrete Manhole Sections
ASTM C 923/923M	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 969/969M	Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 990/990M	Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealers
ASTM D 1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D 2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 3034	Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 949	Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide 4 inch lines of polyvinyl chloride (PVC) plastic pipe. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 1.5 m 5 feet outside of building walls.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 1.5 m 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02302, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES. Before, during**,** and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life is exceeded.

1.4.1 Product Data

Pipeline materials including joints, fittings, and couplings Submit manufacturer's standard drawings or catalog cuts.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03300, "Cast-In-Place Concrete."

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 PVC Plastic Gravity Sewer Piping

2.1.1.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, or ASTM F 949 with ends suitable for elastomeric gasket joints.

2.1.1.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

2.1.2.1 PVC Plastic Pressure Pipe and Fittings

a. Pipe and Fitting Less than 100 mm 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454B.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443M ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923M ASTM C 923 or ASTM C 990M ASTM C 990.

2.2.2 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Proplene Di Monomer (EPDM) rubber with a minimum thickness of 1.5 mm 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and valves are listed in the following tables:

Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic
Tensile, psi	ASTM D 412	1840	2195	-
Elogation percent	ASTM D 412	553	295	350
Tear Resistance, ppi (Die B)	ASTM D 624	280	160	-

2.2.3 Metal Items

2.2.3.1 Frames, Covers, and Gratings for Manholes

FS A-A-60005, cast iron; figure numbers shall be as follows:

a. Traffic manhole: Provide in paved areas.

Frame: Figure 1, Size 22A
Cover: Figure 8, Size 22A
Steps: Figure 19

b. Non-traffic manhole:

Frame: Figure 4, Size 22
Cover: Figure 12, Size 22
Steps: Figure 19

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 181.4 kg (400 pounds). 400 pounds. Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

Apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 1.5 m 5 feet from the building . Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 3 m 10 feet to a water main or service line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 3 m 10 feet on each side of the crossing, or substitute rubber-gasketed pressure

pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 0.9 m 3 feet, horizontal distance, to the water line.

a. Sanitary piping installation parallel with water line:

(1) Normal conditions: Sanitary piping or manholes shall be laid at least 3 m 10 feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.

(2) Unusual conditions: When local conditions prevent a horizontal separation of 3 m 10 feet, the sanitary piping or manhole may be laid closer to a water line provided that:

(a) The top (crown) of the sanitary piping shall be at least 450 mm 18 inches below the bottom (invert) of the water main.

(b) Where this vertical separation cannot be obtained, the sanitary piping shall be constructed of AWWA-approved ductile iron water pipe pressure tested in place without leakage prior to backfilling.

(c) The sewer manhole shall be of watertight construction and tested in place.

b. Installation of sanitary piping crossing a water line:

(1) Normal conditions: Lay sanitary piping crossing water lines to provide a separation of at least 450 mm 18 inches between the top of the sanitary piping and the bottom of the water line whenever possible.

(2) Unusual conditions: When local conditions prevent a vertical separation described above, use the following construction:

a. Sanitary piping passing over or under water lines shall be constructed of AWWA-approved ductile iron water pipe, pressure tested in place without leakage prior to backfilling.

b. Sanitary piping passing over water lines shall, in addition, be protected by providing:

1. A vertical separation of at least 450 mm 18 inches between the bottom of the sanitary piping and the top of the water line.

2. Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.

3. That the length, minimum 6.1 m 20 feet, of the sanitary piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the water line.

c. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Excavation and Backfill

Perform excavation and backfill operations in accordance with Section 02302, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 7.50 m 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03300, "Cast-In-Place Concrete." The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.4 Miscellaneous Construction and Installation

3.1.4.1 Metal Work

a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C 969M ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969M ASTM C 969.

b. Low-pressure air tests: Perform tests as follows:

(1) PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D 2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device. a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.

a. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements

specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

(1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

(2) Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 4 degrees C 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.

(3) Center bored and through-bolted with a 6 mm 1/4 inch minimum diameter steel shaft having a yield strength of not less than 483 MPa 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.

(4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.

c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

END OF SECTION 02530

SECTION 02722

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES:

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

American Society For Testing And Materials (ASTM)

ASTM C 29/C 29M	Bulk Density ("Unit Weight') and Voids in Aggregates
ASTM C 127	Specific Gravity and Absorption of Fine Aggregate
ASTM C 128	Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	Resistance to Degration of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	Sampling Aggregates
ASTM D 422	Particle-Size Analysis of Soils
ASTM D 1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-1bf/cu. ft. (2,700 kN-m.cu.m.)
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	Wire-Cloth Sieves for Testing Purposes

1.2 DEFINITIONS

1.2.1 Aggregate Base

Aggregate base as used herein is well grade, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as percent laboratory maximum density.

1.3 GENERAL

The work specified herein consists of the construction of an aggregate base course. The work shall be performed in accordance with this specification and shall conform to the lines, grade, notes, and typical section shown in the plans. Sources of all materials shall be selected well in advance of the time that materials will be required in the work.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330, Submittal Procedures.

1.4.1 Data

a. List of proposed equipment to be used in performance of construction work including descriptive data.

1.4.2 Design Data

a. Gradation curve

1.4.3 Test Reports

a. Liquid limit
b. Plasticity Index
c. Percentage of wear

1.4.4 Field Test Reports

a. Gradation Tests
b. Density Tests

1.5 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.5.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and have the capability of producing the results specified. Calibrated equipment, such as scales, batching equipment, spreaders, and other similar equipment, shall have been calibrated by a calibration laboratory approved by the Contracting Officer within 12 months of commencing work.

1.6 STOCKPILING MATERIALS

Materials including approved material available from excavation and grading, shall be stockpiled in the manner and at locations designated. Before stockpiling of material, storage

sites shall be cleared, and sloped to drain. Materials obtained from different sources shall be stockpiled separately.

1.7 SAMPLING AND TESTING

1.7.1 Test Results

Results shall verify that materials comply with this specification. When a material source is changed, the new material shall be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

1.7.2 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with ASTM D 75.

1.7.3 Sieve Analysis

Before starting work, at least one sample of material shall be tested in accordance with ASTM C 136 and ASTM D 422 on sieves conforming to ASTM E 11. After the initial test, a minimum of one analysis shall be performed for each 1000 tons of material placed, with a minimum of three analyses for each day's run until the course is completed.

1.7.4 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with ASTM D 4318.

1.7.5 Laboratory Density

Test shall provide a moisture-density relationship for the aggregate. Tests shall be conducted in accordance with ASTM D 1557.

1.7.6 Weight Per Cubic Foot of Slag

Weight per cubic foot of slag shall be determined in accordance with ASTM C 29.

1.7.7 Wear Tests

Wear tests shall be performed in accordance with ASTM C 131.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

Aggregates shall consist of crushed stone, crushed gravel, angular, or other approved material. Aggregates shall be durable and sound, free from lumps of clay, organic matter, objectionable coatings, and other foreign material. Material retained on a No. 4 sieve shall be

known as coarse aggregate and that passing the No. 4 sieve shall be known as binder material.

2.1.1.1 Coarse Aggregate

Only one type of coarse aggregate shall be used on the project. Coarse aggregates, consisting of angular fragments of uniform density and quality, shall have a percentage of wear not to exceed 50 percent after 500 revolution when tested in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3, and an elongated particle is one having a ration of length to width greater than 3.

a. Crushed Gravel

Crushed gravel shall be manufactured from gravel particles 50 percent of which by weight are retained on the maximum size gradation sieve specified.

b. Crushed Stone

Crushed stone retained on each sieve specified shall contain at least 50 percent by weight of crush pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are adjacent, the angle between the planes of the fractures must be at least 30 degrees to count as two fractured faces.

2.1.2 Binder Material

Binder material shall consist of screenings, angular sand, or other finely divided mineral matter processed or naturally combined with the coarse aggregate. Liquid-limit and plasticity-index requirements shall apply to any component that is blended to meet the required gradation and shall also apply to the completed course. The portion of any component or of the completed course passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.1.3 Gradation

Requirements of gradation specified shall apply to the completed base course. The aggregates shall have a 2 inch maximum size and shall be continuously graded within the following limits:

Sieve Designation	Percentage by Weight Passing Square-mesh Sieve (a) (b)
2 inch	100
1- ½ inch	70-100
1 inch	45-80
½ inch	30-60
No. 4	20-50
No. 10	15-40
No. 40	5-25
No. 200	0-10

(a) Particles having diameters less than 0.008 inch shall not be in excess of 3 percent by weight of the total sample tested.

(b) The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves are subject to appropriate correction in accordance with ASTM C 127 and ASTM C 128 when aggregates of varying specific gravities are used.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from off-site sources.

3.3 PREPARATION OF UNDERLYING COURSE

3.3.1 General Requirements

Before constructing aggregate base course, the previously constructed underlying course shall be cleaned of foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances. Ruts or soft, yielding spots that may appear in the underlying course, areas having inadequate compaction, and deviation of the surface from requirements specified shall be corrected. For cohensionless underlying materials containing sands, sand gravels, or any other cohesionless material in harmful quantities, the surface shall be mechanically stabilized with aggregate prior to placement of the aggregate course. Stabilization may be accomplished by mixing base course material into the underlying course and compacting by approved methods. Properly compacted material will be considered as part of the underlying course and shall meet all requirements for the underlying course. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

3.3.2 Grade Control

Underlying material shall be excavated to sufficient depth for the required base course thickness so that the finished base course with the subsequent surface course will meet the fixed grade. Finished and completed area shall conform to the lines, grades, cross section, and dimensions indicated.

3.4 INSTALLATION

3.4.1 Mixing and Placing

Materials shall be mixed and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum water content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to ensure a satisfactory base course.

3.4.2 Edges of Base Course

Approved material shall be placed along edges of aggregate base course in such quantities as will compact to thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least 1 foot width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of base course.

3.4.3 Compaction

Each layer of aggregate base course shall be compacted. Water content shall be maintained at optimum. Density of compacted mixture shall be at least 100 percent of laboratory maximum density. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

3.4.4 Layer Thickness

Compacted thickness of the aggregate course shall be as indicated. No layer shall be in excess of 8 inches nor less than 3 inches in compacted thickness.

3.4.5 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of 30 coverages with a heavy pneumatic-tired roller having four or more ties, each loaded to a minimum of 30,000 pounds and inflated to a minimum of 150 psi. Proof rolling shall be applied to the top lift layer on which base course is laid and to each layer of base course. Water content of the top lift or layer on which base course is laid shall be maintained at optimum or at percentage directed from start of compaction to completion of proof rolling of that layer. Water content of each layer of the base course shall be maintained at the optimum percentage directed from start of compaction to completion of proof rolling. Materials in base course or underlying materials that produce unsatisfactory results by rolling shall be removed and replaced with satisfactory materials and recompacted.

3.4.6 Finishing

The surface of the top layer shall be finished to grade and cross section shown, Finished surface shall be of uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompacted, or replaced as directed.

3.4.6.1 Smoothness

Surface of each layer shall show no deviations in excess of 3/8 inch when tested with the 10 foot straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.4.6.2 Thickness Control

Compacted thickness of the base course shall be within ½ inch of the thickness indicated. Where the measured thickness is more than ½ inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than ½ inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall

be the average of all thickness measurements taken for the job, but shall be within ¼ inch of the thickness indicated.

3.5 FIELD QUALITY CONTROL

3.5.1 Field Density

Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked, and adjusted if necessary, using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil, and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 at least once per lift for each 2000 square yard of base material. Calibration curves and calibration test results shall be furnished within 24 hours of the conclusion of the tests. At least one field density shall be performed for each 500 square yards of each layer of base material.

3.5.2 Smoothness

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline with a 10 foot straightedge. Measurements shall also be taken perpendicular to the road centerline at 50 foot intervals.

3.5.3 Thickness

Thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square yards of base course. Measurements shall be made in 3-inch diameter test holes penetrating the base course.

3.6 TRAFFIC

Completed portions of the area may be opened to traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The aggregate base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall repeated as often as necessary to keep the area intact.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of as directed.

END OF SECTION 02722

SECTION 02770

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615/A 615M	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 31/C 31M	Making and Curing Concrete Test Specimens in the Field
ASTM C 171	Sheet Materials for Curing Concrete
ASTM C 172	Sampling Freshly Mixed Concrete
ASTM C 173	Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 920	Elastomeric Joint Sealants
ASTM D 1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction Nonextruding and Resilient Bituminous Types)
ASTM D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 3405	Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

1.2.1 Product Data

a. Concrete

Copies of certified delivery tickets for all concrete used in the construction.

Submit sufficiently in advance of construction so as not to delay work.

1.2.2 Test Reports

a. Field Quality Control

Copies of all test reports within 24 hours of completion of the test.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 30 degrees C 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 35 degrees C95 degrees F at any time.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.4.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in 1 pass.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of Section 03300, CAST-IN-PLACE CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 3,000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches. Precast concrete curbs shall be of standard local product produced by a manufacturer regularly engaged in the production of such material.

2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C 143.

2.1.3 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615. Wire mesh reinforcement shall conform to ASTM A 185.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 3/8 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

2.5.1 Joint Sealant, Cold-Applied

Joint sealant, cold-applied shall conform to ASTM C 920.

2.5.2 Joint Sealant, Hot-Poured

Joint sealant, hot-poured shall conform to ASTM D 3405.

2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

2.6.2 Curb and Gutter Forms

Unless precast materials are used, curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 3 m 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 38 mm 1-1/2 inch benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted as directed in conformance with Section 02315, Excavation, Filling and Backfilling for Buildings.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 1.2 meters. 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope of 1/4 inch per footwith the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate

the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

3.4.2 Curb and Gutter Finishing

Approved slipformed curb and gutter machines may be used in lieu of hand placement.

3.4.3 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.4 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.5 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

3.5.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.5.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10 degrees C 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.5.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet. Contraction joints shall be constructed by means of 1/8 inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not exceeding 20 feet. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Expansion joints and the top 1 inch depth of curb and gutter contraction-joints shall be sealed with joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be

above 10 degrees C 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.7 CURING AND PROTECTION

3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 6 inches.The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately (200 square feet per gallon) 200 square feet per gallon for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified

curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.7.4 Protective Coating

Protective coating of linseed oil mixture shall be applied to the exposed-to-view concrete surface.

3.7.4.1 Application

Curing and backfilling operation shall be completed prior to applying two coats of protective coating. Concrete shall be surface dry and clean before each application. Coverage shall be by spray application at not more than 50 square yards per gallon) 50 square yards per gallon for first application and not more than (70 square yards per gallon) 70 square yards per gallon for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

3.7.4.2 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at ambient or material temperatures lower than 10 degrees C. 50 degrees F.

3.8 FIELD QUALITY CONTROL

3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

END OF SECTION 02770

SECTION 02924

SEEDING AND SOIL SUPPLEMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Preparation of subsoil.
2. Placing topsoil.
3. Hydroseeding.
4. Mulching.
5. Soil fertilizer.
6. Maintenance.

1.2 REFERENCES

A. ASTM INTERNATIONAL:
1. ASTM C602 – Standard Specification for Agricultural Liming Materials.

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be Established in given area.

1.4 SUBMITTALS

A. Product Data: Submit data for seed mix, fertilizer ,mulch and Other accessories.
B. Test reports: Indicated topsoil nutrient and ph levels with Recommended soil suppliments and application rates.
C. Manufacturer's Certificate: Certify Products meet or exceed Specified requirements.

1.5 CLOSEOUT SUBMITALS

A. Section 01700 – Execution Requirements: Requirements for submittals
B. Operation and Maintenace Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURACE

A. Provide seed mxture in containers showing percentage of seed mix, germination percentage, inert matter percentage, eed percentage, year of production, net weight, date of packaging, and location of packaging.
B. Perform Work in accordace with pulic Work's standard.
C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years documented experience
B. Installer: Company specializing in performing work of this section with minimum 2 years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600-Product Requirements: Product storage and handling requirements.
B. Deliver grass mixture in sealed containers. Seed in damaged packaging is not acceptable.
C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 MAINTENANCE SERVICE

A. Maintain seeded areas for three months from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials in according with Public work's standards.
B. Seed Mixture:
   1. Cynodon dactylon, common Bermuda: 100 percent

2.2 SOILS MATERIALS

A. Topsoil: Fertilizer, agricultural soil, typical for locality, capable of sustaining vigorous plant 100% growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.
B. Topsoil: Excavated from site and free of weeds.

2.3 ACCESSORIES

A. Mulching Material: wood cellulose fiber, chip form, free of growth or germination inhibiting ingredients.
B. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: Nitrogen 5 percent, phosphoric acid 3 percent, soluble potash 1 percent for organic, granular fertilizer; Nitrogen 10 percent, phosphoric acid 30 percent, soluble potash 10 percent for controlled release fertilizer. .
C. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.
D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.
E. Erosion Fabric: Jute matting, open weave.

2.4 SOURCE QUALITY CONTROL

A. Section 01400-Quality Requirements: Testing, inspection and analysis requirements.
B. Analyze to certain percentage of nitrogen, phosphorus, potash, soluble salt contant, organic matter content, and pH value.
C. Provide recommendation for fertilizer and lime application rates for specified seed mix as

result of testing.

D. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300-Administrative Requirements: Verification of existing conditions before starting work.
B. Verify prepared soil base is read to receive the Work of this section.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
B. Remove foreign materials, weeds ad undesirable plants and their roots. Remove contaminated sub-soil.
C. Scarify subsoil to depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 6 inches over area to be seeded. Rake until Smooth.
B. Place topsoil during dry weather and on dry subgrade.
C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.4 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.
B. Apply fertilizer at application rate recommended by soil analysis.
C. Apply after smooth raking of topsoil.
D. Do not apply fertilizer at same time or with same machine used to apply seed.
E. Mix fertilizer thoroughly into upper 2 inches of topsoil.
F. ightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.5 HYDROSEEDING

A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at rate of 25 lbs per 1000sq. ft. evenly in one pass.
B. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.6 SEED PROTECTION

A. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.
C. Secure outside edges and overlaps at 36 inch intervals with stakes.
D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.7 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2 ½ iches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing whe seedlings are 40 percent higher than desired height.
B. Neatly trim edges and hand clip where necessary.
C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.
D. Water to prevent grass and soil from drying out.
E. Roll surface to remove minor depressions or irregularities.
F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.
G. Immediately reseed areas showing bare spots.
H. Repair washouts or gullies.
I. Protect seeded areas with warning signs during maintenance period.

3.8 SCHEDULE

A. Front and Rear Seeded Areas: Grass seed mixture specified, 3 inch top soil.

END OF SECTION 02924

SECTION 02930

EXTERIOR PLANTS

1.1 SUMMARY

A. Section includes:
1. Preparation of subsoil and topsoil.
2. Topsoil bedding.
3. Trees ad Groundcover.
4. Mulching.
5. Soil fertilizer.
6. Maintenance.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A300 – Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance-Standard Practices.
2. ANSI Z60.1 – Nursery Stock.

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.
B. Plants: Living trees, plants, and ground cover specified in this Section.

1.4 SUBMITTALS

A. Product Data: Submit list of plant material sources, data for fertilizer and other accessories.

1.6 QUALITY ASSURACE

A. Provide Work in accordance with Public Work's standard.
B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Nursery: Company specializing I growing and cultivating plants with three years documented experience.
B. Installer: Company specializing in installing and planting with minimum 2 years documented experience.
C. Maintenance Services: Performed by installer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
B. Protect and maintain plant life until planted.
C. Deliver plant life materials immediately prior to placement Keep plants moist.
D. Plant material damaged as a result of delivery, storage or handling will be rejected.

1.10 ENIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may rise above 90 degrees F.
B. Do not install plant life when wind velocity exceeds 30 mph.

1.12 WARRANTY

A. Furnish one-year manufacturer warranty for trees, plants, and ground cover.

. 1.13 MAINTENANCE SERVICE

A. Maintain plat life for three months after Date of Substantial Completion.
B. Maintain plant life immediately after placement. Continue maintenance until termination of warranty period.
C. Maintenance includes:
   1. Cultivation and weeding plant beds and tree pits.
   2. Applying herbicides for weed control. Remedy damage resulting from use of herbicides.
   3. Remedy damage from use of insecticides.
   4. Irrigating sufficient to saturate root system.
   5. Pruning, including removal of dead or broken branches.
   6. Disease control.
   7. Maintaining wrapping, guys, and stakes Repair or replace accessories when required.
   8. Replacemet of mulch.

PART 2 PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

A. Planting Stock:
   1. Species: In accordance with Standardized Plant Names, official code of American Joint Committee on Horticulture Nomenclature.
   2. Identification: Label individual plants or each bundle of plants when tied in bundles.
   3. Plants: No. 1 Grade conforming to “American Standard for Nursery Stock” of American Association of Nurserymen (AAN); well-branched, vigorous and balanced root and top growth; free from disease, injurious insects, mechanical wounds, broke braches, decay and other defects.
B. Plants and Ground cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SOILS MATERIALS

A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of minimum 5.4 and maximum 7.0; organic matter to exceed 1.5%, magnesium to exceed 100 units; soluble salts/conductivity not to exceed 900 ppm/0.9 mmhos/cm in soil.

2.3 SOIL AMENDMENT MATERIALS

A. When soil tests indicate soil amendment, apply soil conditioners or fertilizers to amend soil to specified conditions.
   1. Tree Fertilizer: Containing fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: Nitrogen 10 percent, phosphoric acid 30 percent, soluble potash 10 percent.
B. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates..
C. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of

plants.

2.4 MULCH MATERIALS

A. Mulching Material: Composted, shredded hardwood bark, dark brown in color.

2.5 ACCESSORIES

A. Wrapping Materials: Burlap.
B. Stakes: Softwood lumber, pointed end.
C. Cable, Wire, Eye Bolts: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.
D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

2.6 SOURCE QUALITY CONTROL

A. Test and analyze imported topsoil.
B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter; pH value.
C. Provide recommendation for fertilizer and soil amendment application rates for specified planting as result of testing.
D. Testing is not required when recent tests are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this section.
B. Saturate soil with water to test drainage.
C. Verify required underground utilities are available, in proper location, and ready for use.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
C. Scarify subsoil to depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
D. Dig pits and beds three times wider than plant root system.

3.3 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 6 inches over area to be seeded. Rake until smooth.
B. Place topsoil during dry weather and on dry subgrade.
C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.4 FERTILIZING

A. Apply starter fertilizer.
B. Apply after initial raking of topsoil.
C. Mix thoroughly into upper 2 inches of topsoil.
D. Lightly water soil to aid dissipation of fertilizer.

3.5 PLANTING

A. Place plants for best appearance for review and final orientation by Architect/Engineer.
B. Set plants vertical.
C. Remove non-biodegradable root containers.
D. Set plants in pits or beds, partly filled with prepared plant mix, at minimum depth of 6 inches under each plant. Loosen burlap, ropes, and wires, from top half of root ball.
E. Place bare root plant materials so roots lie in natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.
F. Saturate soil with water when pit or bed is half full of topsoil and again when full.

3.6 PLANT SUPPORT

A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

Tree Caliper	Tree Support Method
1 inch	1 stake with one tie
1 – 2 inches	2 stakes with two ties
2 – 4 inches	3 guy wires with eye bolts and turnbuckles
Over 4 inches	4 guy wires with eye bolts and turnbuckles

3.7 FIELD QUALITY CONTROL

A. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

END OF SECTION 02930

SECTION 03300

CAST-IN-PLACE CONCRETE
(MINOR CONSTRUCTION)

PART 1 GENERAL

1.1 APPLICABLE PUBLICATIONS

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

AMERICAN CONCRETE INSTITUTE (ACI) PUBLICATIONS:

211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
301	Specifications for Structural Concrete for Buildings
302.1R	Guide for Concrete Floor and Slab Construction
304	Recommended Practice for Measuring, Mixing Transporting, and Placing Concrete
305R	Hot Weather Concreting
315	Details and Detailing of Concrete Reinforcing
347	Recommended Practice for Concrete Formwork

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS:

A82	Steel Wire, Plain for Concrete Reinforcement, Specification for
A185	Steel Welded Wire Fabric Plain, for Concrete Reinforcement, Specification for
A496	Steel Wire, Deformed, for Concrete Reinforcement Cement, Specification for
A497	Steel Welded Wire Fabric Deformed for Concrete Reinforcement, Specification for
A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Specifications for
C31	Practice for Making and Curing Concrete Test Specimens in the Field

C33	Concrete Aggregates, Specifications for
C39	Compressive Strength of Cylindrical Concrete Specimens, Test Methods for
C94	Specification for Ready-Mixed Concrete
C136	Sieve Analysis of Fine and Coarse Aggregates, Test Method for
C143	Slump of Hydraulic Cement Concrete, Test for
C150	Portland Cement, Specification for
C171	Sheet Materials for Curing Concrete, Specification
C172	Sampling Freshly Mixed Concrete, Practice for
C309	Liquid Membrane-Forming Compounds for Curing Concrete, Specification for
C494	Chemical Admixtures for Concrete, Specification for
C881	Epoxy-Resin-Base Bonding Systems for Concrete, Specification for
D1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types), Specification for
D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction, Specification for

AMERICAN WELDING SOCIETY (AWS) PUBLICATION:

D1.4	Structural Welding Code-Reinforcing Steel

1.2 DESCRIPTION OF WORK

The work includes all provisions of the cast-in-place concrete.

1.3 QUALITY CONTROL

The Quality Control provisions of Division 1, Section 01450, apply to this section. All approvals, except those required for field installations, field applications and field tests, shall be before construction is started and before delivery of materials or equipment to the project site.

1.4 SUBMITTALS:

1.4.1 Drawings

Submit shop drawings. Reproductions of contract drawings are unacceptable.

1.4.1.1 Shop Drawings for Reinforcing Steel

ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions and details of bar reinforcing, construction joints, accessories, and concrete covering. Do not scale dimensions from structural or detail drawings to determine lengths of reinforcing rods.

1.4.1.2 Concrete Mix Design

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Furnish a complete list of materials including type; brand; source and amount of cement. Obtain approval before concrete placement. Obtain acknowledgment of receipt prior to concrete placement. Submit additional data regarding concrete aggregates if the source of aggregate changes.

1.4.2 Certificates

Submit certificates of compliance. Before delivery of materials, certified test reports are required for the following:

a. Aggregates
b. Reinforcements
c. Cement
d. Admixtures

1.4.3 Manufacturer's Catalog Data:

a. Materials for Curing Concrete
b. Joint Sealant
c. Joint Filler
d. Epoxy Grout

1.5 DELIVERY

Do not deliver concrete until forms, reinforcement, embedded items, and other incidentals are in place and ready for concrete placement.

1.6 STORAGE

ACI 301 for job site storage of concrete aggregates. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Provide for accurate identification after bundles are broken and tags removed.

PART 2 PRODUCTS

2.1 CONCRETE:

2.1.1 Contractor-Furnished Mix Design

Concrete shall be designed in accordance with ACI 211.1 and ACI 301. Concrete shall have a 28-day compressive strength of 3000 psi for Foundations and 4,000 psi for the Superstructure unless specified otherwise and have a maximum aggregate size of 3/4".

1. Slump Requirements:

Element	Slump, Inches	
	Minimum	Maximum
Walls, columns, and grade beams	2	4
Floors, exterior slabs, and other building Construction	1	3

2.2 CONCRETE MATERIALS:

2.2.1 Cement

Cement shall be Type I or II, conforming to ASTM C150 or approved equal, except that cement used for manhole construction or reinforced concrete pipes and fittings shall be Type II only.

2.2.2 Water

Water for mixing and curing including free moisture and water in the aggregates, shall be fresh, clean and potable. Water Cement Ratio shall not exceed 0.45.

2.2.3 Aggregates

In general, aggregates shall be free from deleterious coatings, roots, bark, and other extraneous material. All aggregates shall conform to ASTM C33 and shall be thoroughly and uniformly washed before use. Coarse aggregate shall be made from sound, clean coralline limestone in accordance with ASTM C136, conforming to the following gradation requirements:

Nominal Size Square Sieve Sizes	Percent by Weight Passing Size Range						
Size	1"	3/4"	½"	3/8"	No. 4	No.8	No. 16
1"	100	95-100	25-60	---	0-10	0-5	---
3/4"	---	100	90-100	---	20-55	0-10	0-5
½"	---	---	100	90-100	40-70	0-10	0-5
3/8"	---	---	---	100	85-100	10-30	0-10

Fine aggregate shall be manufactured from clean coralline limestone in accordance with ASTM C136, conforming to the following grading requirements.

Sieve	Percent Passing
3/8 inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

2.2.4 Proportioning, Measuring and Mixing:

2.2.4.1 Proportioning of Materials

Proportioning of materials shall be accomplished by weighing. Volumetric proportioning may be used subject to approval of the Contracting Officer. The Contractor shall furnish the necessary equipment and shall establish accurate procedures, subject to the approval of the Contracting Officer for determining the quantities of free moisture in the aggregates. Allowable tolerances for measuring cement and water shall be 1 percent (1%), and for aggregates 2 percent (2%).

2.2.4.2 Mixing

All concrete shall be machine mixed. In emergencies, the mixing may be done by hand if so authorized by the Contracting Officer. Mixing shall begin within 30 minutes after the cement has been added to the aggregates.

2.2.5 Ready-Mixed Concrete:

Ready-mixed concrete shall conform to ASTM C94 as modified herein. Ready-mixed concrete is defined in this specification as concrete produced regularly by a commercial establishment and delivered to the purchaser in the plastic state. Cement, aggregates and water shall conform to all applicable requirements of this specification.

2.3 ADMIXTURES:

a. Accelerating: ASTM C494, Type C.
b. Retarding: ASTM C494, Type B, D, or G.
c. Water Reducing: ASTM C494, Type A, E, or F.

2.4 MATERIALS FOR FORMS

Provide wood, plywood, or steel. Use plywood or steel forms where a smooth form finish is required. Lumber shall be square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Plywood: PS1, B-B concrete form panels or better. Steel form surfaces shall not contain irregularities, dents, or sags.

2.5 REINFORCEMENT:

2.5.1 Reinforcing Bars

Reinforcing bars, unless otherwise specified shall be ASTM A615, Grade 60. Weldable rebar shall be ASTM A706, Grade 60.

2.5.2 Welded Wire Fabric

ASTM A497 or ASTM A185, 6 by 6, W2.9 by W2.9, unless otherwise indicated.

2.5.3 Mechanical reinforcing Bar Connectors

ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar.

2.5.4 Wire: ASTM A82 or ASTM A496.

2.6 MATERIALS FOR CURING CONCRETE:

2.6.1 Impervious Sheeting

ASTM C171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

2.6.2 Liquid Membrane-Forming Compound

ASTM C309, white-pigmented, Type 2, Class B, free of paraffin or petroleum.

2.7 EXPANSION/CONTRACTION JOINT FILLER

ASTM D1751 or ASTM D1752, 1/2 inch thick, unless otherwise indicated.

2.8 EPOXY GROUT

(For joints between old and new concrete and where called on the drawings)
Three-component units composed of 100% solids ASTM-C881 epoxy resin system.

PART 3 - EXECUTION

3.1 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Unsatisfactory material encountered below the grades shown shall be replaced with satisfactory material, at no additional cost to the Government, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in Section 02315, Excavation, Filling and Backfilling for Buildings.

3.2 FORMS

ACI 301. Provide forms, shoring, and scaffolding for concrete placement unless indicated or specified otherwise. Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width shall be a minimum of 4 inches greater than indicated. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Provide form works with clean-out openings to permit inspection and removal of debris. Forms submerged in water shall be watertight.

3.2.1 Coating

Before concrete placement, coat the contact surfaces of forms with a non-staining mineral oil, non-staining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral on forms for surfaces to which adhesive, paint, or other finish material is to be applied.

3.2.2 Removal of Forms

Prevent concrete damage during form removal. After placing concrete, forms shall remain in place for a minimum time period equal to the curing period. Forms may be removed earlier than specified if ASTM C39 test results of field-cured samples from a representative portion of the structure indicate that the concrete has reached 85 percent (minimum) of the design strength.

3.2.3 Formliners

Provide **Symons Dayton Superior ABS Thermoform Plastic Formliner** for underside of exterior roof slab exposed overhangs with 6" Cedar architectural pattern and install as per manufacturer's recommendations.

3.3 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI 301. Provide bars, wire fabric, wire ties, supports and other devices necessary to install and secure reinforcement. Reinforcement shall not contain rust, scale, oil, grease, clay, and foreign substances that would reduce the bond. Rusting of reinforcement is a basis for rejection if the effective cross sectional area or the nominal weight per foot of the reinforcement has been reduced to less than specified in paragraph entitled "Reinforcing Bars." Remove loose rust prior to placing steel. Tack welding is prohibited.

3.3.1 Tolerances

Place reinforcement and secure with galvanized or non-corrodible chairs, spaces, or metal hangers. Use concrete or other non-corrodible material for supporting reinforcement on the ground.

3.3.2 Splicing

Splices shall be approved prior to use. Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus 2 inches.

3.3.3 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Bolt threads shall match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt in installed.

3.3.4 Cover

ACI 301 for minimum coverage, unless otherwise indicated.

3.3.5 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removal material to prevent the entry of concrete.

3.3.6 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.

3.3.7 Expansion joints and Contraction Joints

For slabs on grade, provide as shown on the drawings or as otherwise specified herein. Provide contraction joints, either formed or saw cut or cut with a jointing tool, to the indicated depth after the surface has been finished. Sawed joints shall be completed within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.3.8 Form Ties and Accessories

The use of wire alone is prohibited. Form ties and accessories shall not reduce the effective cover of the reinforcement.

3.4 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE

ASTM C94, ACI 301, ACI 302.1R, and ACI 304, except as modified herein. ASTM C94. Provide mandatory batch ticket information for each load of ready mix concrete.

3.4.1 Measuring

Make moisture, weight, and air determinations at intervals as specified in paragraph entitled "Sampling and Testing." Allowable tolerances for measuring cement and water shall be 1 percent (1%); for aggregates, 2 percent (2%); and for admixtures, 3 percent (3%).

3.4.2 Mixing

ASTM C94. 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 the mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees Fahrenheit. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 85 degrees Fahrenheit. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.

3.4.3 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.

3.4.4 Placing

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris and water from within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from one end of the structure towards the other. Position grade stakes on 10-foot centers maximum in each direction when pouring interior slabs and on 20-foot centers maximum for exterior slabs.

1. Vibration: ACI 301. Furnish a spare vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches in depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straight edge. Operate vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Do not use vibrators to transport the concrete in the forms. Insert and withdraw vibrators approximately 18 inches apart. Penetrate the previously placed lift with the vibrator when more than one lift is required. Place concrete in 18-inch maximum vertical lifts. External vibrators shall be used on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete.

2. Application of Epoxy Bonding Compound: Apply a thin coat of compound to dry, clean surfaces. Scrub compound into the surface with a stiff-bristle brush. Place concrete while compound is stringy. Do not permit compound to harden prior to concrete placement. Follow manufacturer's instructions regarding safety and health precautions when working with epoxy-resins.

3.4.5 Hot Weather

3.4.5.1 Concrete Temperature

Provide and maintain required concrete temperature using Figure 2.1.5 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.

3.4.5.2 Curing

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 (where worksite 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.

3.5 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION: ACI 302.1R, unless otherwise specified.

3.5.1 Finishing

Place, consolidate and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit the concrete to attain a set sufficient for floating and sufficient to support 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 by porous materials. Do not use dry cement to absorb bleedwater.

1. Floated: Provide for machinery pads and other exterior slabs where not otherwise specified. Float the surface by hand with a wood or magnesium float, or use a power-driven float. Floating of any one area shall be the minimum necessary to produce an even finish, level within 1/4 inch in 10 feet for exterior work.

2. Steel Troweled: First, provide a floated finish. When slab has attained a proper set, hand- or machine-trowel to a smooth, hard, dense finish Finished surfaces shall be free of troweled marks, uniform in texture, and a have true plane, flat within 0.01 foot (approximately 1/8 inch) in 10 feet. Hand-finish portions of the slab not accessible to power finishing equipment (e.g., edges, corners) to match the remainder of the slab. Power trowel once and finally hand trowel where a finished floor covering (e.g., tile, carpet) is specified. Power trowel twice and finally hand trowel for exposed concrete floors.

3.5.2 Precast Concrete Guardrail Posts

A. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL-116.

1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

B. Reinforcement: Comply with the recommendations of CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers and hangers, as required.
3. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

C. Concrete Mixing: Comply with requirements and with ASTM C 94. Following concrete batching, no additional water may be added.

D. Concrete Placement: Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast units. Comply with requirements of ACI 304R for measuring, mixing, transporting, and placing concrete.

1. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with ACI 309R.

E. Finish formed surfaces of precast concrete as indicated for each type of unit, and as follows:

1. Standard Finish: Small surface holes caused by air bubbles, normal color variations, and form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.

F. Finish unformed surfaces by trowel, unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

1. Apply scratch finish to precast concrete units that will receive concrete topping after installation. Following initial strike-off, transversely scarify surface to provide ridges approximately 1/4 inch (6 mm) deep.

3.6 CURING AND PROTECTION

ACI 301 unless otherwise specified. Begin curing immediately following form removal. Protect concrete from injurious action by sun, rain, flowing water, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, or on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period.

3.6.1 Moist Curing

Provide for the removal of water without erosion or damage to the structure.

1. Ponding or Immersion: Continually immerse the concrete throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

2. Fog Spraying or Sprinkling: Provide uniform and continuous application of water throughout the curing period.

3. Pervious Sheeting: Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6 inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously set throughout the curing period.

4. Impervious Sheeting: Wet the entire exposed surface of the concrete

thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12 inches minimum. Provide sheeting not less than 18 inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Cover or wrap columns, walls and other vertical structural elements from the top down with impervious sheeting, overlap and continuously tape sheeting joints, and introduce sufficient water to soak the entire surface prior to completely enclosing.

3.6.2 Liquid Membrane-Forming Compound Curing

Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Provide and maintain compound on the concrete surface throughout the curing period. Do not use this method of curing where the use of Figure 2.1.5 in ACI 305R indicates that hot weather conditions will cause an evaporation rate exceeding 0.2 pound of water per square foot per hour.

1. Applications: Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance, and before joints are sawed. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Re-spray concrete surfaces subjected to rainfall within 3 hours after the curing compound application.

3.6.3 Protection of Treated Surfaces

Prohibit foot and vehicular traffic and other sources of abrasion for not less than 72 hours after compound application. Maintain continuity of the coating for the entire curing period and immediately repair any damage.

3.6.4 Curing Periods and Minimum Temperatures

After placing concrete, maintain air temperature adjacent to the concrete at 70 degrees minimum for a period of 3 days after placing and,

Time Period (Days Minimum)	Concrete Structure or Cement Type
7	ASTM C150, Type I or II; cement for concrete not specified otherwise.

3.7 SAMPLING AND TESTING:

3.7.1. Sampling

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

3.7 .2 Testing

1. Slump Tests: ASTM C143. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) of every 10 cubic yards (maximum) of concrete.

2. Compressive Strength Tests: ASTM C39. Make five test cylinders for each set of tests in accordance with ASTM C31. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Provide concrete cylinders for compressive tests not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs and walls. Double the cylinder collection frequency and number of batches sampled when pumping concrete.

END OF SECTION 03300

SECTION 03301

ANODIC PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes furnishing all labor, tools, materials, equipment and services necessary to properly install embedded galvanic anodes.

B. Embedded galvanic anodes are designed to provide localized corrosion protection. When placed at the appropriate spacing along the perimeter of concrete patches or along the interface between new/existing concrete, the anodes mitigate the formation of new corrosion sites in the existing concrete in adjacent areas.

1.3 APPLICABLE PUBLICATIONS

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

AMERICAN CONCRETE INSTITUTE (ACI) PUBLICATIONS:

ACI/ICRI 2008	Concrete Repair Manual
ACI Guideline No. 222	Corrosion of Metals in Concrete

INTERNATIONAL CONCRETE REPAIR INSTITUTE

ICRI Guideline 310.1R-2008	Guide for Surface Preparation for the Repair of Deteriorated Concrete resulting from Reinforcing Steel Corrosion

AMERICAN SOCIETY OF TESTING MATERIALS

A615/A615M-09	Standard Specification for Deformed and Plain Billet-Steel Bar for Concrete Reinforcement
B06-09	Standard Specification for Zinc
ASTM A82-07	Speciffication for Plain Steel Wire for Concrete Reinforcement

PART 2 - PRODUCTS

2.1 MATERIALS

A. Embedded galvanic anodes shall have the following nominal dimensions: 2.5" diameter by 1.1" high (64mm x 27mm), pre-manufactured, and consist of a minimum of 21 oz (60 grams) of zinc in compliance with ASTM B6 Special High Grade cast around a pair of steel tie wires in compliance with bright annealed ASTM A82 and encased in a highly alkaline cementitious shell with a pH of 14 or greater. The cementitious shell shall contain no added sulfate nor shall it contain chloride, bromide or other constituents that are corrosive to reinforcing steel. Anode units shall be supplied with integral unspliced wires with loop ties for directly tying to the reinforcing steel. Embedded galvanic anodes shall be Sike Galvashield XP available from Sika Corporation (www.sikaconstruction.com or (800)933-7452).

B. Repair mortars, concrete and bonding agents shall be Portland cement-based materials with suitable electrical conductivity less than 15,000 ohm-cm. Non-conductive repair materials such as epoxy, urethane, or magnesium phosphate shall not be permitted. Anodes used with higher resistance repair materials shall be embedded in Sika Galvashield Embedding Mortar, SikeRepair 222, 223 or SikaQuick 1000 (allmixed with water) to create a conductive bridge to the substrate prior to repair material installation.

C. Deformed bars for reinforcement shall be hot-rolled steel in accordance with ASTM A615/A615M, Grade 60 (Grade 400).

D. Deliver, store, and handle all materials in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.01 Concrete Removal

A. Remove loose or delaminated concrete.
B. Undercut all exposed reinforcing by removing concrete from the full circumference of the steel as per ICRI R310.1R. The minimum clearance between the concrete substrate and reinforcing steel shall be 3/4" (19mm) or ¼" (6mm) larger than the largest size aggregate in the repair material, whichever is greater.
C. Concrete removal shall continue along the reinforcing steel until there are no visible signs of corrosion as per ICRI R310.1R.

3.02 Cleaning and Repair of Reinforcing Steel

A. Clean exposed reinforcing steel of rust, mortar, etc. to provide sufficient electrical connection and mechanical bond.
B. If significant reduction in the cross section of the reinforcing steel has occurred, replace or install supplemental reinforcement as directed by the engineer.
C. Secure loose reinforcing steel by tying tightly to other bars with steel tie wire.

3.03 Edge and Surface Conditioning of Concrete

A. Concrete patches shall be square or rectangular in shape with squared corners.
B. Saw cut the patch boundary ½" (13mm) deep or less if required to avoid cutting reinforcing steel.
C. Create a clean, sound substrate by removing bond-inhibiting materials from the conacrete substrate by high pressure water blating or abrasive blasting.

3.04 Galvanic Anode Installation

A. Install anodes and repair material immediately following preparation and cleaning of the steel reinforcement.

B. Galvanic anodes shall be installed along the perimeter of the repair or interface at a spacing as specified on the drawings. Anode spacing will vary with changes in the reinforcing steel density, the level of chloride in the structure and the corrosivity of the local environment, etc.

C. Provide sufficient clearance between anodes and substrate to allow repair material to encase anode.

D. Secure the galvanic anodes as close as possible to the patch edge using the anode tie wires. The tie wires shall be wrapped around the cleaned reinforcing steel and twisted tight to allow little or no free movement.

1. If less than 1" (25mm) of concrete cover is expected, place anode beside or underneath the bar and secure to clean reinforcing steel.
2. If sufficient concrete cover exists, the anode may be placed along a single bar or at the intersection between two bars and secured to each clean bar.

E. If repair materials with resistivity greater than 15,000 ohm-cm are to be used or the resistivity is unknown, create a conductive bridge between the anode and the substrate. Pack Sika Galvashield Embedding Mortar, SikaRepair 222, 223 or SikaQuick 1000 (all mixed with water) to cover minimum area of 4" (100mm) in diameter between the anode and the substrate concrete ensuring no voids exist.

E. Electrical Coninuity

1. Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm) or potential (mV) with a multi-meter.
2. Electrical connection is acceptable if the DC resistance measured with multi-meter is less than 1 ohm or the DC potential is less than 1mV.
3. Confirm electrical continuuity of the exposed reinforcing steel within the repair area. If necessary, electrical continuity shall be established with steel tie wire.
4. Electrical continuuity between test areas is acceptable if the DC resistance measured with multi-meter is less than 1 ohm or the potential is less than 1 mV.

3.05 Concrete or Mortar Replacement

A. Pre-wet the concrete surface and the anodes to achieve a saturated surface dry condition, and then complete the repair. Do not soak the anodes for greater than 20 minutes.

B. Repair materials with significant polymer modification and/or silica fume content may have high resistivity (refer to section 3.04E). Similarly, if bonding agents and/or reinforcing steel coating are used, they shall have suitable conductivity or be applied in a suitable manner (refer to Sika Galvashield XP Installation Detail at http://www.sikaconstruction.com/con/con-prod-name.htm#con-prod-SikaGalvashieldXP). Insulating materials such as epoxy bonding agents shall not be used unless otherwise called for in the design and applied in a suitable manner.

C. Following normal concrete repair procedures complete the repair with the repair material, taking care not to create any air voids around the anode.

END OF SECTION 03301

SECTION 04034

HISTORIC MAMPOSTERIA MASONRY REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Historic treatment work consisting of repairing historic mamposteria masonry.

B. Definitions:

1.2 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference on historic masonry repair and repointing at Project site.
   1. Review minutes of Preliminary Historic Treatment Conference that pertain to masonry historic treatment, masonry repair, and fire protection.
   2. Review methods and procedures related to repairing historic mamposteria masonry.

      a) Historic treatment personnel, equipment, and facilities needed to make progress and avoid delays.

      b) Materials, material application, sequencing, tolerances, and required clearances.

      c) Quality-control program.

      d) Mamposteria historic treatment program.

      e) Cleaning program.

1.3 ACTION SUBMITTALS

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

B. Submittals:
   1. Include plans, elevations, sections, and locations of masonry repair work on the struc tures.
   2. Review methods and procedures related to repairing historic mamposteria masonry.

1.4 QUALITY ASSURANCE

A. Installer shall demonstrate experience with the installation of natural hydrated lime mortar and plasters.

   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Deliver packaged materials to the project site in manufacturer’s original and unopened

containers.

C. Levelling mortar specified has a shelf-life in original container of approximately 6 months. Dry factory-mixed mortar has a shelf-life in original containers of approximately 3 months. Material must be used within those time frames, with measurement of time starting at the date of shipping from the factory.

D. Materials must be stored on elevated platforms and kept dry.

E. Store sand where required characteristics can be maintained and contamination avoided.

1.5 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements for cement plaster work.

B. Plaster shall not be installed when rain is occurring or likely to occur in the 24 hours after the completion of the plastering.

PART 2 - PRODUCTS

2.1 LATH

A. No lath of any sort is allowed on this project.

2.2 ACCESSORIES

A. General: No plastic, metal or fiber accessories shall be used on this project. All corners and shapes shall be formed with plaster materials alone.

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Sand: Coralline sand crushed to a size that approximates the grain size of typical beach sand. No beach sand allowed.

C. Bonding Compound: ASTM C 932. For use only in areas with cement plaster base.

2.4 MORTAR MATERIALS

A. Natural Hydrated Lime Mortar
   1. Manufacturer: St. Astier, imported and distributed by TransMineral USA, Inc.
   2. Plaster Base Components: Binder shall be St. Astier Natural Hydraulic Lime NHL 3.5. Sand shall be as specified
   3. Plaster Finish Components: Binder shall be St. Astier Natural Hydraulic Lime NHL 2. Sand shall be as specified

4. Mixes: 1 part NHL 3.5 to 2 parts sand, proportioned by volume. Add fiber to scratch coat.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Provide temporary rain drainage during work to direct water away from the bell tower.

C. Clean stone to remove dust and other materials that may inhibit bond. .

3.2 MAMPOSTERIA REMOVAL AND REPLACEMENT

A. At locations indicated, remove mamposteria that are loose, spalled, or deteriorated. Carefully remove, without damaging surrounding stone work, in a manner that permits replacement with new stonework.

B. Support and protect remaining masonry that was supported by removed units.

C. Maintain adjoining construction in an undamaged condition.
D. Notify Architect of unforeseen detrimental conditions, including voids, cracks, bulges, loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

E. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.

F. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.
   1. Do not use metal scrapers or brushes.
   2. Do not use acidic or alkaline cleaners.

END OF SECTION 04034

SECTION 04200

UNIT MASONRY

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALs (ASTM)

ASTM A 82	Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM B 370	Copper Sheet and Strip for Building Construction
ASTM C 90	Load-Bearing Concrete Masonry Units
ASTM C 91	Masonry Cement
ASTM C144	Aggregate for Masonry Mortar
ASTM C 150	Portland Cement
ASTM C 207	Hydrated Lime for Masonry Purposes
ASTM C 270	Mortar for Unit Masonry
ASTM C 476	Grout for Masonry

1.2 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.2.1 Manufacturer's Catalog Data

a. Masonry accessories
b. Reinforcement
c. Flashing

Submit for each type.

1.2.2 Drawings

a. Reinforcing steel
b. Drawing Requirements

Indicate splicing, laps, shapes, dimensions, and details of reinforcing steel and accessories. Include details of anchors, adjustable wall ties, positioning devices, bond beams, and lintels. Do not scale drawings to determine lengths of bars.

1.2.3 Design Data

a. Pre-mixed mortar

1.2.4 Instructions

a. Masonry cement

When masonry cement is used, submit the manufacturer's printed instructions on proportions of water and aggregates and on mixing to obtain the type of mortar required.

1.2.5 Samples

a. Masonry units

Submit two sets of each type masonry units, showing full range of color, texture, finish, and dimensions.

1.3 QUALITY ASSURANCE

1.3.1 Appearance

Do not change source or supply of materials after work has started if the appearance of the finished work would be affected.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver cementitious materials to the site in unbroken containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious materials in dry, weather-tight sheds or enclosures. Handle so as to prevent entry of foreign materials and damage by water or dampness. Store masonry units off the ground and handle with care to avoid chipping and breakage. Protect materials from damage and, except for sand, keep dry until used. Cover sand to prevent intrusion of water and foreign materials and to prevent drying. Do not use materials containing frost or ice. Store Type II, concrete masonry units at the site before using for a minimum of 28 days for air cured units, 10 days for atmospheric steam or water cured units, and 3 days for units cured with steam at a pressure of 120 to 150 psi and at a temperature of 350 to 365 degrees F for at least 5 hours.

1.5 SCHEDULING

Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching.

PART 2 PRODUCTS

2.1 MASONRY UNITS

2.1.1 Concrete Masonry Units

Units of modular dimensions and air, water, or steam cured. Surfaces of units which are to be plastered shall be sufficiently rough to provide bond; elsewhere, exposed surfaces of units shall be smooth and of uniform texture. Exterior concrete masonry units shall have water-repellent admixture added during manufacture.

a. Hollow Load-Bearing Units

ASTM C 90, Type I or II, made with or normal weight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

b. Special Shapes

Provide special shapes such as closures, header units, and jamb units as necessary to complete the work. Special shapes shall conform to the requirements for the units with which they are used.

2.1.2 Pre-cast Concrete Lintels

Same materials and surface texture as adjacent masonry units, with a 28-day compressive strength of not less than 4000 psi. Provide reinforcing as indicated. Provide lintels of sizes indicated, with at least 8 inches of bearing at each end.

2.2 MORTAR

2.2.1 Portland Cement

ASTM C 150, Type I, II, or III.

2.2.2 Hydrated Lime

ASTM C 207, Type S.

2.2.3 Masonry Cement

ASTM C 91, except that for masonry cement provided for mortar for exterior walls, the air content of the mortar specimen shall be not more than 16 percent by volume in lieu of 22 percent. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar.

2.2.4 Sand

ASTM C 144.

2.2.5 Water

Clean, potable, and free from substances which could adversely affect the mortar.

2.2.6 Mortar Types

ASTM C 270, Type S for masonry work; except where higher compressive strength is indicated on structural drawings. Air content shall not be less than 11 percent.

2.2.7 Pre-Mixed Mortar

ASTM C 270, Type S, compressive strength of 2,000 psi in 28 days. Air content shall not be less than 11 percent. Admixtures may be provided in mortar to retard curing and provide up to 36 hours of workability, as long as the admixture does not adversely affect bonding or compressive strength.

2.3 MASONRY ACCESSORIES

2.3.1 Horizontal Joint Reinforcement

Reinforcing bars, unless otherwise specified, shall be ASTM A615, Grade 60 placed not more than 16 inches o.c.

2.3.2 Fastenings

Build in bolts, metal wall plugs, and other metal fastenings furnished under other sections for securing furring and other items.

2.3.3 Reinforcing Bars

ASTM A615, Grade 60.

2.3.4 Through-Wall Flashing

Provide one of the following types

a. Coated-Copper Flashing

7-ounce, electrolytic copper sheet, uniformly coated on both sides with acid-proof, alkali-proof, elastic bituminous compound. Factory apply coating to a weight of not less than 6 ounces per square foot (approximately 3 ounces per square foot on each side).

b. Copper or Stainless Steel Flashing

Copper, ASTM B 370, minimum 16-ounce weight; stainless steel, ASTM A 167, Type 301, 302, 304, or 316, 0.010-inch thick, No. 2D finish. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions. Deformations shall consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.

c. Reinforced Membrane Flashing

Polyester film core with a reinforcing fiberglass scrim bonded to one side. The membrane shall be impervious to moisture, flexible, and not affected by caustic alkalis. The material, after being exposed for not less than 1/2 hour to a temperature of 32 degrees F, shall show no cracking when, at that temperature, it is bent 180 degrees over a 1/16-inch diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

a. Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

b. Load

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed.

c. Provide temporary bracing as required.

d. Polyester Embossed Film

Provide protective boards for polyester film during job installation.

3.1.2 Surface Preparation

Surfaces on which masonry is to be placed shall be smooth, clean, and free of foreign substances when mortar is applied.

3.2 WORKMANSHIP

Carry masonry up level and plumb. Furnish and use story poles or gage rods throughout the work. Changes in coursing or bonding after the work is started will not be permitted. Do not carry one section of the walls up in advance of the others. Step back unfinished work for joining with new work. Toothing will not be permitted. Check heights of masonry at each floor and at sills and heads of openings to maintain the level of the walls. Build in door and window frames, louvered openings, anchors, pipes, ducts, and conduits as the masonry work progresses. Fill spaces around metal door frames solidly with mortar. Handle masonry units with care to avoid chipping, cracking, and spalling of faces and edges. Drilling, cutting, fitting, and patching to accommodate the work of others shall be performed by masonry mechanics. Cut masonry with masonry saws for exposed work. Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork specified elsewhere shall be placed in position as the work progresses. Provide chases of approved dimensions for pipes and other purposes where indicated and where necessary. Cover tops of exposed walls and partitions not being worked on with a waterproof membrane secured in place and extended down at least 2 feet on both sides. Inspect scaffolding regularly to ensure that it is amply strong, well braced, and securely tied in position. Do not overload scaffolding.

3.3 MORTAR MIXING

Measure mortar materials in 1 cu. ft. containers to maintain control and accuracy of proportions. Do not measure materials with shovels. Mix mortar in a mechanical batch mixer for not less than 3 nor more than 5 minutes after all ingredients are in so as to produce a

uniform mixture. Add water gradually as required to produce a workable consistency. Do not load mixer beyond its rated capacity. Keep mortar boxes, pans, and mixer drums clean and free of debris and dried mortar. Re-temper mortar which has stiffened because of evaporation by adding water and mixing to obtain a workable consistency. Do not use or re-temper mortar which has not been placed in final position within 2 1/2 hours after the initial mixing. Do not use antifreeze compounds, salts, or other substances to lower the freezing point of mortar.

a. Mortar

Mix mortar in accordance with ASTM C 270 to obtain type mortar required. When masonry cement is provided, conform to masonry cement manufacturer's printed mixing instructions. During mixing, add water-repellent admixture in quantity recommended by the admixture manufacturer to mortar which will be used in exterior concrete masonry unit walls.

b. Grout

ASTM C 476. Provide fine grout in grout spaces less than 2 inches in any horizontal dimension or in which clearance between reinforcing and masonry is less than ¾ inch. Provide coarse grout in grout spaces 2 inches or greater in all horizontal dimensions provided the clearance between reinforcing and masonry is not less than ¾ inch.

3.4 MORTAR JOINTS

Uniform thickness of 3/8-inch unless otherwise indicated. Tool exposed joints slightly concave with a round or other suitable jointer when the mortar is thumbprint hard. For horizontal joints, jointers shall be at least 12 inches long for brickwork and 16 inches long for concrete masonry. Jointers shall be slightly larger than the width of the joint so that complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Strike flush joints that will not be exposed. Tool vertical joints first. Brush joints to remove all loose and excess mortar. Horizontal joints shall be level; vertical joints shall be plumb and in alignment from top to bottom of wall within a tolerance of plus or minus 1/2 inch in 40 feet.

3.5 TOLERANCES

Masonry work shall be within the following limits:

a. Face of Concrete Masonry Unit

1/16 inch from face of adjacent unit.

b. Variation From True Plane

1/4 inch in 10 feet and 1/2 inch maximum in 20 feet or more.

c. Variation From Plumb

1/4 inch in each story, non-cumulative and 1/2 inch maximum in two stories or more.

d. Variation From Level

1/8 inch in 3 feet, 1/4 inch in 10 feet, and 1/2 inch maximum.

e. Variation in Wall Thickness

Plus or minus 1/4 inch.

3.6 CONCRETE MASONRY UNIT WORK

Lay the first course in a full bed of mortar for the full width of the unit. Lay succeeding courses in running bond unless otherwise indicated. Form bed-joints by applying mortar to entire top surfaces of inner and outer face shells. Form head joints by applying mortar for a width of about 1 inch to ends of adjoining units. Mortar shall be of such thickness that it will be forced out of the joints as the units are placed in position. Where anchors, bolts, and ties occur within the cells of the units, place reinforcement in the joint at the bottom of such cells and fill cells with mortar or grout as work progresses. Provide concrete brick for bonding walls, working out the coursing, topping out walls under sloping slabs, distributing concentrated loads, backing brick headers, and elsewhere as required. Do not dampen concrete masonry units before or during laying.

3.6.1 Special Concrete Masonry Unit Work

Where exposed concrete masonry unit walls and partitions are indicated, provide special concrete masonry unit work. Select units for uniformity of size, texture, true plane, and undamaged edges and ends of exposed surfaces. Place units plumb, parallel, and with properly tooled joints of maximum 3/8-inch thickness. Keep exposed surfaces clean and free from blemishes or defects.

3.6.2 Reinforced Concrete Masonry Unit Walls

Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. Embed the adjacent webs in mortar to prevent leakage of grout. Remove mortar fins protruding from joints before placing grout. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

3.7 BONDING AND ANCHORING

Unless indicated otherwise, extend partitions from the floor to the bottom of the construction above. Structurally bond or anchor walls and partitions to each other and to concrete walls, beams, and columns. Securely anchor non-load-bearing partitions and interior walls to the construction above as indicated. Completely embed anchors in mortar joints.

3.7.1 Corners of Load-Bearing Walls

Provide a true masonry bond in each course, except where indicated or specified otherwise.

3.7.2 Intersections of Load-Bearing Walls

Provide a true masonry bond in each course, or anchor with rigid steel anchors not more than 2 feet apart vertically, unless otherwise indicated.

3.7.3 Masonry Walls Facing or Abutting Concrete Members

Anchor masonry to concrete with dovetail or wire-type anchors inserted in slots or inserts built into concrete. Locate anchors not more than 18 inches o.c. vertically and not more than 24 inches o.c. horizontally.

3.8 THROUGH-WALL FLASHING

Provide as indicated. Unless indicated otherwise, extend flashing from a point 1 inch outside of exterior face of walls. Bend down exterior edge to form a drip. Flashing shall be terminated 1 inch back from interior face of walls and turned back on itself not less than 1 inch. Secure flashing as indicated. Provide flashing in lengths as long as practicable. Lap ends not less than 1½ inches for interlocking type and 4 inches for other types. Seal laps as necessary to ensure watertight construction. Provide dams at ends of flashing where masonry abuts concrete and where flashing ends within the masonry.

3.9 HORIZONTAL JOINT REINFORCEMENT

Provide reinforcement where indicated in walls and partitions of concrete masonry units. Reinforcement shall be continuous except at control joints and expansion joints. Reinforcement above and below openings shall extend not less than 24 inches beyond each side of openings. Provide reinforcement in the longest available lengths, utilizing the minimum number of splices. Overlap ends not less than 21 inches. Provide welded L-shaped assemblies and welded T-shaped assemblies to match straight reinforcement, at corners and intersections of walls and partitions. Provide mortar cover for wire of at least 5/8 inch for exterior face of wall, ½ inch for interior face of wall.

3.10 CONCRETE MASONRY UNIT LINTELS AND BOND BEAMS

Provide special units, fill cells solidly with grout or concrete, and provide not less than two No. 5 reinforcing bars, unless indicated otherwise. Reinforcing shall overlap a minimum of 40 bar diameters at splices. Terminate bond beams and reinforcing on each side of expansion joints. Concrete masonry units provided for lintels and bond beams shall have exposed surfaces of the same material and texture as the adjoining masonry units. Lintels shall be straight and true and shall have at least 8 inches of bearing at each end. Allow lintels to set at least 6 days before shoring is removed. During mixing, add water-repellent admixture in quantity recommended by the admixture manufacturer to concrete and grout which will be used to fill lintels and bond beams in exterior walls.

3.11 CONTROL JOINTS

Provide where indicated in concrete masonry-unit walls. Provide sawed type or built-in type as required. Joints shall occur directly opposite each other on both faces of the wall and shall be filled with sealant as specified in Section 07920, “Sealants,” or as indicated.

3.12 EXPANSION JOINTS

Fill joints with a permanently flexible pre-formed filler material and a sealant as specified in Section 07920, “Sealants.”

3.13 GROUT PLACEMENT

Place grout from the interior side of walls, unless approved otherwise. Protect sills, ledges, offsets, and other surfaces from grout droppings. Remove grout from such surfaces immediately. Grout shall be well mixed to prevent segregation and shall be sufficiently fluid to flow into joints and around reinforcing without leaving voids. Place grout by pumping or

pouring from buckets equipped with spouts in lifts not exceeding 5 feet. Keep pours at 1½ inches below top of masonry units in top course, except at finish course. Float bricks into grout to a position not less than 1 inch nor more than 2 inches from surrounding masonry units. Puddle or agitate grout thoroughly to eliminate voids. Remove masonry displaced by grouting operation and re-lay in alignment with fresh mortar.

3.14 FORMS AND SHORING

Construct to the shape, lines, and dimensions of members indicated. Prevent deflections which may result in cracking or other damage to supported masonry. Do not remove until members have cured.

3.15 CLEANING

3.15.1 Protection

During cleaning operations, protect work which may be damaged, stained, or discolored.

3.15.2 Pointing

Upon completion of masonry work and before cleaning, cut out defective mortar joints and tuck point joints and all holes solidly with pre-hydrated mortar.

3.15.3 Cleaning

Clean exposed masonry surfaces with clear water and stiff fiber brushes and rinse with clear water. Where stains, mortar, or other soil remain, continue scrubbing with warm water and detergent. Immediately after cleaning each area, rinse thoroughly with clear water. Restore damaged, stained, and discolored work to original condition or provide new work.

END OF SECTION 04200

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA 45	Aluminum Finishes
AA 46	Anodized Architectural Aluminum

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.3	Power-Actuated Fastening Systems
ANSI B18.2.1	Square and Hex Bolts and Screws Inch Series
ANSI B18.6.2	Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws
ANSI B18.6.3	Machine Screws and Machine Screw Nuts

ASME INTERNATIONAL (ASME)

ASME/ANSI B18.2.2	Square and Hex Nuts (Inch Series)
ASME/ANSI B18.21.1	Lock Washers (Inch Series)
ASME/ANSI B18.22.1	Plain Washers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	Gray Iron Castings
ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 123/A 123M	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167-92b	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 312-92a	Specification for Seamless and Welded Austenitic Stainless

	Steel Pipe
ASTM A 569/A 569M	Commercial Steel (CS) Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled
ASTM A 653/A 653M	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 780	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B 209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 429	Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 1187	Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E 488	Strength of Anchors in Concrete and Masonry Elements

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 8-90	Specification for the Design of Cold-Formed Stainless Steel Structural Members

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	Structural Welding Code - Steel

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM BG	Metal Bar Grating Manual
NAAMM PR	Pipe Railing Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	Life Safety Code

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Shop Drawings

a. Railings, installation drawings
b. Embedded angles and plates, installation drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC S303.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1.2.2 Product Data

a. Railings

1.2.3 Samples

Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.4 Anchor Bolts

ASTM A 307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.1.4.1 Lag Screws and Bolts

ANSI B18.2.1, type and grade best suited for the purpose.

2.1.4.2 Toggle Bolts

ANSI B18.2.1.

2.1.4.3 Bolts, Nuts, Studs and Rivets

ASME/ANSI B18.2.2 and ASTM A 687 or ASTM A 307.

2.1.4.4 Powder Driven Fasteners

Follow safety provisions of ANSI A10.3.

2.1.4.5 Screws

ANSI B18.2.1, ANSI B18.6.2, and ANSI B18.6.3.

2.1.4.6 Washers

Provide plain washers to conform to ASME/ANSI B18.22.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME/ANSI B18.21.1.

2.1.5 Aluminum Alloy Products

Conform to ASTM B 209 for sheet plate, ASTM B 221 for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A 123/A 123M, ASTM A 153/A 153Mor ASTM A 653/A 653M, G90, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780 or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Unexposed Sheet, Plate, and Extrusions

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA 45, or AA 46.

2.6 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as sill angles, miscellaneous mountings and frames.

Provide angles and plates, ASTM A 36/A 36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A 123/A 123M.

PART 3 EXECUTION

3.1 INSTALLATION

Install items at locations indicated, according to manufacturer's instructions. Items listed below require additional procedures.

3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.3 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.5 FINISHES

3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D 1187, asphalt-base emulsion.

3.5.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.5.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

END OF SECTION 05500

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, and Metal Fabrications Section 05500, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Roof Framing/ Trusses: Merbau (Ifit)
   2. Tabique Wall Framing: Merbau (Ifit)
   3. Interior Wall Framing: Merbau (Ifit)
   4. Floor Joist/ Beam Framing & Posts: Merbau (Ifit)
   5. Floor Decking: Ipe (Brazilian Walnut)
   5. Wood furring, shims, and blocking: Merbau (Ifit).

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.
B. Exposed Framing: Dimension lumber not concealed by other construction and indicated to receive a stained or natural finish.

1.4 SUBMITTALS

A. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses as required in the structural drawings. Comply with Wood Species Schedule for each house (See drawings) and provide species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.
B. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
   1. For each type of preservative-treated wood product (if used) include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
   2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
C. Warranty of chemical treatment manufacturer for each type of treatment.
D. Coordinate and provide shop drawings of timber framing systems showing structural connections with welded metal straps, plates and anchors. Locate tenons, notches and opening's as required by strcutural connection in the wood members. Submit timber framing shop drawings together with associated shop drawings of structural connections with welded metal straps, plates, anchors and connection bolts and hardware
E. Three 18" x 7 1 /2" x 1 1/2" samples of different field-hewn boards to be reviewed and selected by GPT representatives for appearance sake.
F. Three 3 1/2" x 3 1/2" x 1 1/2" samples of merbau and ipe wood species to be reviewed to meet performance criteria and species identification field test, including janka hardness, resistance to termites, leachibility test, and endgrain appearance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All wood deliveries shall be provided with clearly marked labels specifying the recipent name of the house as indicated in the Wood Species Schedule Drawing.

B. Keep materials under cover and dry. Protect from humidity, weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels level to prevent warping. Provide for air circulation within and around stacks and under non-staining temporary coverings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Wood-Preservative-Treated Materials:
   a. Thompson's Waterseal or approved equal
   b. Osmose Wood Preserving, Inc. or approved equal
2. Metal Framing Straps/ Anchors:
   a. Simpson Strong-Tie Company, Inc. or approved equal
3. Ipe Floor Decking :
   a. Altruwood or approved equal
4. Merbau Timber and Beams, Rafters, and Joist.
   a. Altruwood or approved equal

2.2 PERFORMANCE REQUIREMENTS OF HARDWOOD SPECIES

DESCRIPTION	**WOOD SPECIES**	
	Ipe	Merbau (Ifit)
Scientific Name	Handroanthus Tabebuia	Intsia Bijuga
Ave Dry Weight	69 lbs/ft3	51 lbs/ft3
Specific Gravity	.91, 1.10	.68, .82
Janka Hardness	3,510 lb (15,620N)	1,840 lb (7,620N)
Modulus Rupture	25,660 lb/in2	21,060 lb/in2
Elastic Modulus	3,200,000 lb/in2	2,310,000lb/in2
Crushing Strength	13,600 lb/in2	10,650 lb/in2
Shrinkage	Radial:5.90% Tangential: 7.20% Volumetric: 12.40% T/R Ratio: 1.2	Radial: 2.90% Tangential: 4.80% 8.00% T/R Ratio: 1.7
Endgrain	Diffuse porous, paranchyma unilateral, winged	Diffuse porous, alifrom (wing or lozenge)

2.3 FRAMING LUMBER

A. Nominal dimensions are indicated in the drawings. Sizes called for are nominal, actual sizes shall conform to American Lumber Standard PS 20-70. Lumber shall be pressure and termite treated except for the following species:

1) Merbau (Ifit) : Intsia Bejuga
2) Ipe (Brazilian Walnut) : Handroanthus Tabebuia

Provide grade and appearance of the lumber for each species/ location as specified in the Wood Species Schedule (See Architectural Drawings) for each house indicated.

B. Grade Stamps: Provide lumber with each piece factory marked with WWPA (Western Wood Products Association) or equivalent grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill. Moisture content of lumber shall be fifteen percent (15%) or less at exterior locations, and twelve percent (12%) or less at interior locations, unless noted otherwise.
   1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.
   2. Recycled merbau and ipe hardwoods are to be visually graded. The moisture content of recycled wood shall be tested to be no more than 15% for exterior locations, and 12% for interior locations. If moisture content is not available, the recycled hardwood shall demonstrate that it has a prior lifespan of more than 40 years. Recycled hardwood from existing stock of standing historic buildings on Guam or elsewhere shall not be acceptable, unless approved by GPT and the State Historic Preservation Officer (SHPO).

C. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   1. Provide dressed lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.
   2. Provide hand-hewn lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.4 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: All lumber, blocking, and shims to be incorporated into the project, shall be treated to comply with applicable requirements of AWPA C2 (lumber), AWPA M4 (wood products), AWPA C20 (structural lumber) and AWPB LP-2. Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
   1. Do not use chemicals containing chromium or arsenic.
   2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
   3. Exceptions to termite-treatment and/or pressure-treatment: Merbau/ Ipe/ Redwood (Heartwood-clear all hearts).

B. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber after drying and discard damaged or defective pieces.

C. Treat ends of lumber exposed to weather by dipping in water-repellent preservative Thompson Sealer for 15 minutes. Provide 2 coat treatement.

2.5 TIMBERS

A. For timbers of 4-inch nominal size and thicker, provide material complying with the following requirements:
   1. Species and Grade : Merbau (Ifit), Select Structural per WCLIB or WWPA rules.
   2. Appearance : As indicated in the Wood Species Schedule

2.6 BOARDS

A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:
   1. Moisture Content : 15 percent (exterior locations)
      12% percent (interior locations)
   2. Species and Grade : As indicated in the Wood Species Schedule
   3. Appearance : As indicated in the Wood Species Schedule

2.7 FLOOR DECKING

A. Exposed Decking Boards: Where boards will be exposed in the finished work, provide the following:
   1. Moisture Content : 15 percent (exterior locations)
      12% percent (interior locations)
   2. Species and Grade : Ipe (Brazilian Walnut) as indicated in the Wood Species Schedule
   3. Appearance : As indicated in the Wood Species Schedule
   4. Type/ thickness : Tongue and Groove (T-G) with ease edge, 3/4 " thickness.

   5. Decking layout : Sizes and spacing of decking boards is as indicated in the Architectural Drawings (See Hardwood Floor/Decking Layout). In addition, 1 board per 8 boards shall be randomly and slightly field-hewn with a broad chisel or broad engraving tool. The chisel /engraving tool shall slighlty cut the wood along the direction of the grain, creating a crest perpendicular to the grain when cut wood is lifted up. The edges and crest shall be sanded smooth to achieve a weathered and rustic look per GPT approval.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture. No nails are permited.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with Type 316 stainless steel.
B. Power-Driven Fasteners: CABO NER-272.
C. Wood Screws: ASME B18.6.1. Provide non-ferrous or stainless steel 316 type.
D. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)
E. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.9 METAL FRAMING STRAPS/ ANCHORS

A. General: Provide hot-dipped galvanized steel framing straps and anchors of structural capacity, type, and size indicated in the structural drawings and as recommendated by the manufacturer for the specific project condition and as follows:
   1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.

2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.10. TABIQUE WALL FRAMING

A. Existing Condtions: The existing tabique wall framing at the Flores house is covered with plaster and is hidden from view. Where selective and partial removal of the tabique wall is indicated, carefully remove the plaster coat to reveal the tabique wall framing system with the mansposteria infill material. Verify the existing framing condition. Based on exposed existing condition, provide a design-built shop drawings for the review by GPT representative to achieve all the following design parameters in a satisfactory manner:
   1. To carefully remove the portion of the tabique.wall as required. Removal effort could include the disassembling and salvage of selective ifit framing members deemed in good condition so that they can be reused in the tabique framing structure reconstruction.,
   2. To protect the tabique wall framing to remain. Protection could include the temporary bracing of the remaining tabique wall.
   3. To reconstruct and reconstitute the existing tabique framing structure and restore the tabique wall system after the adjacent new concrete wall is built. Provide bracing to the reconstructed tabique wall by anchoring to the adjacent new concrete wall with stainless steel fastener/anchor spacing not exceeding 12” oc., and not more than 6” from the top and/or bottom. The spacing indicated is a minimum requirement and is subjected to high winds structural design criteria as follows:
      a) Dead and live loads caused by positive and negative pressure of 175 mph basic wind speed, exposure category "C", Gust Factor = 1.66, Importance Factor = 1 as calculated in accordance with International Building Code, latest edition, ASCE 7, with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65.
   4. To provide barriers to mitigate water penetration and water seepage into the reconstructed tabique wall systems.

B. Based on approved design-built shop drawings, provide new merbau (ifit) framing members (with Janka Scale equal or more than 1,850 lbs) as required to complete the reconstruction and reconstitution of the tabique wall system, using non-ferrous non-magnetic metal fasteners such as stainless steel Type 316. No nails will be permited for the reconstruction work.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
   2. Published requirements of metal framing anchor manufacturer.

3. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction."
4. "Table 23-I-Q--Nailing Schedule" of the Uniform Building Code.

F. Use countersunk screws, unless otherwise indicated. Use finishing nails for interior finish work only. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

G. Use stainless-steel fasteners for rough carpentry at exterior locations, and hot-dipped galvanized fastgeners for rough carpnetry at covered or interior locations.

H. Countersink finishing nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD BLOCKING, SLEEPERS AND SHIMS

A. Install wood blocking, sleepers and shims where shown and/or if not shown, where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
1. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

B. Furring to Receive Cementboard: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring at 16 inches (406 mm) o.c., vertically.

3.4 WOOD FRAMING, GENERAL

A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. Install framing members of size and at spacing indicated.

C. Do not splice structural members between supports..

3.5 WALL AND PARTITION FRAMING

A. General: Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs; except single top plate may be used for non-load-bearing partitions. Screw or anchor plates to supporting construction, unless otherwise indicated.
1. For interior partitions and walls, provide 2-by-4-inch nominal- (38-by-89-mm actual-) size wood studs spaced 16 inches (406 mm) o.c., except where otherwise indicated or as required in the Partition Schedule (See Architectural Drawing).

B. Construct corners and intersections with 3 or more studs. Provide miscellaneous blocking and framing as shown and as required to support facing materials, fixtures, specialty items, and trim.
1. Provide continuous horizontal blocking at midheight of single-story partitions over 96 inches (2438 mm) high and multistory partitions, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.

C. Frame openings with multiple studs and headers. Provide screwed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
   1. For non-load-bearing partitions, provide double-jamb studs with headers not less than 4-inch nominal (89-mm actual) depth for openings 36 inches (900 mm) and less in width, and not less than 6-inch nominal (140-mm actual) depth for wider openings.
   2. For load-bearing walls, provide double-jamb studs for openings 72 inches (1800 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth shown or, if not shown, as recommended by AFPA's "Manual for Wood Frame Construction."

D. Provide in-plane bracing in walls, at locations indicated, full-story height, unless otherwise indicated. Provide one of the following:
   1. Performance-rated structural-use panels, not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.

E. Provide kickers or bracing in walls, at locations indicated, full-story height, Provide 2x4 diagonal wood kicker or brace at 4'-0" oc.

F. Tabique Wall Framing: Comply with approved design-built solution to reconstruct and/or reconstitute the tabique wall system. If required by unforseen field conditions, make necessary modifications subject to strict compliance with design parameters including structural performance, and to the satisfaction of the GPT representative.

3.6 FLOOR JOIST FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists as follows:
   1. Where supported on wood members, by screwing or by using metal framing anchors.
   2. Where framed into wood supporting members, by using wood ledgers as shown or, if not shown, by using metal joist hangers.

B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches (76 mm) and do not embed more than 4 inches (102 mm).

C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches (1200 mm).

D. Do not notch in middle third of joists; limit notches to 1/6 depth of joist, 1/3 at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches (50 mm) from top or bottom.

E. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist at ends of joists unless screwed to header or band.

F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches (102 mm) or securely tie opposing members together. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist over supports.

G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch (6-by-32-mm) metal strap anchors spaced not more than 96 inches (2438 mm) o.c. extending over and fastening to 3 joists. Embed anchors at least 4 inches (100 mm) into masonry with ends bent at right angles 4 inches (100 mm) into grouted masonry.

H. Under jamb studs at openings, provide solid blocking between joist.

I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
   1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

J. Provide bridging between joists at both ends of the joist and as indicated in the structural drawings..

3.7 RAFTER AND CEILING JOIST FRAMING

A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
   1. Where ceiling joists are at right angles to rafters, provide additional short joists perpendicular to rafters from wall plate to first joist; screw to ends of rafters and to top plate and screw to first joist or anchor with framing anchors or metal straps. Provide 2-by-4-inch nominal- size purlins spaced 16 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

C. Provide collar beams (ties) as shown or, if not shown, provide 1-by-6-inch nominal- size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and screw to rafters.

D. Provide special fasica trim as shown for eaves and overhangs..

3.8 TIMBER FRAMING

A. Install timber framing with crown edge up and provide not less than 4 inches (102 mm) of bearing on supports. Provide continuous members, unless otherwise indicated; tie together over supports if not continuous.

B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch (13-mm) air space at sides and ends of wood members.

C. Where built-up beams or girders of 2-inch nominal- dimension lumber on edge are shown, fasten together with 2 rows of 20d screws spaced not less than 32 inches o.c. Locate one row near top edge and other near bottom edge. Locate end joints in members over supports; for continuous members, stagger ends at quarter points between supports.

D. Install wood posts using metal straps/ plates and anchors/bolts indicated.

E. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative Thompson Sealer for 15 minutes.

3.9 FINISHING

A. Apply water-repellent sealer coat to all hardwood surfaces. At end grains, provide 2 applications to seal the end grains.
   1. Do not apply stains or oils to Merbau or Ipe hardwood species. Where stains or oils have been applied, wipe off excess stains or oils immediately. Donot rub the stains or oils into the dense hardwood.

B. Exposed or Visible Locations: Apply wax coat to the desired sheen and as approved by GPT.

END OF SECTION 06100

SECTION 06401

EXTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior standing and running trims
2. Exterior frames and jambs/casing trims
3 Exterior shutter assemblies
4. Exterior siding and trims
5 Exterior railing (Flores house only).
6. Shop priming of exterior woodwork
7. Shop finishing of exterior woodwork

1.3 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.2.1	Square and Hex Bolts and Screws Inch Series
ANSI B18.6.1	Wood Screws (Inch Series)

ASME INTERNATIONAL (ASME)

ASME/ANSI B18.2.2	Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 687	High-Strength Nonheaded Steel Bolts and Studs

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI QS	Architectural Woodwork Quality Standards and Quality Certification Program

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C9	Plywood - Preservative Treatment by Pressure Process
AWPA M2	Inspection of Treated Wood Products

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9	Cabinet Hardware (BHMA 201)

HARDWOOD PLYWOOD & VENEER ASSOCIATION (HPVA)

ANSI/HPVA HP-1	Hardwood and Decorative Plywood

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA RMIHC	Rules for the Measurement and Inspection of Hardwood and Cypress

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

NWWDA I.S.4	Water-Repellent Preservative Non-Pressure Treatment for Millwork

U.S. DEPARTMENT OF COMMERCE (DOC)

PS-1	Construction and Industrial Plywood
PS-20	American Softwood Lumber Standard
PS-58	Basic Hardboard

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA WLGR	Western Lumber Grading Rules

1.4 DEFINITIONS

A. Exterior architectural woodwork includes wood blocking and shims for installing woodwork items unless concealed within other construction prior to woodwork installation.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Wood-preservative-treatment data from chemical treatment manufacturer. Include certification of chemical solution and affirm that it complies with indicated treatment standard.

E. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of blocking including concealed blocking and reinforcing specified in other Sections.
   3. Apply WIC Certified Compliance Label to first page of shop drawings.

F. Samples for verification of the following:

   1. Lumber for transparent finish (exterior wood stain), 50 sq. in. (300 sq. cm), for each species, with one-half of exposed surface finished with specified coating.

2. Lumber and panel products for shop-applied opaque finish, 8 by 10 inches (200 by 250 mm) for panels and 50 sq. in. (300 sq. cm) for lumber, for each finish system and color, with one-half of exposed surface finished..

G. Product certificates signed by woodwork manufacturers certifying that their products comply with specified requirements.

H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

J. Mockups: Provide one mockup for each Shutter Type as indicated in the Shutter Schedule for each house, complete with associated hardware sets except where the shutter type is duplicated in another house. Make necessary adjustments as required (including adjustments to the hardware types and sizes) to promote smooth and uninterupted closing and opening of the shutters, and better performance during high wind conditions.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

B. Installer Qualifications: Arrange for exterior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.

C. Quality Standard: Except as otherwise indicated, comply with the following standard:

1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of exterior architectural woodwork, construction, finishes, and other requirements.

a. Provide AWI Certification Labels or Certificates of Compliance indicating that woodwork meets requirements of grades specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. All wood deliveries shall be provided with clearly marked labels specifying the recipent name of the house as indicated in the Wood Species Schedule Drawing.

B. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration. Do not store finish woodwork in the open or exposed to the rain. Stack lumber, and other panels level to prevent warping. Provide for air circulation within and around stacks and under non-staining temporary covering

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Obtain and comply with woodwork manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage.

B. Weather Limitations: Proceed with installation of exterior woodwork only when existing and forecasted weather conditions will permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

C. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Verify locations of concealed framing, blocking, and reinforcements that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.9 COORDINATION

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

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

A. Available Fabricators: Subject to compliance with requirements, fabricators offering exterior architectural woodwork that may be incorporated in the Work include, but are not limited to, the following:

B. Fabricators: Subject to compliance with requirements, provide the following exterior architectural woodwork:

i) Exterior Shutters Assemblies: Luxbaum Windows + Doors or approved equal.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade, species and appearance indicated in the Wood Species Schedule (located in the drawings) and, where the following products are part of exterior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Nonpressure Process: Comply with NWWDA I.S.4 and the following for woodwork items indicated to receive water-repellent preservative treatment.

1. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate (IPBC) as its active ingredient.

2. Water-Repellent Preservative/Insecticide: NWWDA-tested and -accepted preservative and water-repellent formulation containing 3-iodo-2-propynyl butyl carbamate (IPBC) as its active ingredient, combined with an insecticide containing chlorpyrifos as its active ingredient.

B. Preservative Treatment by Pressure Process: Comply with AWPA C2 (lumber) and AWPA C9 (plywood) and the following for woodwork items indicated to receive pressure preservative treatment. Mark each treated item with the AWPB or SPIB Quality Mark Requirements.

1. Preservative Chemicals: Pressure-impregnate woodwork with preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

2. Pressure-treat aboveground items with preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). Kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 and 15 percent.

C. Extent of Preservative Treatment with either Insecticide or Pressure Process: Treat each item of exterior woodwork except the wood members that can be documented and labelled or marked to be from the following wood species:

1. Merbau or Ifit (Intsia Bejuga)
2. Ipe (Brazilian Walnut)
3. Redwood (Heartwood-clear all hearts, no sapwood)

2.4 INSTALLATION MATERIALS

A. Blocking and Shims: Ifit or Merbau lumber.

B. Screws: Select material, type, size, and finish required for each use, nonferrous metal or non-magnetic stainless steel (316), unless otherwise indicated. Comply with ASME B18.6.1 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.

C. Nails: No nails are allowed on any exterior woodwork except for the following: Stainless steel (316) or non-ferrous type gate nails. Select type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

1. Stainless-steel nails.
2. Aluminum/non-ferrous nails.
3. Any material indicated above.

D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts, unless otherwise indicated. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.5 FABRICATION, GENERAL

A. Wood Moisture Content: 15% kiln dried (KD) or less. Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of solid-wood (lumber) members 3/4 inch (19 mm) thick or less: 1/16 inch (1.5 mm).
2. Edges of rails and similar members more than 3/4 inch (19 mm) thick: 1/8 inch (3 mm).

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop-cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and seal edges with a water-resistant coating suitable for exterior applications.

2.6 EXTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 300.
B. Grade: Premium.
C. Backout or groove backs of flat trim members, kerf backs of other wide, flat members, except for members with ends exposed in finished work.
D. Assemble casings in plant except where limitations of access to place of installation require field assembly.
E. Wood Species: Merbau (Ifit). See Wood Species Schedule (located in the drawings).

2.7 EXTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 300.
B. Grade: Premium.
C. Backout or groove backs of flat trim members, kerf backs of other wide, flat members, except for members with ends exposed in finished work.
D. Assemble casings in plant except where limitations of access to place of installation require field assembly.
E. Wood Species: Merbau (Ifit). See Wood Species Schedule (located in the drawings).
1. Sort lumber stock to eliminate flat-sawed pieces of hardwood whose exposed, flat surfaces are more than 3 inches (75 mm) wide.

2.8 EXTERIOR ORNAMENTAL WORK /RAILINGS FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 700.
B. Grade: Premium.
C. Wood Species: Merbau (Ifit) See Wood Species Schedule (located in the drawings).

2.9 EXTERIOR ORNAMENTAL WORK/RAILINGS FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 700.
B. Grade: Premium.
C. Wood Species: Merbau (Ifit) See Wood Species Schedule (located in the drawings).

2.10 EXTERIOR FRAMES AND JAMBS/CASING FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 900.
B. Grade: Premium.
C. Wood Species: Merbau(Ifit). See Wood Species Schedule (located in the drawings).

2.11 EXTERIOR FRAMES AND JAMBS/CASING FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 900.
B. Grade: Premium.
C. Wood Species: Merbau(Ifit). See Wood Species Schedule (located in the drawings).

2.12 EXTERIOR SHUTTER ASSEMBLY WITH TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 1200.
B. Grade: Premium.
C. Wood Species: Merbau(Ifit). See Wood Species Schedule (located in the drawings).
D. Provide assocated shutter hardware sets as indicated in the Shutter Schedule (See Architectural Drawings) for each house. The hardware items consist of the following:

a) Hinges: 4 X 4 Mortise Hinges (US10B/613)
b) Hinges: 5 X 5 Mortise Hinges (US10B/613) only at Flores house
c) 4" heavy duty barrel bolts wth 7/8" throw/receiver (US10B/613)
d) Door bolt with thumbturn (No trim/cylinder on other side) (US10B/613)
e) 6" J-Bolt with eye-bolt (Painted)
f) Stormkeeper hot dipped galvanized metal z-clips
g) Merbau (Ifit) wood components as shown in the Drawings

2.13 EXTERIOR SHUTTER ASSEMBLY WITH OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 1200.
B. Grade: Premium.
C. Wood Species: Merbau(Ifit). See Wood Species Schedule (located in the drawings).
D. Provide assocated shutter hardware sets as indicated in the Shutter Schedule (See Architectural Drawings) for each house. The hardware items consist of the following:

a) Hinges: 4 X 4 Mortise Hinges (US10B/613)
b) 4" heavy duty barrel bolts wth 7/8" throw/receiver (US10B/613)
c) Door bolt with thumbturn (No trim/cylinder on other side) (US10B/613)
d) 6" J-Bolt with eye-bolt (Painted)
e) Stormkeeper hot dipped galvanized metal z-clips
f) Merbau (Ifit) wood components as shown in the Drawings

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

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

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) for plumb and level.

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Preservative-Treated Lumber (if used): Where cut or drilled in field, treat cut ends with preservative solution used in original treatment by brushing, spraying, dipping, or soaking.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where necessary. Stagger joints in adjacent and related members.

1. Install standing and running trim with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.

G. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill fastener holes with matching filler where exposed.

H. Field apply sealer/ prime coat prior to applying specified finish coats. At exposed field-cut surfaces, provide 2 coats of field applied sealer/primer coat prior to applying finish coat.

3.3 ADJUSTING AND CLEANING

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

B. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 06401

SECTION 06402

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, and Division 8 Stile and Rail Wood Doors, Section 08212 apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Wood cabinets, shelvings, and tops
2. Wood wall trims and window casing trims
3. Interior ornamental ceiling woodwork, and light valances
4. Wood doors assemblies including frames, jambs/casing trims.
5. Shop finishing of woodwork

1.3 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.2.1	Square and Hex Bolts and Screws Inch Series
ANSI B18.6.1	Wood Screws (Inch Series)

ASME INTERNATIONAL (ASME)

ASME/ANSI B18.2.2	Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 687	High-Strength Non-headed Steel Bolts and Studs

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI QS	Architectural Woodwork Quality Standards and Quality Certification Program

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA M2	Inspection of Treated Wood Products

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9	Cabinet Hardware (BHMA 201)

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA RMIHC	Rules for the Measurement and Inspection of Hardwood and Cypress

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

NWWDA I.S.4	Water-Repellent Preservative Non-Pressure Treatment for Millwork

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA WLGR	Western Lumber Grading Rules

1.4 DEFINITIONS

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

1.5 SUBMITTALS

A. Product data for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
B. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
C. Samples for initial selection of the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
   1. Shop-applied transparent finishes.
   2. Shop-applied opaque finishes.
D. Samples for verification of the following:
   1. Lumber with or for transparent finish, 50 sq. in. (300 sq. cm), for each species and cut, finished on one side and one edge.
   2. Lumber and panel products with shop-applied opaque finish, 8 by 10 inches (200 by 250 mm) for panels and 50 sq. in. (300 sq. cm) for lumber, for each finish system and color, with one-half of exposed surface finished.
   3. Exposed cabinet hardware, one unit for each type and finish.
E. Product certificates signed by woodwork fabricator certifying that products comply with specified requirements.
F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities, experience, and capabilities of their woodworking shop. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service and on-island (Guam)

performance, as well as sufficient production capacity to produce required units in a fully equiped woodworking shop without delaying the Work.

B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.

C. Quality Standard: Except as otherwise indicated, comply with the following standard:
   1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements..

E. Mockup: Prior to fabricating or installing interior architectural woodwork, construct mockup as required in the Drawings and/or as requested by the Architect, to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockup of the size indicated, using materials indicated for final unit of work, and complying with the following requirements.
   1. Locate mockup on site in the location indicated or, if not indicated, as directed by Architect.
      a. When directed, demolish and remove mockup from Project site.
      b. Accepted mockup in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliveries of woodwork and related work shall be provided with clearly marked labels specifying the recipent name of the house as indicated in the Wood Species Schedule and elsewhere in the drawings.

B. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

C. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in covered and well-ventilated areas whose environmental conditions meet requirements specified in "Project Conditions."

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Obtain and comply with woodwork fabricator's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork will be within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
   2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.9 COORDINATION

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

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

2.1.1 Wood Species, Grade, Appearance and Finishes

Provide species, grades, appearance and finishes as listed in the Wood Species Schedule for each type of interior woodwork and as follows:

TABLE OF GRADES FOR WOOD USED IN INTERIOR ARCHITECTURAL WOODWORK

Grading Rules	Species	Grade
SCMA GSC Standard Specification	Merbau(Ifit)	1 or Better
RIS GCRL Standard Specification	Redwood	Heartwood, Clear All Hearts
NHLA RMIHC rules	Merbau(Ifit)	1 or Better

2.1.2 Moisture Content: Wood used in interior architectural woodwork shall not have a moisture content greater than 12%.

2.1.3 Sizes and Patterns of Wood Products

Yard and board lumber sizes shall conform to PS-20. Provide shaped lumber and millwork in the patterns indicated and standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the applicable standard.

2.1.4 Standing and Running Trims: Run trim, except window stools and aprons with hollow backs.

2.1.5 Water-repellent Sealer: A penetrating wood sealer shall be applied prior to finish coat. At cut ends, a wood sealer shall be applied to the exposed end grains of the wood.

2.2 WOODWORK FABRICATORS

A. Available Fabricators: Subject to compliance with requirements, fabricators offering interior architectural woodwork that may be incorporated in the Work include, but are not limited to the following:

1) Wood Door Assemblies: Luxbaum Windows + Doors or approved equal.

2.3 CABINET HARDWARE AND ACCESSORY MATERIALS

A. General: Provide cabinet hardware and accessory materials associated with cabinetwork,
B. Cabinet Hardware Schedule: Refer to the schedule at end of this Section for cabinet hardware required for cabinetwork.
C. Cabinet Hardware Standard: Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA code number indicated and as selected by the Architect from any one of the following manufacturer's finishes:
   1. Dark, Oxidized, Satin Bronze, Oil Rubbed, on Bronze Base: BHMA 613 and matching Architect's sample.

E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.

2.4 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Hardwood lumber of Merbau (Ifit) species, air or kiln dried to less than 15 percent moisture content.

B. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.

C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements. Use finishing nails where nails are exposed.

D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:
   1. Grade: Custom.

B. Wood Moisture Content: Not exceeding moisture content of 12%.

C. Fabricate woodwork to dimensions, profiles, and details indicated in the Drawings for each house. Ease edges to radius indicated for the following:
   1. Corners of cabinets and edges of solid-wood (lumber) members 3/4 inch (19 mm) thick or less: 1/16 inch (1.5 mm).
   2. Edges of rails and similar members more than 3/4 inch (19 mm) thick: 1/8 inch (3 mm).

D. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Trial fit assemblies at the fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on approved shop drawings before disassembling for shipment.

E. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

F. Install glass to comply with applicable requirements of Division 8 Section "Glazing" and of FGMA "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.6 WOOD CABINETS (CABINETWORK) FOR TRANSPARENT (SEALER /WAX) FINISH

A. Quality Standard: Comply with AWI Section 400 requirements for wood cabinets.
   1. Grade: Custom.

B. AWI Type of Cabinet Door Construction: As indicated in the Drawings and/or the following :
   1. Flush overlay.
C. Wood Species for Exposed Surfaces: Hardwood: Merbau (Ifit)
   1. Grain Matching: As required by Cabinetwork drawing (See Architectural Drawings)for each House indicated.
D. Semiexposed Surfaces: Hardwood: Merbau (Ifit)

2.7 INTERIOR ORNAMENTAL WORK (STANDING /RUNNING TRIMS) FOR TRANSPARENT (SEALER /WAX) FINISH

A. Quality Standard: Comply with AWI Section 700.
   1. Grade: Custom
B. Wood Species: Merbau (Ifit), 1 or Better, S4S

2.8 INTERIOR ORNAMENTAL WORK (STANDING /RUNNING TRIMS) FOR OPAQUE STAIN FINISH

A. Quality Standard: Comply with AWI Section 700.
   1. Grade: Custom.
B. Wood Species: Redwood, Heartwood-Clear all Hearts (No Sapwood), S4S

2.9 INTERIOR ORNAMENTAL CEILING WOODWORK FOR OPAQUE STAIN /PAINT FINISH

A. Quality Standard: Comply with AWI Section 700 or other relevant Sections..
   1. Grade: Custom.
B. Wood Species: Redwood, Heartwood-Clear All Heart (No Sapwood), S4S

2.10 INTERIOR FRAMES AND JAMBS/ CASING TRIMS FOR TRANSPARENT (SEALER/WAX) FINISH

A. Quality Standard: Comply with AWI Section 700.
   1. Grade: Custom.
B. Wood Species: Merbau (Ifit), 1 or Better, S4S

2.11 INTERIOR FRAMES AND JAMBS/ CASING TRIMS FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 700.
   1. Grade: Custom.
B. Wood Species: Merbau (Ifit), 1 or Better, S4S

2.12 WOOD DOOR/ FRAME ASSEMBLIES

A. See Related Section: Stile and Rail Wood Doors, Section 08212

2.13 FIELD FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
   1. Grade: Provide finishes of same grades as items to be finished.
B. General: The entire finish of interior architectural woodwork is specified in this Section, regardless of whether shop applied or applied after installation.
   1. Field Finishing: The extent to which the final finish is applied to architectural woodwork at the fabrication shop is the Contractor's option, except shop apply at least the prime/base coat to the greatest extent possible before delivery.
   2. Refer to Division 9 Section "Painting" for final finishing of installed architectural woodwork.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
   1. Backpriming: Apply one coat of sealer or primer compatible with finish coats to concealed surfaces of woodwork, including backs of trim, cabinets, paneling, and ornamental work and the underside of countertops.
   2. Field-apply 2 backprime coats to back of in-place wood formwork at the countertops.

E. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
   1. Apply vinyl washcoat sealer after staining and before filling.

E. Finishes: Comply with the Finish Legend and elsewhere in the Drawings.
   1. Do not apply opaque stains/oils to hardwoods exceeding 1600 Janka Scale, including Merbau (Ifit) and Ipe (Brazilian Walnut). If applied, wipe off excess stains/oils immediately.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

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

C. Verify that the back walls of base cabinets, running trims and blocking have been made of termite-resistant wood species. Verify by feeding wood scrapes to known termite colonies.

D. Verify substrate floor and wall is level, plumb and true and does not cause uneven and noticable gaps between the finish installation and the substrate. Correct all unsatisfactory conditions prior to commencing with the installation work.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm)

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where necessary. Stagger joints in adjacent and related members. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
   1. Install standing and running trim with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.

F. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

G. Tops: Anchor securely to base units and other support systems as indicated. Caulk space between backsplash and wall with specified sealant.
1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. At hard-tile countertops with cement mix topping, backprime wood contact surfaces. Provide in-place cementboard formwork and welded wire mesh to control shrinkage. Provide a 3,000 psi concrete mix with 3/8" pea gravel/sand/cement/water mix. Upon curing, provide hard tile set on a mudset, and grout all joints. Seal grout joints with a water-repellent sealer.
3. Secure back and side splashes to tops and caulk all perimeter gaps including the gap between the backand side splash and the top.

I. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop. Where even gaps exist at joints, provide continuous caulking at the joint to provide an acceptable appearance.

3.3 ADJUSTING AND CLEANING

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

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion

3.5 CABINET HARDWARE AND ACCESSORY SCHEDULE

A. BHMA numbers are used below to designate hardware requirements, except as otherwise indicated.

B. Available Products: Subject to compliance with requirements and as selected by the Architect from the manufacturer's full line of cabinet hardware and accessory, cabinet hardware and accessory that may be incorporated in the Work include, but are not limited to, the following:

C. Flores House:
1. Concealed (European Type) Hinges: B01602, Chrome Plated US26D.
2. Door and Drawer Pulls: <u>3" Scroll Edge Pull</u>, One piece,
   3" center to center, antique bronze US10B.
3. Roller Catches: B03033, US10B
   (Install at Upper Cabinet /Pantry Cabinet doors only)
4. Drawer Slides: Side-mounted, zinc-plated steel drawer slides with steel ball bearings, complying with BHMA A156.9, Grade 1 and rated for the following loads: Box Drawer Slides: 100 lbf (440 N).
5. Adjustable Shelf Hardware: Shelf Rest or Clip, antique bronze US10B. B04013.

D. Lujan House:
1. Concealed (European Type) Hinges: B01602. Chrome Plated, US26D
2. Door and Drawer Pulls: "Football" Knob, One piece metal, antique bronze US10B.
3. Roller Catches: B03033, US10B (Install at Upper Cabinet /Pantry Cabinet doors only)
4. Drawer Slides: Side-mounted, zinc-plated steel drawer slides with steel ball bearings, complying with BHMA A156.9, Grade 1 and rated for the following loads: Box Drawer Slides: 100 lbf (440 N).
5. Adjustable Shelf Hardware: Shelf Rest or Clip, antique bronze US10B. B04013.

E. Chargulaf House:
1. Concealed (European Type) Hinges: B01602. Chrome Plated US26D
2. Door and Drawer Pulls: 3 3/4 " Martini Pull, One piece metal, 3 3/4 " Center to center, antique bronze US10B.
3. Roller Catches: B03033, US10B (Install at Upper Cabinet /Pantry Cabinet doors only)
4. Drawer Slides: Side-mounted, zinc-plated steel drawer slides with steel ball bearings, complying with BHMA A156.9, Grade 1 and rated for the following loads: Box Drawer Slides: 100 lbf (440 N).
5. Adjustable Shelf Hardware: Shelf Rest or Clip, antique bronze US10B. B04013.

F. Meno House:
1. Concealed (European Type) Hinges: B01602. Chrome Plated US26D
2. Door and Drawer Pulls: 3 3/4 " Martini Pull, One piece metal, 3 3/4 " Center to center, antique bronze US10B.
3. Roller Catches: B03033, US10B (Install at Upper Cabinet /Pantry Cabinet doors only)
4. Drawer Slides: Side-mounted, zinc-plated steel drawer slides with steel ball bearings, complying with BHMA A156.9, Grade 1 and rated for the following loads: Box Drawer Slides: 100 lbf (440 N).
5. Adjustable Shelf Hardware: Shelf Rest or Clip, antique bronze US10B. B04013.

END OF SECTION 06402

SECTION 07141

FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	Concrete Aggregates
ASTM C 836	High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use With Separate Wearing Course
ASTM D 1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.2 PERFORMANCE REQUIREMENTS

Provide waterproofing that prevents the passage of liquid water under hydrostatic pressure and complies with physical requirements of ASTM C 836 as demonstrated by testing performed by an independent testing agency of manufacturer’s current waterproofing formulations.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.3.1 Product Data

a. Fluid-applied membrane
b. Membrane primer
c. Solvent
d. Moisture meter
e. Bond breaker

Submit material description and physical properties, application details, and recommendations regarding shelf life, application procedures, and precautions on flammability and toxicity.

1.3.2 Samples

3” x 6” minimum size, of each waterproofing material required for Project.

1.3.3 Certificate of Compliance

Installer certificates signed by manufacturer certifying that Installers comply with following requirements:

a. Installer Qualifications: Engage an experienced Installer who is certified in writing by waterproofing manufacturer as qualified to install manufacturer’s waterproofing and who has completed similar waterproofing to that indicated for this project.

b. Manufacturer Qualifications: Engage a firm experienced in manufacturing cold fluid-applied waterproofing similar to that indicated for this project and that has a record of successful in-service performance.

c. Single-Source Responsibility: Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing waterproofing.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver waterproofing materials in manufacturer's original, unopened containers, with labels intact and legible. Containers of materials covered by a referenced specification number shall bear the specification number, type, and class of the contents. Deliver materials in sufficient quantity to continue work without interruption. Store and protect materials in accordance with manufacturer's instructions, and use within their indicated shelf life. When hazardous materials are involved, adhere to special precautions of the manufacturer, unless precautions conflict with local, state, and federal regulations. Promptly remove from the site materials or incomplete work adversely affected by exposure to moisture or freezing. Store materials on pallets and cover from top to bottom with canvas tarpaulins.

1.5 ENVIRONMENTAL CONDITIONS

Apply materials when ambient temperature is 40 degrees F or above for a period of 24 hours prior to the application and when there is no rain, fog, mist, surface moisture, visible dampness on the substrate surface, or when relative humidity exceeds 85 percent. Apply materials when air temperature is expected to remain above 40 degrees F during the cure period recommended by the manufacturer. Moisture test for substrate is specified under paragraph entitled "Moisture Test." Work may be performed within heated enclosures, provided the surface temperature of the substrate is maintained at a minimum of 40 degrees F for 24 hours prior to the application of the waterproofing, and remains above that temperature during the cure period recommended by the manufacturer. Maintain adequate ventilation during application and through complete curing of waterproofing materials.

PART 2 PRODUCTS

2.1 FLUID-APPLIED MEMBRANE

Provide waterproofing materials as recommended by manufacturer to be fully compatible with and able to develop bond to substrate under conditions of service and application required, as demonstrated by waterproofing manufacturer based on testing and field experience.

2.1.1 Single Component Modified Polyurethane

Subject to compliance with performance and physical requirements of ASTM C836, the manufacturer’s printed physical requirements as certified by a qualified independent testing agency for application on conrete roof slab, Mult-I-Thane 4556-75 mils (Carlisle or equal).

2.2 MEMBRANE PRIMER

Manufacturer's standard factory-formulated epoxy primer as recommended by the fluid-applied membrane manufacturer unless specifically prohibited by the manufacturer of the fluid-applied membrane.

2.3 SEALANT

Multicomponent polyurethane sealant complying with ASTM C920 Type M, Class 25, Grade NS for sloping and vertical applications or Grade P for deck applications. Use NT and as recommended by manufacturer for substrate and joint conditions and for compatibility with waterproofing.

2.3.1 Backer Rod

Closed-cell polyethylene foam.

2.4 SHEET FLASHING

50-mil minimum, nonstaining uncured sheet neoprene.

2.4.1 Adhesive

Manufacturer's recommended contact adhesive.

2.6 BOND BREAKER

As recommended by the fluid-applied membrane manufacturer. Bond breaker shall not interfere with the curing process or other performance properties of the fluid-applied membrane.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions under which waterproofing systems will be applied, with Installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

a. Do not proceed with installation until after the minimum concrete curing period recommended by waterproofing manufacturer. Verify that the concrete substrate is properly cured.

b. Verify substrate is visibly dry and free of moisture and curing compound. Test for capillary moisture by the plastic sheet method according to ASTM D 4263.

c. Verify adhesion of Portland cement plaster and patching compound, if any for proper adhesion to the substrate. Do not proceed with waterproof application until all unsatisfactory conditions are corrected.

d. Verify all roof slopes to slope down to the roof/floor drains/scuppers at low point. Where roof/floor drains are not located at low point of roof/floor, provide patching compound to build up the roof/floor slopes such that the roof/floor drains are located at the low points. Verify and eliminate undesired potential ponding spots on the roof/floor. Do not proceed with the waterproof application until all unsatisfactory conditions are corrected.

3.2 PREPARATION

Coordinate work with that of other trades to ensure that components to be incorporated into the waterproofing system are available when needed. Inspect and approve surfaces immediately before application of waterproofing materials. Remove laitance, loose aggregate, sharp projections, grease, oil, dirt, curing compounds, and other contaminants which could adversely affect the complete bonding of the fluid-applied membrane to the concrete surface.

3.2.1 Flashings

Make penetrations through sleeves in concrete slab watertight before application of waterproofing. After flashing is completed, cover elastomeric sheet with fluid-applied waterproofing during waterproofing application.

3.2.1.1 Drains

Make drain flanges flush with surface of structural slab. Apply a full elastomeric sheet around the drain, with edges fully adhered to drain flange and to structural slab. Do not adhere elastomeric sheet over joint between drain and concrete slab. Do not plug drainage or weep holes. Cover elastomeric sheet with fluid-applied waterproofing during waterproofing application. Lap elastomeric sheet a minimum of 4 inches onto concrete slab.

3.2.1.2 Penetrations and Projections

Flash penetrations and projections through structural slab with an elastomeric sheet adhered to the concrete slab and the penetration. Leave elastomeric sheet unadhered for one inch over joint between penetration and concrete slab. Adhere elastomeric sheet a minimum of 4 inches onto horizontal deck.

3.2.2 Cracks and Joints

Prepare visible cracks and joints in substrate to receive fluid-applied waterproofing membrane by placing a bond breaker and an elastomeric slip sheet between membrane and substrate. Cracks that show movement shall receive a 2 inch bond breaker followed by an elastomeric sheet adhered to the deck. Nonmoving cracks shall be double coated with fluid-applied waterproofing.

3.2.3 Priming

Prime surfaces to receive fluid-applied waterproofing membrane. Apply primer as required by membrane manufacturer's printed instructions.

3.3 SPECIAL PRECAUTIONS

Protect waterproofing materials during transport and application. Do not dilute primers and other materials, unless specifically recommended by materials manufacturer. Keep containers closed except when removing contents. Do not mix remains of unlike materials. Thoroughly remove residual materials before using application equipment for mixing and transporting materials. Do not permit equipment on the project site that has residue of materials used on previous projects. Use cleaners

only for cleaning, not for thinning primers or membrane materials. Ensure that workers and others who walk on cured membrane wear clean, soft-soled shoes to avoid damaging the waterproofing materials.

3.4 APPLICATION

Over primed surfaces, provide a uniform, wet, monolithic coating of fluid-applied membrane, 60 mils thick, plus or minus 5 mils by following manufacturer's printed instructions. Apply material by trowel, squeegee, roller, brush, spray apparatus, or other method recommended by membrane manufacturer. Check wet film thickness as specified in paragraph entitled "Film Thickness" and adjust application rate as necessary to provide a uniform coating of the thickness specified. Where possible, mark off surface to be coated in equal units to facilitate proper coverage. At expansion joints, control joints, prepared cracks, flashing, and terminations, carry membrane over preformed elastomeric sheet in a uniform 60 mil thick, plus or minus 5 mils, wet thickness to provide a monolithic coating. If membrane cures before next application, wipe previously applied membrane with a solvent to remove dirt and dust that could inhibit adhesion of overlapping membrane coat. Use solvent recommended by the membrane manufacturer, as approved.

3.4.1 Drainage Course

Place drainage course where shown after flood tests are completed and concrete protection slab or wearing course is ready to be installed.

3.5 FIELD QUALITY CONTROL

3.5.1 Moisture Test

Prior to application of fluid-applied waterproofing, measure moisture content of substrate with a moisture meter in the presence of the Contracting Officer. An acceptable device is the Delmhorst Moisture Meter, Model BD7/2E/CS, Type 21 E. Similar meters by other manufacturers, which are suitable for the purpose, may be used as approved by the Contracting Officer. Do not begin application until meter reading indicates "dry" range.

3.5.2 Film Thickness

Measure wet film thickness every 100 square feet during application by placing flat metal plates on the substrate or using a mil-thickness gage especially manufactured for the purpose.

3.5.3 Flood Test

After application and curing is complete, plug drains and fill waterproofed area with water to a depth of 2 inches. A minimum 48 hour cure time, or longer cure time if recommended by the membrane manufacturer, shall be required prior to flood testing. Allow water to stand 24 hours. Test watertightness by measuring water level at beginning and end of the 24 hour period. If water level falls, drain water, allow installation to dry, and inspect. Make repairs or replace as required and repeat the test. Work shall not proceed before approval of repairs or replacement.

3.6 INFORMATION CARD

Furnish a typewritten card containing information listed in the attached Form l, framed in a watertight frame under clear glass or plastic for each waterproofing installation. Furnish framed card and duplicate card.

FORM 1
FLUID-APPLIED WATERPROOFING SYSTEM COMPONENTS

1. Contract Number

2. Date Work Completed

3. Project Specification Designation

4. Substrate Material

5. Slope of Substrate

6. Waterproofing
   a. Membrane
   b. Sealant
   c. Elastomeric Sheet
   d. Materials Manufacturer(s)

7. Protection Board
   a. Type
   b. Thickness
   c. Manufacturer's Name

8. Protection Slab
   a. Material
   b. Thickness
   c. Support
   d. Joint System

9. Wearing Course
   a. Type
   b. Slope
   c. Joint System
   d. Sealant/Gasket Type

10. Wearing Surface Type
    Manufacturer's Name

11. Statement of Compliance or Exception

Contractor's Signature Date Signed

Inspector's Signature Date Signed

END OF SECTION 07141

SECTION 07142

ALUMINUM BITUMINOUS ROOF COATING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D -2824 Type III (Non-Asbestos)	Standard Specification for Alumium Pigmented Asphalt Roof Coatings, Non Fibered and Fibered without Asbestos
ASTM D-3805	Standard Guide for Aplication of Aluminum Pigmented Asphalt Roof Coatings
ASTM D-962 Type II	Standard Specification for Aluminum Powder and Paste Pigments for Paints
TT-C-498C (except Non-Asbestos)	Federal Specification: Coating Compounds, Bituminous, Fillers, Solvent Type, Aluminum Pigmented

1.2 QUALITATIVE REQUIREMENTS

The roof coating shall be based on solvent cutback petroleum asphalts. The roof coating shall be a uniform mixture of petroleum asphalt, aluminum pigment conforming to ASTM D 962, filler, solvent, and additives processed to meet the requirements of this specification. The coating shall be asbestos-free.

1.2.1 Application Properties.

The material shall be capable of uniform application without difficulty by brush, heavy duty sprayer, or roofer's mop at a rate of approximately 1 gallon per 60SF at any temperature from 5 degrees to 60 degrees C.

1.2.2 Behavior at 71 degrees C

Test pieces prepared and exposed as specified in 1.3.3 shall not slip or sag more than 6 mm on corrugated metal roofing. The reverse side of the roofing shall not show penetration of the coating on more than 5 percent of the panel.

1.2.3 Behavior at 0 degrees C

Metal test pieces as specified in 1.3.4 shall show no cracking of the coating and no separation of metal and coating.

1.2.4 Weather Resistance

The roof coating, when applied according to the manufacturer's instructions, shall not show signs of cracking, blistering or peeling, or a loss of greater than 10 percent of the initial reflectivity when tested as in 1.3.5.

1.2.4 Salt Fog Resistance

The roof coating, when applied according to the manufacturer's instructions, shall protect a steel panel from pitting or rusting after being exposed to a 5 percent salt fog for 168 hours.

1.2.5 Quantitative Requirements

The roof coating shall meet the following requirements in table I.

TABLE I. Quantitative Requirements

Characteristics	Minimum	Maximum	Paragraph Reference
Nonvolatile content, percent by weight of coating	50	---	
Moisture content, percent by weight of coating	---	0.2	
Consistency, K.U.	100	130	
Reflectivity, percent	50	---	

1.3 QUALITY ASSURANCE

Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. All tests shall be conducted in accordance with the methods specified in Table I. Unless otherwise specified, standard testing conditions are 23 degrees +/- 1 degrees C and a relative humidity of 50 +/- 5 percent. All test reports shall contain the individual values utilized in expressing the final result. Each final result shall be compared with the applicable requirements to determine compliance with the specification. Failure to pass any test shall be cause for rejection of the sample.

1.3.1 Condition in Container

Place the drum on a drum roll for 1 hour before withdrawing a 1-gallon sample or shake the 5-gallon can for 10 minutes before withdrawing a 1-gallon sample. Allow the 1-gallon sample to sit undisturbed overnight and then lower a stiff spatula into the sample and observe whether the material is abnormally thick and to what extent settling or caking exists. The material shall be a smooth, homogeneous mixture after stirring and shall be ready for use without heating or thinning. When a gallon of the coating is stored at 16 degrees C for 48 hours, the material shall not settle to the extent that it cannot be redispersed to a homogeneous mixture in 2 minutes, using a spatula.

1.3.2 Application Properties

Brush the coating at a rate of approximately 1 gallon per 60SF on a 0.4-mm thick, smooth-surfaced steel plate at an ambient temperature of 5 degrees C. A convenient size for the test panel is 100 x 150mm. Prepare three test panels and note whether the coating spreads easily without drawing or pulling. Repeat the test at 60 degrees C. and determine compliance with 1.2.1.

1.3.3 Behavior at 71 degrees C

Prepare two 100- x 150mm pieces of smooth-surfaced asphalt roof conforming to ASTM D 224, type II. Also prepare duplicate 100- x 150-mm metals from 0.4-mm thick smooth-surfaced steel plate, and clean with solvent according to ASTM D 609, method A. Brush on the coating at a rate of approximately 1 gallon per 60SF. Embed a thread in each coating, extending across the coating at a distance of not more than 50mm from the top of the test panels and measure the distance from the top. After exposing these test panels for 60 minutes at an incline of 15 degrees in a well ventilated room at a temperature not below 15 degrees C, but no in the direct rays of the sun, elevate the test panels to an incline equivalent to 1 inch per foot for 5 hours at 71 degrees C. Remove the panels and examine the metal panels for blisters and all panels for slippage by comparing the distance of the thread from the top of the test panel with the distance at the start of the test. Evaluate the coating compound for compliance with the requirement in 1.2.2.

1.3.4 Behavior at 0 degrees C

Cool the coated metal panels from the test in 1.3.3 to room temperature and immerse them in a container of melting ice for 1 hour. Bend quickly over a 25mm mandrel and examine for compliance with the requirement in 1.2.3.

1.3.5 Weather Resistance

Brush the coating on the underside of 1-gallon steel can lids at the rate of 60 SF/gallon and allow to air dry for 24 hours. The lids shall be free from rust, grease, or other surface contamination prior to painting. Prepare three lids for et. Place approximately 50mm of water in a vented and lined gallon can. Place a lid on the can and heat at 38 deg. For 50 hours. Examine the lids and measure the reflectivity to determine compliance to 1.2.4.

1.3.6 Salt Fog Resistance

The roof coating shall be tested for conformance to 1.2.6 using ASTM B 117.

1.3.7 Nonvolatile Content

The nonvolatile content of the roof coating shall be determined by baking a 5-g sample of the material in a tared dish at a temperature of 163 degrees C for 3 hours in a convection oven. The dish and its contents shall be cooled and the weight of the contents determined within 1 minute. The heating, cooling, and weighing operations shall be repeated, except that the baking period shall be 1 hour, until the loss in weight between any two successive weighings is equal to or less than 1 percent of the original sample weight. Two determinations shall be made concurrently. If the results obtained in the two determinations differ by more than 1 percent, the determinations shall be repeated. The final results shall comply with the requirements in Table I.

1.3.8 Moisture Content

Determine the water content using ASTM D 95 for compliance with the requirement in Table I.

1.3.9 Consistency

Determine the consistency using ASTM D 562 for compliance with the requirement in Table I.

1.3.9 Reflectivity

This procedure yields a numerical value which represents the ration (in percent) of the light reflected from the test specimen to that incident on it. The instrument used for this determination shall integrate diffuse and specular reflectance by means of a hollow integrating sphere. The instrument shall be calibrated using standardized placques in accordance with manufacturer's instructions. Two test panels shall be prepared as described in 1.3.2 and allowed to air dry for 24 hours. The total reflectance shall be measured, with readings taken from at least three different areas of each panel. Values from the two different panels shall be averaged to provide the reported value. This value shall comply with the requirement in Table I.

1.3.10 Drying Properties.

Brush the coating on grease-free steel panels at a rate of 60SF/gallon. Determine the set-to-touch time by touching the surface at least 10mm from the edge. Lightly touch the test film with a finger tip and immediately place the finger tip against a piece of clear glass. Observe whether any of the coating is transferred to the glass. For test purposes, the pressure of the finger tip against the coating shall not be greater than that required to transfer a spot of the coating from 3 to 5 mm in cross section. The film shall be considered set-to-touch when it still shows a tacky condition but none of it adheres to the finger. The set-to-touch dry time shall comply with the requirement in Table I.

1.3.11 Solvent Analysis

Analyze the solvent by gas chromatography. The solvent shall be separated from the room coating as specified in ASTM D 3272 and then injected into the gas chromatograph. The procedure specified in ASTM E 260 and any apparatus, operating conditions, columns, and options permitted therein shall be used for the chromatographic analysis. The accuracy of the analysis shall be 0.25 percent absolute by weight over three or more runs. All peaks 0.25 percent of the sample or greater shall be identified and quantified. Convert percent by weight to percent by volume, and evaluate the results for compliance with 3.3.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.3.1 Product Data

a. Aluminum Bituminous Roof Coating
b. Membrane primer
c. Solvent

Submit MSDS Sheets, material description and physical properties, application details, and recommendations regarding shelf life, application procedures, and precautions on flammability and toxicity.

1.3.2 Samples: Submit 4 inch by 4 inch material and color sample on a backer board.

1.3.3 Certificate of Compliance

Installer certificates signed by manufacturer certifying that Installers comply with following requirements:

a. Installer Qualifications: Engage an experienced Installer who is certified in writing by roof coating manufacturer as qualified to install manufacturer's roof coating and who has completed similar roof coatings to that indicated for this project.

b. Manufacturer Qualifications: Engage a firm experienced in manufacturing aluminum bintuminous roof coatings similar to that indicated for this project and that has a record of successful in-service performance.

c. Single-Source Responsibility: Obtain materials from a single manufacturer regularly engaged in manufacturing aluminum bituminous roof coatings.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver aluminum bituminous roof coating materials in manufacturer's original, unopened containers, with labels intact and legible. Containers of materials covered by a referenced specification number shall bear the specification number, type, and class of the contents. Deliver materials in sufficient quantity to continue work without interruption. Store and protect materials in accordance with manufacturer's instructions, and use within their indicated shelf life. When hazardous materials are involved, adhere to special precautions of the manufacturer, unless precautions conflict with local, state, and federal regulations. Promptly remove from the site materials or incomplete work adversely affected by exposure to moisture or freezing. Store materials on pallets and cover from top to bottom with canvas tarpaulins.

PART 2 PRODUCTS

2.1 ALUMINUM BITUMINOUS ROOF COATING

Provide materials as recommended by manufacturer to be fully compatible with and able to develop bond to substrate under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

Manufacturer: KARNAK #98AF or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions under which roof coating will be applied for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

Coordinate work with that of other trades to ensure that components to be incorporated into the roof coating are available when needed. Inspect and approve surfaces immediately before application of

roof coating materials. Remove laitance, loose aggregate, sharp projections, grease, oil, dirt, curing compounds, and other contaminants which could adversely affect the complete bonding of the roof coating to the substrate.

3.2.1 Flashings

Make penetrations through sleeves in corrugated metal roofing watertight before application of roof coating

3.2.1.2 Penetrations and Projections

Flash penetrations and projections through corrugated metal roofing with metal flashing prior to application of roof coating.

3.3 APPLICATION

1. Apply materials in compliance with Federal Specification TT-C-498C and in accordance with manufacturer's recommendations. The roof coating material shall be capable of uniform application without difficulty by brush, heavy duty sprayer, or roofer's mop at a rate of approximately 1 gallon per 60SF at any temperature from 5 degrees to 60 degrees C. Use solvent recommended by the roof coating manufacturer.

2. Within 18 inches of the edge of the corrugated roof panels at eave overhangs, apply two coats. Allow sufficient drying or curing time between coats.

3. Extend coating over roof flashing, ridge flashing, and as indicated in the Drawings.

4. At eave overhangs, apply single coat and extend 12 inches to the exposed underside of the corrugated roof panels..

5. Where the single coat appears uneven, blotchy and thin, apply a second coat at localized areas to fully mask or hide the primer coats.

END OF SECTION 07142

SECTION 07160

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product data for each type of product specified, including data substantiating that materials comply with requirements for each dampproofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course.
   1. Certification by dampproofing manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.4 PROJECT CONDITIONS

A. Substrate: Proceed with dampproofing only after substrate construction and penetrating work have been completed.
B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.
C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Cold-Applied, Cut-Back Asphalt Dampproofing:
      a. ChemRex, Inc.; Sonneborn Building Products Div.
      b. Karnak Chemical Corporation.
      c. Meadows: W.R. Meadows, Inc.
      d. Carboline Corporation.
   2. Cold-Applied, Asphalt Emulsion Dampproofing:
      a. ChemRex, Inc.; Sonneborn Building Products Div.

b. Euclid Chemical Co.
c. Karnak Chemical Corporation.
e. Carboline Corporation.

2.2 BITUMINOUS DAMPPROOFING

A. General: Provide products recommended by manufacturer for designated application.
1. Odor Elimination: For interior and concealed-in-wall uses, provide type of bituminous dampproofing material warranted by manufacturer to be substantially odor free after drying for 24 hours under normal conditions.

B. Cold-Applied, Cut-Back Asphalt Dampproofing (For asbestos-free roof cement/coating): Asphalt and solvent compound mixed to a smooth, uniform consistency to provide a firm, moisture-resistant, vapor-resistant, elastic coating recommended by the manufacturer for dampproofing use when applied according to the manufacturer's instructions.
1. Trowel Grade: Asphalt roof cement, consisting of an asphalt base with petroleum solvents and mineral stabilizers, complying with ASTM D 4586, Type I.
2. Semimastic Grade: Asphalt roof coating, consisting of an asphalt base with petroleum solvents and mineral stabilizers, complying with ASTM D 4479, Type I.

C. Cold-Applied, Asphalt Emulsion Dampproofing: Asphalt-based emulsions recommended by the manufacturer for dampproofing use when applied according to the manufacturer's instructions.
1. Trowel Grade: Emulsified asphalt mastic, prepared with mineral- colloid emulsifying agents suitable for application in a relatively thick film, complying with ASTM D 1187, Type I: For use below grade only.
2. Trowel Grade: Emulsified asphalt mastic, prepared with mineral- colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV: For use above grade.
3. Semimastic Grade: Emulsified asphalt semimastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV: For use above grade.
4. Spray Grade: Emulsified asphalt, prepared with mineral-colloid emulsifying agents without fibrous reinforcement, complying with ASTM D 1227, Type III.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Asphalt primer complying with ASTM D 41, for asphalt-based dampproofing.
B. Glass Fabric: Woven glass fabric, treated with asphalt, complying with ASTM D 1668, Type I.
C. Protection Course, Board Type: Premolded, 1/8-inch- (3-mm-) thick, multi-ply, semirigid board, consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on one side with polyethylene film.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
a. Protection Course II; ChemRex, Inc.; Sonneborn Building Products Div.
b. Bituthene Asphaltic Hardboard; Grace: W.R. Grace & Co.
c. PC-2 Protection Course; Meadows: W.R. Meadows, Inc.

D. Protection Course, Roll Roofing Type: Smooth-surfaced roll roofing, complying with ASTM D 224, Type II.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify substrate surface to be subject to hydrostatic pressure. If so, do not apply damp-proofing until hydrostatic pressure is removed.

B. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.
C. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.
D. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at construction joints.
E. Install separate flashings and corner protection stripping, as recommended by prime materials manufacturer, where indicated to precede application of dampproofing. Comply with details shown and with manufacturer's recommendations. Pay particular attention to requirements at building expansion joints, if any.
F. Prime substrate as recommended by prime materials manufacturer.
G. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's recommendations except where more stringent requirements are indicated and where Project conditions require extra precautions to ensure satisfactory performance of work.
B. Application: Apply dampproofing to the following surfaces.
   1. Exterior, below-grade surfaces of exterior concrete or masonry walls (eg. footing wall, sewer manhole) in direct contact with earth or other backfill and where space is enclosed on opposite side.
   2. Exterior side of concrete or masonry retaining walls to prevent percolating of water through the wall or facing.
   3. Inside surface of single-wythe, exterior, furred-concrete, or masonry walls above grade, to prevent water-vapor penetration through the wall.
   4. Where indicated on the Drawings.
C. Cold-Applied Asphalt Dampproofing: For exterior surfaces, provide either emulsified or cut-back, asphalt dampproofing materials, at Contractor's option. For interior surfaces, provide only emulsified asphalt materials.
D. Reinforcement: At changes in plane or where otherwise shown as "reinforced," install lapped course of glass fabric in first coat of dampproofing compound before it thickens.
E. Bituminous Cant Strips: Install 2-by-2-inch (50-by-50-mm) cant strip of bituminous grout at base of vertical dampproofing where it meets horizontal surface.
F. Apply vertical dampproofing down walls from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when the Project is completed.

3.3 COLD-APPLIED, CUT-BACK ASPHALT DAMPPROOFING

A. Spray Grade: Brush or spray apply a coat of dampproofing at a rate of 1.25 to 2 gal./100 sq. ft. (0.5 to 0.8 L/sq. m), depending on substrate texture, to produce a uniform, dry-film thickness of not less than 20 mils (0.3 mm).
B. Apply a second coat, as specified above, after allowing 24 hours for first coat to dry. Apply second coat at a rate of 0.8 to 1.25 gal./100 sq. ft. (0.3 to 0.5 L/sq. m). Apply double thickness of second coat where first application has failed to produce a smooth, shiny, impervious coat.
C. Semimastic Grade: Brush or spray apply a coat of dampproofing at a rate of 5 gal./100 sq. ft. (2 L/sq. m), to produce a uniform, dry-film thickness of not less than 45 mils (0.8 mm).

D. Trowel Grade: Trowel apply a coat of mastic asphalt dampproofing onto substrate at a minimum rate of 7 gal./100 sq. ft. (2.8 L/sq. m), to produce an average, dry-film thickness of 70 mils (1.8 mm) but not less than 45 mils (0.8 mm) at any point.

3.4 COLD-APPLIED, ASPHALT EMULSION DAMPPROOFING

A. Spray Grade: Brush or spray apply a coat of asphalt emulsion dampproofing at a rate of 1.5 to 2.5 gal./100 sq. ft. (0.6 to 1 L/sq. m), depending on substrate texture, to produce a uniform, dry-film thickness of not less than 20 mils (0.4 mm). Apply in 2 coats, if necessary, to obtain required thickness, allowing time for complete drying between coats.

B. Semi-mastic Grade: Brush or spray apply a coat of asphalt emulsion dampproofing at a rate of 5 gal./100 sq. ft. (2 L/sq. m), to produce a uniform, dry-film thickness of not less than 45 mils (0.8 mm).

C. Trowel Grade: Trowel apply a coat of mastic asphalt emulsion dampproofing onto substrate at a minimum rate of 7 gal./100 sq. ft. (2.8 L/sq. m), to produce an average, dry-film thickness of 70 mils (1.5 mm) but not less than 45 mils (0.8 mm) at any point.

3.5 PROTECTION AND CLEANING

A. Protect exterior, below-grade dampproofing membrane from damage until backfill is completed. Remove overspray and spilled materials from surfaces not intended to receive dampproofing.

3.6 INSTALLATION OF PROTECTION COURSE

A. General: Where indicated, install protection course of type indicated over completed-and-cured dampproofing treatment. Comply with dampproofing materials manufacturer's recommendations for method of support or attaching of protection materials. Support with spot application of trowel-grade mastic where not otherwise indicated.

END OF SECTION 07160

SECTION 07214

BOARD AND BLOCK INSULATION

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 165	Measuring Compressive Properties of Thermal Insulations
ASTM C 177	Test Method for Steady-State Thermal Transmission Properties by means of the Guarded Hot Plate
ASTM C 203	Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C 272	Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C 423	Test Method for Sound Absorption and the Sound Absorption Coefficient by the Reverberation Room Method
ASTM C 518	Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter
ASTM C 553	Standard Specification for Mineral Fiber Blanket and Felt Insulations
ASTM C 612	Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C 930	Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 828	Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus
ASTM D 1621	Compressive Properties of Rigid Cellular Plastics
ASTM D 3833/D 3833M	Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D 4397	Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 84	Surface Burning Characteristics of Building Materials

ASTM E 96	Water Vapor Transmission of Materials
ASTM E 136	Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 154	Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electrical Code

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM	Puncture Test for Containerboard

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Product Data

a. Block or board insulation
b. Vapor retarder
c. Pressure sensitive tape
d. Protection board or coating
e. Accessories

1.3.1 Manufacturer's Instructions

a. Block or Board Insulation
b. Adhesive

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials to the site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.3.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.4 SAFETY PRECAUTIONS

1.4.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.4.2 Other Safety Considerations

Consider safety concerns and measures as outlined in ASTM C 930.

PART 2 PRODUCTS

2.1 BLOCK OR BOARD INSULATION

Provide only thermal insulating materials recommended by manufacturer for type of application indicated. Provide board or block thermal insulation conforming to the following standards and the physical properties listed below:

a. Board Insulation Fiber Glass: ASTM C 612

Type: FSK (foil-scrim-kraft) faced glass fiber thermal insulation complying with ASTM C 612, Type I, Class A.

2.1.1 Thermal Resistance

Ceiling R-11 Wall R-11.

2.1.2 Fire Protection Requirement

a. Flame spread index of 25 or less when tested in accordance with ASTM E 84.

b. Smoke developed index of 50 or less when tested in accordance with ASTM E 84.

2.1.3 Other Material Properties

Provide thermal insulating materials with the following properties:

a. Dimensional Stability: Linear shrinkage less than 0.1%

b. Water Vapor Permeance: FRK (foil) facing Perms Maximum 0.02

d. Water Adsorption: Not more than 1 percent by volume when measured in accordance with paragraph 14 of ASTM C 553.

2.1.4 Premolded Concrete Masonry Insert

ASTM C 578. Install inserts in concrete masonry units at the masonry unit manufacturing plant. Provide insert with thickness not less than 1 1/4 inches.

2.1.5 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum required recycled material contents (by weight, not volume) are:

Polyisocyanurate/Polyurethane: 9 percent
Phenolic Rigid Foam : 5 percent
Perlite Board: 23 percent

2.1.6 Prohibited Materials

Do not provide materials containing asbestos.

2.2 VAPOR RETARDER AND DAMPPROOFING

2.2.1 Vapor Retarder in Frame Walls and Roofs

a. 6 mil thick polyethylene sheeting conforming to ASTM D 4397 and having a water vapor permeance of one perm or less when tested in accordance with ASTM E 96.

b. Membrane with the following properties:

Water Vapor Permeance: ASTM E 96: 1 perm
Maximum Flame Spread: ASTM E 84: 25
Combustion Characteristics: Passing ASTM E 136
Puncture Resistance: TAPPI T803 OM: 50
Tensile Strength: ASTM D 828: 35

2.2.2 Vapor Retarder under Floor Slab

a. Water vapor permeance: 0.2 Perm or less when tested in accordance with ASTM E 96.

b. Puncture resistance: Maximum load no less than 40 pounds when tested according to ASTM E 154.

2.3 PRESSURE SENSITIVE TAPE

As recommended by manufacturer of vapor retarder and having a water vapor permeance rating of one perm or less when tested in accordance with ASTM D 3833/D 3833M.

2.4 PROTECTION BOARD OR COATING

As recommended by insulation manufacturer.

2.5 ACCESSORIES

2.5.1 Adhesive

As recommended by insulation manufacturer.

2.5.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that all areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If installing perimeter or under slab insulation, check that the fill is flat, smooth, dry, and well tamped. If moisture or other conditions are found that do not allow the proper installation of the insulation, do not proceed but notify the Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Unless using insulation board that passes ASTM E 136 in addition to the requirements in Part 2, install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70and, if insulation is to be placed above fixture or device, 24 inches above fixture.

3.3 INSTALLATION

3.3.1 Insulation Board

Install and handle insulation in accordance with the manufacturer's installation instructions. Keep material dry and free of extraneous materials. Observe safe work practices.

3.3.2 Electrical Wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.3 Continuity of Insulation

Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating any thermal bridges or voids.

3.4 INSTALLATION ON WALLS

3.4.1 Installation using Furring Strips

Install insulation between members as recommended by insulation manufacturer.

3.4.2 Installation on Masonry Walls

Apply board directly to masonry with adhesive or fasteners as recommended by the insulation manufacturer. Fit between obstructions without impaling board on ties or anchors. Apply in parallel courses with joints breaking midway over course below. Put ends in moderate contact with adjoining insulation without forcing. Cut and shape as required to fit around wall penetrations, projections or openings to accommodate conduit or other services. Seal around cut-outs with sealant. Install board in wall cavities so that it leaves at least a nominal one inch free air space outside of the insulation to allow for cavity drainage.

3.4.3 Adhesive Attachment to Concrete and Masonry Walls

Apply adhesive to wall and completely cover wall with insulation as recommended by the insulation manufacturer]. Butt all edges of insulation and seal edges with tape.

3.4.4 Mechanical Attachment on Concrete and Masonry Walls

Cut insulation to cover walls. Apply adhesive to wall and set clip or other mechanical fastener in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners, bend split prongs flush with insulation. Butt all edges of insulation and seal with tape.

3.4.5 Protection Board or Coating

Install protection board or coating in accordance with manufacturer's instructions. Install protection over all exterior exposed insulation board.

3.5 VAPOR RETARDER

Apply a continuous vapor retarder as indicated. Overlap all joints at least 6 inches and seal with pressure sensitive tape. Seal at sill, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

END OF SECTION 07214

SECTION 07411

MANUFACTURED METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Architectural corrugated metal roofing panel.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide manufactured roof panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.

B. Air Infiltration: Provide manufactured roof panel assemblies with permanent resistance to air leakage through assembly of not more than 0.09 cfm/sq. ft. of fixed roof area when tested according to ASTM E 1680 at a static-air-pressure difference of 4.0 lbf/sq. ft..

C. Water Penetration: Provide manufactured roof panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 1646 at a minimum differential pressure of 20 percent of inward acting, wind-load design pressure of not less than 6.24 lb/sq. ft. and not more than 12.0 lb/sq. ft..

D. Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for Class 90 wind-uplift resistance.

E. Structural Performance: Provide manufactured roof panel assemblies capable of safely supporting design loads indicated under in-service conditions with vertical deflection no greater than the following, based on testing manufacturer's standard units according to ASTM E 1592 by a qualified independent testing and inspecting agency.

1. Maximum Deflection: 1/180 of the span.
2. Maximum Deflection: 1/140 of the span.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.

B. Shop Drawings: Show layouts of panels on roofs, details of edge conditions, joints, panel profiles, supports, anchorages, trim, flashings, underlayment, closures, snow guards, and special details. Distinguish between factory- and field-assembled work.

1. For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: Manufacturer's color charts or chips showing the full range of colors, textures, and patterns available for roof panels with factory-applied finishes.

D. Samples for Verification: Provide sample panels 12 inches long by actual panel width, in the profile, style, color, and texture indicated. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.

E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Test Reports: Indicate compliance of manufactured roof panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed metal roof panel projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to ASTM E 699.

D. Fire-Test-Response Characteristics: Where fire-resistance-rated roof panel assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: As indicated by design designations in UL's "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation or handling.

B. Handling: Exercise care in unloading, storing, and erecting roof panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish opening dimensions and proceed with fabricating roof panels without field measurements or allow for trimming panel units. Coordinate roof construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal roof panels within the specified warranty period and agreeing to repair finish or replace roof panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.

C. Finish Warranty Period: 20 years from date of Substantial Completion.

D. Special Weathertight Warranty: Submit a written warranty executed by manufacturer agreeing to repair or replace metal roof panel assembly that fails to remain weathertight within the specified warranty period.

E. Weathertight Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide panels by one of the following:

1. Galvanized Steel Sheet Roof Panels:

a. Architectural Building Components.

2.2 METALS AND FINISHES

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755 and the following requirements:

1. Galvanized Steel Sheet: ASTM A 653, G90; structural quality.
2. Thickness: 0.0299 inch (22ga), unless otherwise indicated.
3. Batten Caps: 0.0359 inch (20 ga) thick.
4. Purlin Strips: 0.0598 inch (16 ga) thick.
5. Finish: Aluminum bituminous roof coating manufacturer: KARNAK #98AF.
   Provide materials as recommended by manufacturer to be fully compatible with and able to develop bond to substrate under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

2.3 ROOF PANEL ASSEMBLIES

A. Architectural Corrugated Sheet Metal Roofing Panel: Manufacturer's standard factory-formed, corrugated roof panel assembly designed for mechanical attachment of panels to roof purlins or deck using exposed fasteners and sealants.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and accessories required for a complete roof panel assembly and as recommended by panel manufacturer, unless otherwise indicated.

B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Use stainless-steel fasteners for exterior applications and galvanized steel fasteners for interior applications.
2. Use aluminum or stainless-steel fasteners for exterior applications and aluminum or galvanized steel fasteners for interior applications.
3. Provide exposed fasteners with heads matching color of panel by means of plastic caps or factory-applied coating.
4. Provide metal-backed neoprene washers under heads of exposed fasteners bearing on weather side of panels.
5. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.

C. Accessories: Unless otherwise specified, provide components required for a complete roof panel assembly including trim, copings, fasciae, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Closure Strips: Closed-cell, self-extinguishing, expanded, cellular, rubber or cross-linked, polyolefin-foam flexible closure strips. Cut or premold to match configuration of panels. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

3. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to seal joints in panel roofing and remain weathertight. Provide sealant recommended by panel manufacturer.

D. Primer: Rust-inhibitive primer recommended by panel manufacturer for finish coat.

2.5 FABRICATION

A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Sound Control: Where sound-absorption requirement is indicated, fabricate interior liner panels with 1/8-inch- (3-mm-) diameter holes uniformly spaced approximately 1000 holes per square foot (10 750 holes per square meter). Cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

C. Fabricate panel joints with captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

2.6 PANEL SUPPORTS AND ANCHORAGE

A. Secondary Framing: Provide components complying with the Light Gage Structural Institute's "Guide Specifications," Section 07410, "Manufactured Roof and Wall Panels."

1. Roof Purlins: C- or Z-shaped sections fabricated from 0.0598-inch- (1.5-mm-) thick, shop-painted, roll-formed steel. Purlin spacers fabricated from 0.079-inch- (2.0-mm-) thick, cold-formed, galvanized steel sections.
2. Eave Struts: Unequal flange, C-shaped sections formed to provide adequate back-up for roof panels. Fabricate from 0.0598-inch- (1.5-mm-) thick, shop-painted, roll-formed steel.
3. Flange and Sag Bracing: 1-5/8-by-1-5/8-inch (41-by-41-mm) angles, fabricated from 0.0598-inch- (1.5-mm-) thick, shop-painted, roll-formed steel.
4. Base or Sill Angles: Fabricate from 0.079-inch- (2.0-mm-) thick, cold-formed, galvanized steel sections.
5. Secondary structural members, except columns and beams, shall be manufacturer's standard sections fabricated from 0.079-inch- (2.0-mm-) thick, cold-formed galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements indicated for conditions affecting performance of metal panel roofing.

1. Panel Supports and Anchorage: Examine roof framing to verify that purlins, angles, channels, and other secondary structural panel support members and anchorage have been installed according to written instructions of panel manufacturer.

2. Do not proceed with roof panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate metal panel roofing with rain drainage work; flashing; trim; and construction of decks, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

C. Secondary Structural Supports: Install purlins, bracing, and other secondary structural panel support members and anchorage according to the Light Gage Structural Institute's "Guide Specifications," Section 07410, "Manufactured Roof and Wall Panels."

3.3 PANEL INSTALLATION

A. General: Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting exterior panels by torch is not permitted.
2. Install panels with concealed fasteners, unless otherwise indicated.
3. Install panels with exposed exterior and interior fasteners, prefinished to match panel finishes.
4. Install panels over solid substrate with minimum 3:12 slope. Install 1 ply of felt from lower edge up, with at least 3-inch side laps and 4-inch end laps.

B. Accessories: Install components required for a complete roof panel assembly including trim, copings, fascia, ridge closures, clips, seam covers, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items.

C. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized-asphalt underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.

E. Coat back side of metal panels with bituminous coating where it will contact wood, ferrous metal, or cementitious construction.

F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not otherwise indicated, types recommended by panel manufacturer.

1. Install weatherseal under ridge cap. Flash and seal panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
2. Seal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
3. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

G. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 CLEANING AND PROTECTING

A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

END OF SECTION 07411

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 WORK INCLUDED

a. Roof and sill flashings.
b. Counterflashings over bituminous base flashings.

1.2 REFERENCES

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

AA (Aluminum Association)

Aluminum Construction Manual: Aluminum Sheet Metal Work and Building Construction.

AISI (American Iron and Steel Institute)

ANSI/ASTM B32	Solder Metal
ASTM A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate
ASTM A525	Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process
ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
ASTM B370	Copper Sheet and Strip for Building Construction
FS O-F-506	Flux, Soldering, Paste and Liquid
FS QQ-S-571	Solder, Tin Alloy
FS QQ-T-201	Terne Plate, for Roofing and Roofing Products
FS SS-C-153	Cement, Bituminous, Plastic
NAAMM	Metal Finishes Handbook

NRCA (National Roofing Contractors Association) Roofing Manual

SMACNA	Architectural Sheet Metal Manual

1.3 SYSTEM DESCRIPTION

Work of this Section is to physically protect membrane roofing, base flashings, and metal roofing from damage that would permit water leakage to building interior.

1.4 QUALITY ASSURANCE

Applicator: Company specializing in sheet metal flashing work with three years minimum experience.

1.5 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.5.1 Shop Drawings

Submit shop drawings and product date under provisions of Section 01300

1.5.2 Decision Data

Describe material profile, jointing pattern, jointing details, fastening methods, and installation details.

1.5.3 Instructions

Submit manufacturer's installation instructions under provisions of Section 01300.

1.5.4 Samples

Provide full sized sample of metal flashing illustrating typical external corner, internal corner, and junction to vertical dissimilar surface, material and finish.

1.5.5 Color Samples

Submit samples under provisions of Section 01300.

1.6 DELIVERY, HANDLING, AND STORAGE

a. Store products under provisions of Section 01011.

b. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation.

c. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

2.1.1 Stainless Steel

ASTM A 167, Type 304, 2D Finish, fully annealed, dead-soft temper, smooth finish.

2.2 ACCESSORIES

2.2.1 Fastener

Stainless steel with soft neoprene washers at exposed fasteners. Finish exposed fasteners same as flashing metal.

2.2.2 Protective Backing Paint

Zinc chromate alkyd or bituminous.

2.2.3 Sealant

Type specified in Section 07900.

2.2.4 Bedding Compound

Rubber-asphalt.

2.2.5 Plastic Cement

FS SS-C-153, Type II-coal-tar base cement.

2.2.6 Solder

FS QQ-S-571; ANSI/ASTM B32; 50/50 type.

2.2.7 Flux

FS O-F-506

2.3 FABRICATION

a. Form sections true to shape, accurate in size, square, and free from distortion or defects.

b. Form pieces in longest practical lengths.

c. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

d. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

e. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; solder for rigidity, seal with sealant.

f. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

g. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.4 FINISH

a. Shop prepare and prime exposed ferrous metal surfaces.

Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

PART 3 EXECUTION

3.1 INSPECTION

a. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

b. Verify membrane termination and base flashings are in place, sealed, and secure.

c. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

a. Field measure site conditions prior to fabricating work.

b. Install starter and edge strips, and cleats before starting installation.

c. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

d. Insert flashings into reglets to form tight fit. Secure in place with lead or plastic wedges at maximum 4 inches (100 mm) on center. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

e. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Contracting Officer.

f. Seam and seal all joints.

g. Apply plastic cement compound between metal flashings and felt flashings.

h. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

i. Solder metal joints watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

3.3 INSTALLATION

Conform to drawing details included in SMACNA or NRCA manual.

END OF SECTION 07620

SECTION 07920

JOINT SEALANTS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 834	Latex Sealants
ASTM C 920	Elastomeric Joint Sealants

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Product Data

a. Sealants
b. Primers
c. Bond breakers
d. Backstops

Data for the sealants shall include shelf life, and recommended solvents.

1.3 ENVIRONMENTAL CONDITIONS

The ambient temperature shall be within the limits of 40 and 100 degrees F when sealant is applied.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, [color,] and material designation clearly marked thereon. Elastomeric sealant containers shall be labeled to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 F degrees or less than 0 degrees F.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

2.1.1 Interior Sealant

ASTM C 920, Type S or M, Grade NS, Class 12.5, Use NT. Location(s) and color(s) of sealant shall be as follows:

	LOCATION	COLOR
a.	Small voids between walls or partitions, built-in or surface-mounted equipment and fixtures, and similar items.	White
b.	Casework, shelving, door frames	Dark Brown

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T. Location(s) and color(s) of sealant shall be as follows:

	LOCATION	COLOR
a.	Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Dark Brown
b.	Voids where items pass through exterior walls.	White
c.	Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	White

2.1.3 Floor Joint Sealant

ASTM C 920, Type S or M, Grade P, Class 25, Use T. Location(s) and color(s) of sealant shall be as follows:

	LOCATION	COLOR
a.	Control joints in floors, slabs, & walkways.	Dark Brown

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer for the particular application.

2.4 BACKSTOPS

Provide glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Backstop material shall be compatible with sealant. Do not use oakum or other types of absorptive materials as backstops.

2.5 PRE-COMPRESSED SELF-EXPANDING FOAM JOINT SEALANT

2.5.1 Manufacturer

Willseal LLC, 34 Executive Drive, Hudson, NH 03051
Telephone 1-800-274-2813, Website www.Willseal.com

2.5.2 Materials

Material to be supplied in roll format. Rolls shall be used with joints up to 1-1/2" in width (from substrate to substrate). Stick form material shall be used when joints exceed 1-3/4".

2.5.3 Performance Requirements:

Water resistant (driving rain) per DIN 18542: no penetration of water when compression is less than 35% of original foam thickness. Consult manufacturer for various joint sizes and recommended compression ratios. The maximum compression ratio of Willseal® 600 is not more than 18% of the original foam thickness. The movement capability of the tape is 90%, based upon the manufacturer's data and expected width of actual joints under most extreme conditions. Ultraviolet light resistant DIN 74069 (3 months lab exposure time). Flammability ASTM E-84 (Smoke Development and Flame Spread Characteristics. Compatibility with conventional construction materials DIN 52423. Manufacturer to provide a Certificate of Compliance with the independent testing requirements for this specification section.

2.6 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces shall be clean, dry to the touch, and free from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. When resealing an existing joint, remove existing calk or sealant prior to applying new sealant.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

3.3 APPLICATION

3.3.1 Joint Width-To-Depth Ratios

a. Acceptable Ratios:

	JOINT WIDTH	JOINT DEPTH	
		Minimum	Maximum
For metal, glass, or other nonporous surfaces:	1/4 inch (minimum)	1/4 inch	1/4 inch
	over 1/4 inch	1/2 of width	Equal to width

	JOINT WIDTH	JOINT DEPTH	
		Minimum	Maximum
For wood, concrete, masonry:	1/4 inch (minimum)	1/4 inch	1/4 inch
	Over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
	Over 1/2 inch to 2 inches	1/2 inch	5/8 inch
	Over 2 inches	(As recommended by sealant manufacturer)	

b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding shall not be required on metal surfaces.

3.3.2 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

a. Where indicated.

b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios."

3.3.3 Primer

Immediately prior to application of the sealant, clean out 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 sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.4 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

3.3.5 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

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

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.

b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

END OF SECTION 07920

SECTION 08120

ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

ANSI/ AAMA 101	Aluminum Prime Windows and Sliding Glass Door

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	Structural Steel
ASTM B 209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM E 283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimens
ASTM E 331	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Structural

Design and provide shapes, thicknesses and joints of framing members to withstand dead and live loads caused by positive and negative pressure of 175 mph basic wind speed, exposure category "C", Gust Factor = 1.66, Importance Factor = 1 as calculated in accordance with International Building Code, latest edition, ASCE 7, with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65.

1.2.2 Air Infiltration

When tested in accordance with ASTM E 283, air infiltration shall not exceed 0.06 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind).

1.2.3 Water Penetration

When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 10 pounds per square foot of fixed area.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals."

1.3.1 Drawings

a. Doors and frames

Show elevations of each door type, size of doors and frames, metal gages, details of door and frame construction, methods of anchorage, glazing details, weatherstripping, provisions for and location of hardware, and details of installation.

1.3.2 Instructions

a. Doors and frame

Submit detail specifications and instructions for installation, adjustments, cleaning, and maintenance.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on nonabsorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Swing-type and sliding-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members and accessories.

2.2 MATERIALS

2.2.1 Anchors: Stainless steel.

2.2.2 Weatherstripping: Continuous wool pile, silicone treated, or type recommended by door manufacturer.

2.2.3 Aluminum Alloy for Doors and Frames: ASTM B 221, Alloy 6063-T5 for extrusions. ASTM B 209, alloy and temper best suited for aluminum sheets and strips.

2.2.4 Fasteners: Stainless steel screw-type fasteners.

2.2.5 Structural Steel: ASTM A 36/A 36M.

2.2.6 Aluminum Grille Doors: Provide the following metal screens for grille doors at houses as noted:

2.2.6.1 Chargulaf/ Meno House: Perforated aluminum screen with 1 /16” diameter hole on 7 /64” on center staggered. Metal thickness: 0.063”. Aluminum Type 3003-H14, Dark bronze anodized.

Manufacturer /model: McNichols, Quality Perforated Screens or approved equal

2.2.6.2 Flores/ Lujan House: Aluminum expanded metal screen. Aluminum Type 3003-H14, 3/16", #0.051 ga, Dark bronze anodized.
Manufacturer /model: McNichols, Lancet (Flatten) or approved equal

2.3 FABRICATION

2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 12 inches o.c. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

2.3.2 Aluminum Doors

Of type, size, and design indicated and not less than 1 3/4 inches thick. Minimum wall thickness, 0.125 inch, except beads and trim, 0.050 inch. Door sizes shown are nominal and shall include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor.

2.3.2.1 Stile and Rail Doors

Doors shall have wide stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 1/2 inch diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and shall have countersunk heads. Weld concealed reinforcements for hardware in place.

2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping shall be replaceable without special tools, and adjustable at meeting rails of pairs of doors. Installation shall allow doors to swing freely and close positively.

2.3.5 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill. Place anchors near top and bottom of each jamb and at intermediate points not more than 25 inches apart.

2.3.6 Provisions for Door Hardware

Door hardware is specified in Section 08710, "Finish Hardware" which refers to “Door Hardware Set” located in the Architectural Drawings. Deliver hardware templates and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws. Provide reinforcement in core of flush doors as required to receive locks, door closers, and other hardware.

2.3.7 Finish

Door frames shall have anodized aluminum finish. Clean exposed aluminum surfaces and provide an anodized finish conforming to AA Finish shall be integral color-anodized, designation AA-M10-C22-A42, Architectural Class I 0.0175 mm 0.7 mil or thicker. Color shall be “dark bronze”.

PART 3 EXECUTION

3.1 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors, transoms, adjoining sidelights and adjoining window walls. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions. Anchor bottom of each frame to rough floor construction with 3/32-inch thick stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. Seal metal-to-metal joints between framing members as specified in Section 07920, "Sealants." Hang doors to produce clearances specified in paragraph 2.3.2 entitled, "Aluminum Doors," of this section. After erection and glazing, adjust doors and hardware to operate properly.

3.2 PROTECTION FROM DISSIMILAR MATERIALS

3.2.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by one or a combination of the following methods:

a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.
b. Apply a good quality elastomeric sealant between the aluminum and the dissimilar metal.
c. Paint the dissimilar metal with one coat of primer and one coat of aluminum paint.
d. Use a nonabsorptive tape or gasket in permanently dry locations.

3.2.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint, to prevent aluminum discoloration.

3.2.3 Aluminum to Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

3.2.4 Aluminum to Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-

bodied bituminous paint. In lieu of painting the aluminum, the Contractor shall have the option of painting the wood or other absorptive surface with two coats of aluminum paint and sealing the joints with elastomeric sealant.

3.3 CLEANING

Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

3.4 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

END OF SECTION 08120

SECTION 08212

STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, and Door Hardware Section 08710, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior stile and rail wood doors with infill panels.
   2. Exterior stile and rail wood doors with glass infill panels.
   3. Interior stile and rail wood doors with infill panels
   4. Interior stile and rail wood doors with fixed louvers/infill panels.

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Structural

Provide shapes, thicknesses and connection joinery of framing members of exterior door assemblies to withstand dead and live loads caused by positive and negative pressure of 175 mph basic wind speed, exposure category "D", Gust Factor = 1.66, Importance Factor = 1 as calculated in accordance with International Building Code, latest edition, ASCE 7, with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65.

1.2.2 Air Infiltration

When tested in accordance with ASTM E 283, air infiltration shall not exceed 0.06 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind).

1.2.3 Water Penetration

When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 6.24 pounds per square foot of fixed area.

1.3 SUBMITTALS

A. Product data for each type of door, including details of construction, glazing, and factory-finishing specifications.
B. Shop drawings indicating location and size of each door; elevation of each kind of door; construction details not covered in product data, including those for stiles, rails, panels, and moldings (sticking); location and extent of hardware cutouts; factory finishing; and other pertinent data.
C. Samples for initial selection in the form of color charts consisting of actual materials in small sections for the following:

1. Faces of factory-finished doors with transparent finish. Show the full range of colors available for stained finishes.

D. Samples for verification in the form of a corner section, 12 inches (300 mm) square, showing edges, faces, joinery, and material qualities of typical stile, rail, molding, and panel for each exposed material, door type, and finish required; and as follows:
   1. Doors for Transparent Finish: Door faces with typical range of color and grain for each veneer and lumber species required.
   2. Factory-Finished Doors: Door faces with typical factory finish.

E. Product certificates signed by door manufacturers certifying that their products comply with specified requirements

1.4 QUALITY ASSURANCE

A. Quality Standard: Comply with the following standard:
   1. NWWDA Quality Standard: I.S.6, "Industry Standard for Wood Stile and Rail Doors," of the National Wood Window and Door Association.
   2. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grade of door, construction, finish, and other requirements.

B. Safety Glass: Provide products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials except where those of Category I are expressly indicated and permitted.

C. Single-Source Responsibility: Obtain doors from one source and by a single manufacturer.

D. Product Certification: Require door manufacturer to certify that doors comply with specified requirements including those of referenced door standard.
   1. Mark, label, or otherwise identify panel wood doors as complying with NWWDA I.S.6.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package and deliver door assemblies with clearly marked labels with door symbols designated in the architectural drawings for each recipent house.

B. Protect door assemblies during transit, storage, and handling to prevent damage, wraping, discoloration, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.

C. Identify each door components with a designation system based on the door symbols, using temporary, removable, or concealed markings.

1.6 PROJECT CONDITIONS

A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in covered and well-ventilated storage and installation areas during the remainder of the construction period to comply with the following requirements applicable to Project's geographical location:
   1. AWI quality standard Section 100-S-11 "Relative Humidity and Moisture Content."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide doors as indicated in the Door Schedule and by one of the following manufacturers which includes but not limited to:
   1. Stile and Rail Wood Doors: Luxbaum Windows and Doors +or approved equal.

2.2 STILE AND RAIL DOORS

A. Exterior Doors: Assemble with wet-use adhesives and comply with the following requirements:
   1. NWWDA Grade for Transparent Finish: Premium.

2. NWWDA Grade for Opaque Finish: Standard.
3. Wood Species for Transparent Finish: Merbau (Ifit), plain sawed /sliced.
5. Wood Species for Opaque Finish: Merbau (Ifit) plain sawned/ sliced
6. Panel Configuration: As indicated in the Door Schedule (See Architectural Drawings).
   a. Raised Panel Thickness: As indicated in the Architectural Drawings.
   b. Flat Panel Thickness: As indicated in the Architectural Drawings.
   c. Provide overlapping or criss-cross shallow reveal with tapered ends at both faces of the panel where shown in the drawings except for the following locations: closets, toilet/bathrooms.
7. Design and Layout: As indicated in the Door Schedule (See Architectural Drawings)

B. Interior Doors: Comply with the following requirements:
1. NWWDA Grade for Transparent Finish: Select.
2. NWWDA Grade for Opaque Finish: Standard.
3. Wood Species for Transparent Finish: Merbau (Ifit) plain sawed/ sliced.
4. Wood Species for Opaque Finish: Merbau (Ifit) plain sawed/ sliced.
5. Panel Configuration: As indicated in the Door Schedule (See Architectural Drawings).
   a. Raised Panel Thickness: As indicated in the Architectural Drawings
   b. Flat Panel Thickness: As indicated in the Architectural Drawings
   c. Provide overlapping or criss-cross shallow reveal with tapered ends at both faces of the panel where shown in the drawings except for the following locations: closets, toilet/bathrooms.
6. Design and Layout: As indicated in the Door Schedule (See Architectural Drawings)

2.4 FABRICATION

A. Fabricate stile and rail wood doors to comply with the following requirements:
1. In sizes indicated for job-site fitting.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, DHI A115-W series standards, and hardware templates.
1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.

C. Glazed Openings: Trim glazed openings with solid wood moldings of profile indicated, with one side removable.

D. Exterior Doors: Factory treat exterior doors after fabrication with water repellent to comply with NWWDA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.5 FIELD PRIMING

A. Doors for Opaque Finish: Field prime exposed portions of doors for paint finish with one coat of wood primer specified in Division 9 Section "Painting."

B. Transparent Finish: Field seal faces and edges of doors for transparent finish with stain (if required) and other required pretreatments and first coat of finish as specified in the following:
1. Division 9 Section "Painting."
2. Division 9 Section "Exterior Wood Stains."

2.6 FIELD FINISHING

A. General: Comply with referenced quality standard's requirements for field finishing.
B. Finish and protect wood door assembly surfaces where indicated on schedules or Drawings.
   1. Transparent Finish (Sealer and Wax): Comply with Finish Legend
   2. Opaque Finish (Paint): Comply with Finish Legend for color selection and sheen.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine installed door frames prior to hanging door:
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
   2. Verify that masonry and concrete surfaces is visibly dry and free of excess mortar, sand, and other construction debris. Verify thickness and adhesion of built-up plastered surfaces, if any, at the rough opening and modify anchors accordingly to ensure sufficient and proper anchor penetration into the structural substrate below the plaster.
   3. Verify door cut-outs with indicated requirements for type, quantities, locations and size of door hardware.
   4. Replace doors with defects.
B. Do not proceed with installation until unsatisfactory conditions have been corrected

3.2 INSTALLATION

A. Hardware: For installation see Division 8 "Door Hardware" Section 08710.
B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and referenced quality standard and as indicated.
C. At exterior door frames, provide stainless steel fasteners type 316 with the more stringent spacing of the following:
   1) An on-center spacing of not more than 16" oc. with the an end spacing of not more than 8" to the edge of the opening.
   2) As required by the structural performance for high winds design criteria.
D. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.
   1. Fitting Clearances for Non-Fire-Rated Doors: Provide 1/8 inch (3.2 mm) at jambs and heads, 1/16 inch (1.6 mm) per leaf at meeting stiles for pairs of doors, and 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch (6.4-mm) clearance from bottom of door to top of threshold.
   2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
E. Field-Finished Doors: Refer to the following for finishing requirements:
   1. Division 9 Section "Painting."
   2. Division 9 Section "Exterior Wood Stains."

3.3 ADJUSTING AND PROTECTION

A. Operation: Rehang or replace doors that do not swing or operate freely.
B. Finished Doors: Refinish or replace doors damaged during installation.
C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08212

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA 45	Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101	Voluntary Specification for Aluminum, Vinyl (PVC), and Wood Windows and Glass Doors
AAMA 611	Voluntary Specification for Anodized Architectural Aluminum

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Structural

Design and provide shapes, thickness and joint connections of framing members to withstand dead and live loads caused by positive and negative pressure of 175 mph basic windspeed, exposure category "D," Gust Factor = 1.66, Importance Factor = 1 as calculated in accordance with the International Building Code, latest edition, and ASCE 7-88, with a deflection of not more than 1/175 times the length of the member and safety factor of not less than 1.65.

1.2 CERTIFICATION

Each prime window unit shall bear the AAMA Label warranting that the product complies with ANSI/AAMA 101. Certified test reports attesting that the prime window units meet the requirements of ANSI/AAMA 101, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittals Procedures." Refer to paragraph entitled "Quality Assurance" for further submittal explanation.

1.3.1 Manufacturer's Catalog Data
- a. Windows
- b. Fasteners
- c. Accessories

1.3.2 Shop Drawings

Drawings shall indicate elevations of windows, full-size sections, thicknesses and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, mullion details, installation details, and other related items.

1.3.3 Windload Design Calculations

Design calculations of windows and anchors to demonstrate compliance with structural performance requirements.

1.3.4 Schedules

Submit schedule with drawings indicating location of each window unit.

1.3.5 Factory Test Reports

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to ANSI/AAMA 101 including test size.

1.3.6 Sample: Provide Finish Sample

1.3.7 Operation and Maintenance Manuals

Submit in accordance with Section 01730, "Operation and Maintenance Data."

1.4 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, rainbowing or otherwise damaging the windows. Damaged windows shall be repaired to an "as new" condition as approved. If windows can not be repaired, provide a new unit at no cost to the Government.

1.5 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which caulking and glazing compounds must adhere.

PART 2 PRODUCTS

2.1 WINDOWS

Prime windows shall comply with ANSI/AAMA 101 and the requirements specified herein. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window shall be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum subject to compliance with structural performance requirements. Color of window frames shall be factory finished "dark bronze" anodized.

a. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with ASCE 7-88 and the International Building Code, latest edition, with a basic wind speed of 175 mph; Exposure Category "D,", Gust Factor = 1.66, Importance Factor = 1, maximum height = 20 feet. Submit calculations and test results.

b. Limit member deflection to 1/200; with full recovery of glazing materials.

c. Design and size components which withstand seismic loads and sway displacement as calculated in accordance with Uniform Building Code, latest edition.

d. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing, tolerance of supporting components.

e. Limit air infiltration through assembly to the following criteria:

1. Windows: 0.37 cfm/min/sq ft of frame area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E283.

f. Limit water penetration through assembly to the following criteria:

1. Windows: None, when measured in accordance with ASTM E331 with a test pressure difference of 10 lbf/sq ft for fifteen minutes at a flow rate of 5 gal/hr/ft2

g. Maintain continuous air and vapor barrier throughout assembly, primarily in line with pane of glass and heel bead of glazing compound.

h. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental affect to system components.

i. Drain, water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

j. Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system are not permitted.

2.1.1 Fixed Windows (F): Type F-HC40.

2.1.2 Horizontal Sliding Windows (HS): Type HS-HC40.

2.1.3 Projected Windows (AP): Type AP-HC40. Provide projected windows with concealed four bar friction hinges only.

2.1.4 Glass and Glazing: As specified in Section 08800, "Glazing."

2.1.5 Calking and Sealing: As specified in Section 07920, "Joint Sealants."

2.1.6 Weatherstripping: AAMA 101.

2.1.7 Insect screens: Relevant AAMA Sections where occurs. Aluminum Dark Bronze Anodized. Provide convenient access to remove insect screens for cleaning or maintenance reasons. Types as follows:

2.1.7.1. Fixed insect screens with aluminum hold-down clips with thumbturn.
2.1.7.2 Sliding screens

2.1.8 Grille screens: Relevant AAMA Sections where occurs. Access to remove screens for cleaning or maintenance reasons shall be at the interior side. Provide the following screens at the houses as noted:

2.1.8.1 Lujan House: Aluminum expanded metal screen. Aluminum Type 3003-H14, 3/16", #0.051 ga, Dark bronze anodized.

Manufacturer /model: McNichols, Lancet (Flatten) or approved equal

2.2 FABRICATION

Fabrication of window units shall comply with AAMA 101.

2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness as required by 2.1a.

2.2.2 Fasteners

Use stainless steel fasteners as standard with the window manufacturer for window components, windows, trim, and accessories.

2.2.3 Weep Holes

Provide weep holes as required to return water from the inside of the sill frame to the outside. In addition, provide weep holes at bottom of the jamb frames as required to return water from the inside to the outside.

2.2.4 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.

a. Hardware

ANSI/AAMA 101. The item, type, and functional characteristics shall be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.5 Finishes

a. Anodic Coating

Clean exposed aluminum surfaces and provide a Dark Bronze anodized finish conforming to AA 45. Finish shall be Architectural Class II (0.01 to 0.0175 mm 0.4 mil to 0.7 mil), designation AA-M10-C22-A32, integral color.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, the aluminum surface shall be protected from dissimilar materials as recommended in the Appendix to ANSI/AAMA 101. Surfaces in contact with sealants after installation shall not be coated with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls shall have head and jamb members designed to recess into masonry wall not less than 1 1/2 inch. The fastener spacing shown in the drawings are maximum dimensions and are subject to more stringent structural performance design criteria.

3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

END OF SECTION 08520

SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1	Butts and Hinges (BHMA 101)
BHMA A156.2	Bored and Preassembled Locks and Latches (BHMA 601)
BHMA A156.4	Door Controls - Closers (BHMA 301)
BHMA A156.5	Auxiliary Locks & Associated Products (BHMA 501)
BHMA A156.6	Architectural Door Trim (BHMA 1001)
BHMA A156.7	Template Hinge Dimensions
BHMA A156.16	Auxiliary Hardware
BHMA A156.18	Materials and Finishes (BHMA 1301)
BHMA A156.21	Thresholds
BHMA A156.22	Door Gasketing Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	Life Safety Code

UNDERWRITERS LABORATORIES (UL)

UL BMD	Building Materials Directory

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Manufacturer's Catalog Data

a. Manufacturer’s data sheet for each hardware items

1.2.2 Samples: Provide one sample of the following hardware items with the specified finish for each house. The sample shall be labeled with the name or names of its recipent house.

a. Latch/ Lockset with Lever handles
b. Door peep with knockers
c. Single Cylinder deadbolt
d. Door Bolt with thumbturn
e. Hinges : i) 4x4 mortise ball bearing hinge
ii) 4x4 bearing hinge with 5/8” barrel type with ball type finial cap

1.2.3 Instructions

a. Installation Guides
b. Operation and Maintenance Manual

1.2.4 Schedules

a. Door Hardware Schedule: Use door symbols and hardware set as designated by the Door Hardware Schedule/ Door Hardware Set in the Architectural Drawings for each house.

1.3 QUALITY ASSURANCE

1.3.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks of one lockset manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys to the GPT representative, either directly or by certified mail.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware to be applied to metal or to prefinished doors shall be made to template. Promptly furnish template information or templates to door and frame manufacturers. Template hinges shall conform to BHMA A156.7. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE ITEMS

Hinges, pivots, locks, latches, exit devices, bolts, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed.

2.2.1 Hinges

2.2.1.1 Ball Bearing Hinge :BHMA A156.1, 4X4 standard mortise ball bearing type hinge, Antique bronze finish, US10B. Provide nonremovable pin where indicated in the Door Hardware Set.

2.2.1.2 Bearing Hinge : 4X4 bearing type with 5/8" barrel with ball type finial cap, Antique bronze finish, US10B.

2.2.1.3 Continuous Geared Aluminum Hinge: See Door Hardware Set. Dark Bronze Anodized.

2.2.2 Locks, Latches/ Cylinders, Cores/ Lock Trims: Provide strikeplate with each lock, latch, cylinder, and core.

2.2.2.1 Bored Locks and Latches: BHMA A156.2, Grade 1. Dull bronze, oil rubbed, US10B.

2.2.2.2 Cylinders and Cores: Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Cylinders and cores shall have six pin tumblers. Cylinders shall be products of one manufacturer, and cores shall be the products of one manufacturer.

2.2.2.3 Handles: Provide lever type handles to match appearance (similar to "Flair" by Schlage) as indicated in the Door Hardware set for each house. Dull bronze, oil rubbed, US10B.

2.2.3 Sliding Door Hardware/Track: Dull bronze, oil rubbed, US10B.

2.2.4 Pocket Door Hardware/Track: Dull bronze, oil rubbed, US10B.

2.2.5 Pocket Door Lockset with integral recess flush pulls: Dull bronze, oil rubbed, US10B.

2.2.6 Pocket Door finger pulls: Dull bronze, oil rubbed, US10B.

2.2.7 Flush/ Recess Door pulls: Dull bronze, oil rubbed, US10B.

2.2.8 Door Stops:
- 2.2.8.1 Floor Mount Door Stop: Dull bronze, oil rubbed, US10B.
- 2.2.8.2 Wall Mount Door Stop: Dull bronze, oil rubbed, US10B.
- 2.2.8.3 Door Mount Door Stop: Dull bronze, oil rubbed, US10B.

2.2.9 Door Shoe/ Door Bottom Shoe: Aluminum, Dark Bronze Anodized

2.2.10 Bolt: Provide strikeplate or coverplate with each bolt.
- 2.2.10.1 Flush Bolt: Dull bronze, oil rubbed, US10B
- 2.2.10.2 Dead Bolt: Dull bronze, oil rubbed, US10B.

Door Hook:. See Door Hardware Set, Dull bronze, oil rubbed, US10B

2.2.4 Thresholds/Saddles: See Door Hardware Set, BHMA A156.21. Aluminum, Dark Bronze Anodized.

2.2.9 WeatherStripping Gasketing

A set shall include head and jamb seals, sweep strips. Air leakage of weather stripped doors shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283.

2.2.9.1 Extruded Aluminum Mortise Retainers

Extruded aluminum mortise retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Aluminum shall be bronze anodized.

2.2.10 Overhead Rain Drips: Mount at the top jamb or head.
Aluminum: Dark Bronze Anodized

Extruded aluminum drip screeds, not less than 0.08 inch thick. Set drips in sealant conforming to Section 07920, "Joint Sealants," and fasten with stainless steel screws.

2.2.11 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.3 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel. Provide fasteners of type necessary to accomplish a permanent installation.

2.4 FINISHES

BHMA A156.18. Aluminum hardware shall have BHMA 710 finish (dark bronze anodized), unless specified otherwise. Provide items not manufactured in aluminum in BHMA 613 finish (oxidized bronze, oil-rubbed).

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weather Stripping Installation

Handle and install weather stripping so as to prevent damage. Provide full contact, weather-tight seals. Doors shall operate without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 9 inches o.c.

3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 HARDWARE LOCATIONS

See Mounting Heights for Door Hardware and SDI 100, unless indicated or specified otherwise.

3.3 KEY CONTROL SYSTEM

All the four houses are keyed separately and with each house having a masterkey system.

3.4 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.5 DOOR HARDWARE SETS: The door hardware set for each house is located in the Architectural Drawings together with the Door Hardware Schedule which refers to the particular door and its handing. Make necessary adjustments to the hardware items to accommodate the particular door handing.

Hardware for aluminum doors shall be provided under this section. Deliver Hardware templates and hardware, except field-applied hardware to the aluminum door and frame manufacturer for use in fabricating the doors and frames.

END OF SECTION 08710

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 669	Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
ASTM C 920	Elastomeric Joint Sealants
ASTM C 1036	Flat Glass
ASTM C 1048	Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Manufacturer's Instructions

a. Setting and sealing materials
b. Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified. Include cleaning instructions for plastic sheets.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.4 ENVIRONMENTAL REQUIREMENTS

Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 STRUCTURAL

Shape and thickness shall be sufficient to withstand dead and live loads caused by positive and negative pressure of 175 mph basic wind speed, exposure category "D", Gust Factor = 1.39, Importance Factor = 1 as calculated in accordance with International Building Code, 2009 edition with a deflection of not more than 1/175 times the length of the member and safety factor of not less than 1.65.

PART 2 PRODUCTS

2.1 GLASS

ASTM C 1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.1.1 Laminated Glass

Fabricated from two pieces of Type I, Class 1, Quality q3 glass laminated together with a clear 0.015 inch thick polyvinyl butyral interlayer. The total thickness shall be nominally 5/16 inch and 7/16 inch thick minimum as noted in the window schedule. Thickness of glass indicated is a minimum requirement and will govern unless exceeded by structural or other performance requirements.

2.1.2 Wired Glass

ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 2 (tinted heat absorbing), Quality q3, 1/4 inch thick minimum. Fire-resistance rating: 1 hour or 20 minute. Thickness of glass indicated is a minimum requirement and will govern unless exceeded by structural or other performance requirements. Provide only at Meno House windows indicated to have a fire-resistance rating of not less than 1 hour .

2.1.3 Fire Lite Plus Glass Ceramic

ASTM C1048, Kind Type I, Class 2 (tinted heat absorbing), Quality q3, 5/16 inch thick minimum. Fire-resistance rating: 1 hour or 30 minute. Thickness of glass indicated is a minimum requirement and will govern unless exceeded by structural or other performance requirements. Provide only at Meno House windows indicated to have a fire-resistance rating of not less than 1 hour.

Manufacturer: TGP, Fire Lite Plus, or approved equal.

2.1.4 Frosted Glass

Where frosted glass is indicated at laminated glass assembly, provide frosted glass panel on the inside panel. ASTM C1048, Type I, Class 1, Quality q3 glass laminated together with a clear 0.015 inch thick polyvinyl butyral interlayer. The total thickness shall be as noted in the window schedule. Thickness of glass indicated is a minimum requirement and will govern unless exceeded by structural or other performance requirements.

2.2 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, SIGMA TM-3000, SIGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted shall be black.

2.2.1 Glazing Compound

Silicone sealant, ASTM C 669. Use for face glazing metal sash. Do not use preformed gaskets.

2.2.2 Elastomeric Sealant

Silicone sealant complying with ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G. Use for stop glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes. Color of sealant shall be black.

2.2.3 Sealing Tapes

Preformed, semisolid, polymeric-based material of proper size and compressibility for the particular condition. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

2.2.4 Setting Blocks and Edge Blocks

Neoprene of 70 to 90 Shore "A" durometer hardness, chemically compatible with sealants used, and of sizes recommended by the glass manufacturer.

2.2.5 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide non-corroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

PART 3 EXECUTION

3.1 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, SIGMA TB-3001, SIGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave UL labels for fire-rated glass in place. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, SIGMA TB-3001, SIGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted. Clean plastic sheet in accordance with manufacturer's instructions.

END OF SECTION 08800

SECTION 09100

METAL SUPPORT SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463	Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C 645	Nonstructural Steel Framing Members
ASTM C 754	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 841	Installation of Interior Lathing and Furring

METAL LATH/STEEL FRAMING ASSOCIATION (ML/SFA)

ML/SFA MLF	Metal Lathing and Furring

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	Fire Resistance Directory

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Shop Drawings

Metal support systems

Submit for the erection of metal framing, furring, and ceiling suspension systems. Indicate materials, sizes, thicknesses, and fastenings.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A 653/A 653M, G-60; aluminum coating ASTM A 463/A 463M, T1-25; or a 55-percent aluminum-zinc coating.

2.1.1 Nonload-Bearing Wall Framing

ML/SFA MLF.

2.1.2 Materials for Attachment of Gypsum Wallboard

2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 645.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C 645, but not thinner than 0.0329 inch thickness.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Nonload-Bearing Wall Framing

ML/SFA MLF, except that framing members shall be 16 inches o.c. unless indicated otherwise.

3.1.2 Systems for Attachment of Gypsum Wallboard

3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 754, except that framing members shall be 16 inches o.c. unless indicated otherwise.

3.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C 754, except as indicated otherwise.

3.2 ERECTION TOLERANCES

Framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/4 inch in 8 feet from a straight line;

c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/8 inch in 8 feet from a straight line;

c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/8 inch in 8 feet from a true plane.

END OF SECTION 09100

SECTION 09212

CEMENT PLASTER

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 61	Gypsum Keene's Cement
ASTM C 91	Masonry Cement
ASTM C 150	Portland Cement
ASTM C 206	Finishing Hydrated Lime
ASTM C 631	Bonding Compounds for Interior Plastering
ASTM C 897	Aggregate for Job-Mixed Portland Cement
ASTM C 926	Application of Portland Cement Based Plaster
ASTM C 932	Surface-Applied Bonding Agents for Exterior Plastering

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Samples

a. Plaster Finish

Submit four 36 inch square panels of varying texture and appearance for review, and selection.. Submit samples listed above sufficiently in advance of construction so as not to delay work.

b. Field Mockup.

Based on selected sample, provide a field mockup at each house for review. Make necessary adjustment to achieve texture, appearance and finish to the satisfaction of GPT representative.

1.2.2 Manufacturer's Instructions

a. Ready-mix plaster

Submit manufacturer's instructions listed above sufficiently in advance of construction so as not to delay work.

1.3 QUALITY ASSURANCE

Finished cement plaster work shall match the approved sample.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver manufactured materials in the manufacturers' original unbroken packages or containers which are labeled plainly with the manufacturers' names and brands. Keep cementitious materials dry and stored off the ground, under cover, and away from sweating walls and other damp surfaces until ready for use.

1.5 ENVIRONMENTAL CONDITIONS

1.5.1 Cement Plaster

Maintain an ambient temperature of not less than 40 degrees F continuously where cement plaster work will be performed. Maintain this temperature for not less than 48 hours prior to application, during application, and during the curing operation. In interior work, maintain heat within the building until occupancy conditions are established. When the building is exposed to hot dry winds or day-to-night temperature differentials of 20 degrees F or more, cover openings that are not glazed.

1.5.1.1 Protection from Sun and Dry Winds

During the application of the finish coat, and for a period of 48 hours following the completion of finish coat application for any given area, protect the surface of the cement plaster from direct sunlight and direct winds. Use of tarpaulins or other temporary means are acceptable. Provide moist curing in accordance with paragraph, "Curing".

PART 2 PRODUCTS

2.1 PORTLAND CEMENT PLASTER

ASTM C 150, gray portland cement Type I or II; white portland cement, Type I with 1/2 inch chopped alkali resistant fiberglass strands, minimum 1.5 percent by weight to cement, 1 1/2 pounds per sack of cement.

2.2 MASONRY CEMENT BASE COAT

ASTM C 91 natural in color.

2.3 HYDRATED LIME

ASTM C 206, Type S.

2.4 AGGREGATES

2.4.1 Sand for Portland Cement Lime Plaster

ASTM C 144, except gradation of sand shall conform to the following requirements:

a. Sand Gradation for Basecoats:

Sieve Size	Max.	Min.

No. 4	0	0
No. 8	5	0
No. 16	30	5
No. 30	65	30
No. 50	95	65
No. 100	100	90

b. Sand for Finish Coats: Natural color and graded within the limits shown above for basecoats, except that the sand shall pass the No. 8 sieve, and for smooth finish the sand shall pass the No. 30 sieve.

2.5 WATER

Suitable for domestic consumption, and free of mineral and organic substances that affect the hardening and durability of the plaster or stucco.

2.6 PROPORTIONING AND MIXING

Unless specified otherwise, materials are specified on a volume basis and shall be measured in approved containers, to ensure that the specified proportions will be controlled and accurately maintained during the progress of the work. Measuring materials with shovels (shovel count) will not be permitted. Prepare ready-mix cement plaster for use by the addition of water only.

2.6.1 Basecoat Proportions

2.6.1.1 Portland Cement Plaster Basecoats

Mix scratch coat in proportion of one part by volume portland cement to 3/4 to 1 1/2 parts by volume hydrated lime and 2 1/2 to 4 parts sand (volume of sand per sum of cement and lime). Mix brown coat in proportion of one part by volume portland cement, 3/4 to 1 1/2 parts by volume hydrated lime and 3 to 5 parts sand (volume of sand per sum of cement and lime).

2.6.2 Finish Coat Proportions

2.6.2.1 Portland Cement-Lime Plaster Finish Coat

Mix finish coat in the proportion of one part by volume of portland cement to not more than one part by volume of hydrated lime, and not more than 4 parts by volume of damp loose sand. Workability shall govern the actual amount of lime and sand used in the finish coat, within the limits specified herein. Where smooth troweled finish is indicated, allow plaster to set up to the extent that it does not flow ahead or under the trowel, yet has not solidified. Trowel the face lightly to embed the granules. Do not over-trowel or burnish the surface.

2.7 MIXING

Mix materials in mechanical mixers except finish coats containing lime may be hand mixed. The mechanical mixers shall be an approved type that accurately and uniformly controls the quantity of water. When mixing by hand, mix dry plaster aggregate to a uniform color in the mixing box, add water, and hoe the plaster immediately into the water and mix thoroughly to a proper consistency. Avoid excessive mixing and agitation. Discard plaster which has begun to set before it is used; retampering will not be permitted. Do not use frozen, caked, or lumped materials. Empty mixers and mixing boxes

after each batch is mixed, and keep free of old plaster. Mix ready-mixed plaster in accordance with manufacturer's printed instructions.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean surfaces of projections, dust, loose particles, grease, bond breakers, and foreign matter to receive plaster. Do not apply plaster directly to surfaces (1) of masonry or concrete that have been coated with bituminous compound or other waterproofing agents, (2) that have been painted or previously plastered, or (3) smooth surfaces. Where surfaces are smooth, roughen surfaces to ensure sufficient bond. Before plaster work is started, wet masonry and concrete surfaces thoroughly with a fine fog spray of clean water to produce a uniformly moist condition. Check expansion and control joints to ensure that expansion and control joints can move unrestrained.

3.2 WORKMANSHIP

3.2.1 Slump Tests

Apply Plaster by hand or machine. When a plastering machine is used, control the fluidity of cement plaster to have a slump of not more than 2 1/2 inches when tested using a 2 by 4 by 6 inch high slump cone.] Subsequent to determining water content to meet the specified slump, do not add additional water to the mix. Conduct the slump test according to the following procedure:

a. Place cone on level, dry, non-absorptive base plate.

b. While holding cone firmly against base plate, fill cone with plaster taken directly from the hose or nozzle of the plastering machine, tamping with metal rod during filling to release air bubbles.

c. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.

d. Place cone in a vertical position adjacent to freed plaster sample, using care not to shake or move base plate.

e. Lay a straightedge across top of cone, being careful not to shake or move cone. Measure slump in inches from the bottom edge of the straightedge to the top of the slumped plaster sample.

3.3 PORTLAND CEMENT-LIME PLASTER

Apply base coats with sufficient pressure to provide strong bond on masonry or concrete bases.

3.3.1 Application

Scratch coats for plaster apply in three coats to a thickness of not less than 7/8 inch. Apply the scratch coat not less than 3/8 inch thick, lightly score horizontally, and moist cure for not less than 24 hours. Apply the brown coat after the scratch coat has been aged at least 24 hours in addition to the moist curing period. Apply the brown coat to bring the base coat out to the screeds, compact and straighten to a true surface with rod and darby, and float to receive the finish coat. After the brown coat has been moist cured for not less than 24 hours and aged at least an additional 5 days, apply the finish coat to a thickness of not less than 1/8 inch. Where previous coat has become dry, dampen the surface evenly with water, prior to the application of the finish coat. Moist cure plaster for 24 hours using a fine fog

spray of water and apply to the finish coat as a frequently as required to prevent dry-out of the plaster. Do not saturate the plaster to the point where free water stands on the surface. Prevent staining of the finish coat. Provide moist curing.

3.4 PATCHING AND POINTING

Cut out and patch loose, cracked, damaged, or defective cement plaster. Patch shall match existing work in texture, color and finish flush with previously applied cement plaster surfaces. Point work abutting or adjoining finish work in a neat manner. Remove droppings or spatterings from surfaces. Leave clean and in a condition to receive paint or other finish. Remove protective covering from floors and other surfaces, and rubbish and debris from the interior and exterior of the building.

END OF SECTION 09212

SECTION 09221

LIME-BASED PLASTER / MORTAR

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Natural hydrated lime-based plaster system for the repair and restoration of the following:
   a) Interior wall surfaces of existing mamposteria construction (Flores House)
   b) Interior wall surfaces of existing tabique walls (Kitchen/Dining room at Flores House).

B. Salt-tolerant and natural hydrated lime-based plaster system for the repair and restoration of the following:
   a) Wall surfaces of existing mamposteria construction (Lujan House)

C. Application of a levelling mortar for the application of fiber-reinforced plaster with sulphate-resistant binder for moisture and salt contaminated substrates. This includes salt-tolerant and natural hydrated lime-based mortar system for the repair and restoration of the following:
   a) Construction of existing mamposteria walls (Lujan House)
   b) Construction of existing mamposteria and tabique walls (Flores House)

1. 2 QUALITY CONTROL

A. Provide field samples of mortar and plaster from existing mamposteria walls and/or tabique walls to be refurbished, to the supplier for their review and analysis.

B. Plaster Samples: Prepare three 12 inch x 12 inch samples of hydrated lime-based plaster with various texture and appearance to be reviewed and selected by GPT representative. The four samples shall consist of:
   1) Pre-mixed lime-based plaster + microfibers (broadcast evenly) + sand
   2) Two additional pre-mixed lime-based plaster with different surface texture/appearance to be prepared consecutively at the request of GPT representatives.

C. Mockup: Based on selected plaster sample, prepare two 3 feet by 3 feet field mock-up at locations selected by GPT representative. Make necessary adjustments to the mock-ups to the satisfaction of the GPT representative.

D. Work Plan shall be submitted by the plaster installer that details work sequence, personnel protection and curing methodology to be followed in the installation of natural hydrated lime mortars and plaster

1.3 QUALITY ASSURANCE

A. Applicator: Company specializing in performing the work with lime-based mortar and plaster of this section with minimum three years experience in high humid, tropical and marine environments. Qualified applicators that participated in previous GPT projects includes but not limited to the following:
   1) Restura (Mexico)

B. Deliver packaged materials to the project site in manufacturer's original and unopened containers.

C. Levelling mortar specified has a shelf-life in original container of approximately 6 months. Dry factory-mixed mortar has a shelf-life in original containers of approximately 3 months. Material must be used within those time frames, with measurement of time starting at the date of shipping from the factory.

D. Materials must be stored on elevated platforms and kept dry.

E. Store sand where required characteristics can be maintained and contamination avoided.

PART 2 PRODUCTS

2.1 LIME-BASED MORTAR AND PLASTER

A. Factory-mixed dry lime-based and salt-tolerant mortar with cementitious, sulphate resistant binders with salt inhibitor and natural, cementitious aggregates. Water vapor permeable, accelerating the drying of damp surfaces and reducing loss of heat resulting from moisture penetration. Mortar shall be Natural, Hydraulic (NHL) Type and/or as compatible with existing hydrated lime mortar systems to be refurbished (Supplier shall verify with field samples taken from existing mamposteria walls)

1. Suppliers: Include but not limited to the following:
   a. BASF Wall Systems, GmbH & Co. KG, Tholauer Strase 25, 95615 Marktredwitz / Germany. Telephone: +49 9231 802-0. Fax: +49 9231 802-330. www.rajasil.com
   b. St Astier (Imported and distributed by TransMineral USA Inc) www.stastier.com

2. Type:
   a. Leveling Mortar: NHL5

3. Mixes:
   a. Prepare mortar mixes with sand in accordance with manufacturer's written instructions.
   b. Mix only as much mortar as can be used prior to initial set.
   c. Mix materials dry, to uniform consistency, before adding water.
   d. Protect mixes from excessive evaporation and from contamination.

4. Properties:
   Bulk density: approx. 0.85 kg/dm3
   Quality control: Composition and quality.
   Grain size: up to approx.. 2.0 mm.
   Compressive strength: 5 N/mm2
   Cappilary water absorption > 90.3 kg/m2
   Water penetration depth h < 5 mm
   Water vapor diffusion resistance coefficient u < 12
   Low thermal conductivity coefficient: approx.. 0.17 W/mK

c. Hydrated Lime-based Render and Plaster: Natural, Hydraulic (NHL) Type and/or as compatible with existing hydrated lime plaster systems to be refurbished (Supplier shall verify with field samples taken from existing locations). Lime-based render at exterior locations shall be salt-tolerant, with cementitious, sulphate resistant binders with salt inhibitor.

1. Suppliers: Include but not limited to the following:
   a. Rajasil (Rajansil renovation render system) Fax # (49)9321-80259. www.rajasil.com
   b. St Astier (imported and distributed by TransMineral USA Inc). www.stastier.com

2. Type:
   a. Salt Tolerant Render and Restoration Render (Exterior locations): NHL3.5.
   b. Plaster Base (Interior locations): NHL 3.5.
   c. Plaster Finish (Interior locations): NHL 2.

3. Mixes: Prepare dry mortar mixes in accordance with manufacturer's written instructions.
   a. Scratch coat: 1 part NHL 3.5 to 2 parts sand, proportioned by volume. Add microfibers to scratch coat.
   b. Brown coat: 1 part NHL 3.5 to 2 parts sand, proportioned by volume.
   c.. Finish coat: 1 part NHL 2 to 2.5 parts of sand, proportioned by volume.

d. Micro-fibers: Polypropylene, inert microfibers (transparent or white) and compatible with lime-based plaster systems used.

e. Sand: Silicate Sand, Clean and Washed sand free of salts. (No beach sand allowed) Grain size: up to approx.. 3 /32 " (2.0 mm) or less.

f. Local limestone : Grind to sand sizes (aprox. 2.0 mm.) , and washed clean and free of salts

g. Water: Clear, portable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories

h. Lath: No metal /plastic lath of any sort is allowed on this project.

i. Bonding Compound: ASTM C 932. For use only in areas with cement plaster base.

j. Accessories: No plastic, metal or fiber accessories shall be used on this project. All corners and shapes shall be formed with plaster materials alone

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements for cement plaster work.

B. Plaster shall not be installed when rain is occurring or likely to occur in the 24 hours after the completion of the plastering.

C. Verify environmental conditions prior to commencement of plastering work to ensure that the room is well ventilated with desired humidity level and protected from moisture and/or rainwater

3.2 EXAMINATION

A. Verify surface and conditions of the existing plaster/ mortar work and determine the type of plaster/ mortar used in the original building. When removing field samples for analysis, verify that they are from an original phase of work, and not from later remedial works. The samples should be representative of the bulk of the remaining materials to determine correct binder, aggregate size, color and type.

B. Remove existing lime-based plaster at mamposteria wall and/or tabique walls to sound stone. Lime plaster that is still well-adhered and forms a base for additional plastering may remain. Where the existing lime-based plaster surface and/or mortar has deteriorated and/or damaged beyond repair, remove the deteriorated areas until satisfactory substrate conditions are

encountered. Clean stone to remove dust and other materials that may inhibit bond. Prepare substrates in accordance with manufacturer's instructions.

C. Where existing lime plaster/ mortar coat and/or surface is exposed by the removal of existing wall tiles, verify newly exposed conditions. Remove any loose, cracked and deteriorated plaster /mortar, and prepare substrate to received new lime-based plaster /mortar coat. Where damage to the substrate is encountered, repair and restore to the satisfaction of GPT representative.

D. Substrate: Substrate base must be verified to be load bearing and free of damage, and material that could interfere with the adhesion of the base plaster or render. Any damage and/or deteriorated conditions at the substrate base must be repaired and/or restored. The rendering base can be dry but should not show any pressing moisture. Flaking or rising damp, old and damaged render, paint and other coatings should be thoroughly removed. Adhesion capacity on moderately, evenly absorbent render base can be improved by pre-wetting.

3.3 INSTALLATION

A. Apply plaster and/or render coats in accordance with Manufacturer's instruction.

B. Apply initial coat with "pigtail" overlaps with substrate's ifit frame and/or limestone to promote better adhesion.

C. Where initial base coat overlaps the ifit wood frame, provide rough hand hewn or chiselled wood surfaces with deep crevices to promote better adhesion to the substrate

D. At mamposteria walls facing the exterior side or uninhibited crawl space, install salt-tolerant lime-based plaster or render in accordance with manufacturer's instructions. Wet stone surfaces before plaster application. Install with an allowance for finish coat of natural hydrated lime-based plaster or render finish

E. At interior tabique walls and interior sides of mamposteria walls to be refurbished, install hydrated, non-hydraulic lime-based plaster in accordance with manufacturer's instructions.

F. After installation of each coat of plaster or render, surfaces shall be kept wet for the time required by the manufacturer by covering with plastic sheeting, wet burlap or other method approved by GPT representative.. Hairline cracking of finished surfaces within the plaster, or plaster separation at the edges of replacement plaster, is unacceptable and will require removing such work and replastering. In addtition, examine, repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed

G. Finish flat surfaces with same smooth and uneven texture as adjacent plaster. Corners shall be smooth and rounded to a minimum of one inch radius. However, great uniformity is not desirable and some slight hand-finish characteristics are encouraged. These should be demonstrated in the samples prepared prior to the start of the work.

H. Provide continuous silicone sealant (white) at exterior plaster coat edges where the underlying substrate abuts a different construction forming a cold joint. Smear the wet sealant to form a rough and smooth appearance to match the appearance of the plaster finish coat .

END OF SECTION 09221.

SECTION 09250

GYPSUM BOARD/CEMENTITIOUS BACKER BOARD

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11	Interior Installation of Cementitious Backer Units
ANSI A118.9	Cementitious Backer Units

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 36	Gypsum Wallboard
ASTM C 475	Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 630	Water-Resistant Gypsum Backing Board
ASTM C 840	Application and Finishing of Gypsum Board
ASTM C 954	Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 1002	Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases
ASTM C 1177	Gypsum Panel Products

GYPSUM ASSOCIATION (GA)

GA 216	Application and Finishing of Gypsum Board

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Product Data

a. Cement Board
b. Fasteners
c. Joint Treatment Materials

Submit for each type of gypsum board. Submit product data listed above sufficiently in advance of construction so as not to delay work.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.3.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board products outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation.

1.3.3 Handling

Neatly stack gypsum board products flat to prevent sagging or damage to the edges, ends, and surfaces.

1.4 ENVIRONMENTAL CONDITIONS

1.4.1 Temperature

Maintain a uniform temperature of not less than 50 degrees F in the structure for at least 48 hours prior to, during, and following the application of gypsum board products, and joint treatment materials, or the bonding of adhesives.

1.4.2 Exposure to Weather

Protect gypsum board and cementitious backer unit products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified herein. Provide materials manufactured from asbestos free materials only.

2.1.1 Cementitious Backer Units (Cement Board)

ANSI A118.9: 7/16” thick cement backerboard

2.1.2 Joint Treatment Materials

ASTM C 475.

2.1.2.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at cement board joints and compatible with tape, substrate and fasteners.

2.1.2.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.2.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.2.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.2.5 Joint Tape

Cross-laminated, tapered edge, reinforced fiber glass mesh tape recommended by the manufacturer. No paper type tape is allowed.

2.1.2.6 Fasteners

2.1.2.6.1 Screws

ASTM C 1002, Type "G", Type "S" or Type "W" steel drill screws for fastening cement board to cement board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C 954 steel drill screws for fastening cement board to steel framing members 0.033 to 0.112 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive cementitious backer boards. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive shelves and similar items. Do not proceed with work until framing and furring are acceptable for application of cementitious backer boards.

3.2 APPLICATION OF GYPSUM BOARD

Apply cement board to framing and furring members in accordance with ANSI A108.11 and ASTM C 840 or GA 216 and the requirements specified herein. Apply cement board with separate panels in moderate contact; do not force in place. Provide 1/2" gap at bottom of panel. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use cement board of maximum practical length. Cut out cement board as required to make neat close joints around openings. In vertical application of cement board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Surfaces of cement board and substrate members may be bonded together with an adhesive, except where prohibited by fire rating(s). Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the board manufacturer. Provide type of cment board for use in each system specified herein as indicated.

3.2.1 Application of Cement Board to Wood Framing and Furring: Comply with ASTM C 840 and/or other relevant sections with Merbau (Ifit) wood framing members.

3.2.2 Application of Gypsum Board to Steel Framing and Furring: Comply with ASTM C 840, System VIII or GA 216.

3.3.2 Joint Treatment

ANSI A108.11

3.4 FINISHING OF CEMENT BACKERBOARD

Tape and finish cement board in accordance with ASTM C 840, GA 214 and GA 216. Provide joint, fastener depression, and corner treatment. Use fiber glass mesh tape with setting or hardening type joint compounds as recommended by the board manufacturer.

3.4.1 Skim Coat

Wherever cement board is to receive eggshell, semigloss or gloss paint finish, apply a thin skim coat of joint compound to the entire board surface, after the three-coat joint and fastener treatment is complete and dry. Apply skim coat with trowel, broadknife or long-nap roller. Wipe tightly with trowel or broadknife.

3.5 CAULKING

Caulk openings around pipes, fixtures, and other items projecting through gypsum board as specified in Section 07920 Joint Sealants." Apply caulking material with exposed surface flush with cementitious backerboards.

3.6 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finish as specified.

END OF SECTION 09250

SECTION 09310

CERAMIC TILE, QUARRY TILE, TERRACOTTA TILE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1	Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
ANSI A108.4	Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive (Available only as part of ANSI A108.1)
ANSI A108.5	Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar (Available only as part of ANSI A108.1)
ANSI A108.6	Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile Setting and Grouting Epoxy (Available only as part of ANSI A108.1)
ANSI A108.8	Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile Setting and Grouting Epoxy (Available only as part of ANSI A108.1)
ANSI A108.10	Installation of Grout in Tilework (Available only as part of ANSI A108.1)
ANSI A118.1	Dry-Set Portland Cement Mortar (Available only as part of ANSIA108.1)
ANSI A118.3	Chemical-Resistant, Water-Cleanable Tile-Setting and Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive (Available only as part of ANSI A108.1)
ANSI A118.4	Latex-Portland Cement Mortar (Available only as part of ANSI A108.1)
ANSI A137.1	Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM C 144	Aggregate for Masonry Mortar
ASTM C 150	Portland Cement
ASTM C 206	Finishing Hydrated Lime
ASTM C 207	Hydrated Lime for Masonry Purposes

TILE COUNCIL OF AMERICA (TCA) Handbook for Ceramic Tile Installation

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 Samples

a. Ceramic tiles. Submit tiles showing size, form, finish and range.
b. Quarry tiles. Submit tiles showing size, form, finish and range.
c. Terracotta tiles. Submit tiles showing size, form, finish and range.
d. Grout
e. Accessories

1.3 DELIVERY, STORAGE, AND HANDLING

Store tiles in their packaging containers in a covered area and protect from any damage.

1.5 EXTRA STOCK

Supply an extra five (5) percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 MATERIALS: ANSI A108.1, ANSI A108.4, ANSI A108.5, AND ANSI A108.6 SECTION A-2.

2.1.1 Tile: ANSI A137.1, Standard Grade.

2.1.1.1 Color and Patterns

Tile colors and patterns shall be as indicated on drawings. Colors and patterns indicated by reference to manufacturer's name and designations are for color and appearance identification only and are not intended to limit selection of other manufacturer's products with similar colors and apearance.

2.1.1.2 Wall Tile

a. Glazed ceramic wall tile: ANSI A137.1, Trim shall be cushion edged.

Nominal Facial Dimensions (in inches):	Nominal Thickness (in inches):
3 by 6	5/16
6 by 6	5/16

2.1.1.3 Quarry Tile

a. Unglazed Quarry tile: ANSI A137.1, standard grade, square edges, with plain, figured face.

Nominal Facial Dimensions (in inches):	Nominal Thickness (in inches):
6 by 6	1 /2

b. Slip Resistant, Unglazed Quarry tile: ANSI A137.1, and ASTM C1028, standard grade, square edges, with raised pattern figured face.

Nominal Facial Dimensions (in inches):	Nominal Thickness (in inches):

6 by 6	1 /2

2.1.1.4 Terracotta Tile

a. Unglazed Terracotta tile: ANSI A137.1, standard grade, square edges, with plain, figured face.

Nominal Facial Dimensions (in inches):	Nominal Thickness (in inches):
6 by 6	1 /2

b. Slip Resistant, Unglazed Terracotta tile: ANSI A137.1, and ASTM C1028, standard grade, square edges, lain, figured face.

Nominal Facial Dimensions (in inches):	Nominal Thickness (in inches):
6 by 6	1 /2

2.1.1.4 Trim Units

Provide matching trim units with tile work. Provide where indicated for a complete and finished installation. Provide bullnose units for wainscots, except where wainscot is flush with abutting wall surface. Provide up-and-down corners with bullnose units where there is a break in wainscot height, or where the wainscot does not terminate against projecting construction. Provide coved base units for wainscots, and 4 inch coved base units for tile floors where wainscots are not provided. Internal corners shall be squared and external corners rounded using appropriate matching trim units.

2.1.2 Hydrated Lime

ASTM C 206, Type S; or ASTM C 207, Type S.

2.1.3 Aggregate

ASTM C 144, except sand for grout shall pass a number 16 sieve.

2.1.4 Water: Clean, potable.

2.1.5 Portland Cement: ASTM C 150, Type 1, white for grout, gray for other uses.

2.1.6 Mortars and Grouts

2.1.6.1 Mortar and Adhesives, Tile Setting

a. Portland cement mortar: ANSI A108.1 Section A4.1 for proportions, [white] [gray].
b. Dry-set portland cement mortar: ANSI A118.1, factory sanded.
c. Latex-portland cement mortar: ANSI A118.4.
d. Chemical-resistant, water-cleanable, tile-setting and grouting epoxy: ANSI A118.3.
e. Organic adhesive: ANSI A136.1.

2.1.6.2 Grout

a. Dry set: ANSI A118.1, factory sanded.
b. Latex-portland cement: ANSI A118.4.
c. Chemical-resistant, water-cleanable, tile-setting and grouting epoxy: ANSI A118.3.

2.1.7 Sealants and Caulking

Provide sealants and caulking in joints between tile and toilet accessories as specified in Section 07920, "Joint Sealants."

2.1.8 Scratch Coat: Scratch coat for wall tile as specified in Section 09212, "Plastering".

2.1.9 Metal Lath: ANSI A108.1, ANSI A108.4, ANSI A108.5, and ANSI A108.6, Section A-2.

PART 3 EXECUTION

3.1 EXAMINATION

Do not start tile work until roughing in for plumbing, heating, ventilating, air conditioning, and electrical work has been installed and tested.

3.2 PREPARATION

3.2.1 Concrete Subfloor Preparation

Do not begin floor tile installation in areas receiving wall tile until wall tile installation has been completed.

3.2.1.1 Slab on Grade Construction Where No Bending Stresses Occur

Prepare in accordance with ANSI A108.1, ANSI A108.5, ANSI A108.6.

3.2.2 Preparation of Mortar Mixes

Measure mortar materials in approved containers to ensure that proportions of materials will be controlled and accurately maintained. Measuring materials with shovels is not permitted. Unless specified otherwise, mix mortar in proportions by volume in approved mixing machines or mortar boxes. Control the quantity of water accurately and uniformly.

3.3 INSTALLATION

3.3.1 Floor Tile

Install ceramic tile in accordance with the recommendations provided by the manufacturer and by the Tile Council of America TCA HDBK.

a. Epoxy Grout: Use at Toilet Rooms with Latex-Portland Cement Mortar Bond Coat or Dry-Set Mortar, Water-Cleanable, Tile Setting and Grouting Epoxy: ANSI A108.6
b. Dry-set mortar: ANSI A108.5.
c. Latex-portland cement mortar: ANSI A108.5.

3.3.2 Wall Tile

Wall surfaces to receive ceramic tile shall have square corners, be plumb and true, with variations not exceeding 1/4 inch in eight feet from the required plane.

a. Chemical-resistant, water-cleanable, tile-setting and grouting epoxy: ANSI A108.6. Clean in accordance with the manufacturer's recommendations.

3.3.3 Joints

Make parallel, plumb, level, and in alignment. Make end joints in broken-joint work on center lines of adjoining tiles, as far as practicable. Set square tiles with straight joints, and set oblong tiles with broken joints, except in special arrangements and design, where indicated.

3.3.3.1 Joint Width

Make joints uniform in width and space to accommodate tile with a minimum of cutting, but maintain standard mounting widths between units abutting sheets of mounted ceramic mosaic tile. Make joint widths as follows:

a. Mounted tile: As determined by the mounted tile spacing.
b. Trim units and accessories: Match adjoining tile units.

3.3.3.2 Grouting and Pointing Joints

See color schedule for grout color selections for walls.

a. Grout tile in accordance with ANSI A108.10.

3.3.4 Thresholds

Align edges with faces of trim on both sides of openings. Fit thresholds neatly and bed properly in cement mortar flush with adjoining floors.

3.3.5 Curing

Cover floors with 30 pound natural kraft paper with joints overlapping at least 4 inches and tape-sealed or held down with planks or other weights. Allow to damp cure for at least 72 hours before permitting foot traffic on tiled floor. Cure in accordance with ANSI A108.1 ANSI A108.5 ANSI A108.6.

3.4 CLEANING

Clean in accordance with ANSI A108.1, ANSI A108.4, ANSI A108.5, and ANSI A108.6, Section A-3. Acid cleaning of unglazed tile when necessary, shall be done no sooner than 14 days after setting tile.

3.5 PROTECTION

Meet the requirements of ANSI A108.1, ANSI A108.4, ANSI A108.5, and ANSI A108.6 Section A-3. Cover finished tile floors with temporary plywood before permitting foot traffic. Place board walkways on floors that are to be continuously used as passageways by workers. Cover thresholds with boards. Protect tiled corners, external angles, with board corner strips in areas used as passageways by workers.

END OF SECTION 09310

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:
   1. Exposed exterior items and surfaces (includes crawl space at Lujan house).
   2. Exposed interior items and surfaces.
   3. 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 exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless otherwise indicated:
   1. Prefinished items include the following factory-finished components:
      a. Finished mechanical and electrical equipment.
      b. Light fixtures.
      c. Distribution cabinets.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.
      c. Enclosed ceiling plenums.
   3. Finished metal surfaces include the following:
      a. Anodized / powder-coated finished aluminum.
      b. Stainless steel.
      c. Chromium plate.
      d. Copper.
      e. Bronze and brass.
   4. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
   1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
   2. Division 6 Section "Rough Carpentry"
   3. Division 6 Section "Exterior Architectural Woodwork"

4. Division 6 Section "Interior Architectural Woodwork"
5. Division 8 Section "Wood Windows"
6. Division 9 Section "Gypsum Board/ Cement Board Assemblies"
7. Division 9 Section "Exterior Wood Stains" for exterior wood stains.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.
1. Material List: Provide an inclusive list of required 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.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by the manufacturer that products supplied comply with EPA regulations controlling use of volatile organic compounds (VOCs).

B. Samples: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Submit Samples on the following substrates for the Architect's review of color and texture only:
a. Concrete: Provide two 4-inch- square samples for each color and finish.
b. Concrete Masonry: Provide two 4-by-4-inch samples of masonry, with mortar joint in the center, for each finish and color.
c. Painted Wood: Provide two 12-inch- square samples of each color and material on hardboard.
d. Sealed and Waxed Wood: Provide two 12-by-12-inch samples of sealed and waxed wood finish on actual wood surfaces.
e. Stained Wood: Provide two 12-by-12-inch samples of stained wood finish on actual wood surfaces.

D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Field Mockups: When requested by the GPT representative, provide a field mock-up with final colors for review on approved location. Make any modifcations or adjustments as indicated by GPT representative.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the 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 stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F and not more than 90 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

C. Do not apply paint in rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed, dry and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner as follows:
   1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 5 gal. in 1 container of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with other requirements, provide products as indicated in the Finish Schedule or equivalent products from manufacturers that include, but are not limited to the following:
   1. Behr Paint or approved equal
   2. Frazee Paint or approved equal
   3. Minwax or approved equal
   4. Zar Wood Stains or approved equal

5. Thompson or approved equal

C. Subject to compliance with requirements and recommendations of the manufacturer, provide products for exterior locations that meet the following minimum Performance Requirements:

	STRENGTH	
1.	Impact Load ASTM E 695	: 30 inch lbs
2.	Falling Ball Impact ASTM D1037	: 200 inch lbs
3.	Transverse Wind Load Resistance ASTM E330	: Negative Wind Load: 150 psf
4.	Tensile Strength ASTM C297	: As recommended by manuf
5.	Adhesion ASTM D 4541	: As recommended by manuf
	FIRE PERFORMANCE	
6.	Flame Spread ASTM E 84	: 0 -25
7.	Smoke Developed ASTM E 84	: 0 –10
	ENVIRONMENTAL DURABILITY	
8.	Accelarated Weathering ASTM G 23	: 2000 hours: no deleterious effect
9.	Wind driven rain FS-TTC-C-555B	: 24 hours: no penetration of water
10.	Fungus Resistance Mil Std 810B	: 28 days: no growth
11.	Abrasion Resistance ASTM D968	: 1000 liters: no deleterious effect
12.	Salt Fog Resistance ASTM B 117	: 1000 hours: no deterioration
13.	Volatile Organic Compound (VOC) 40 CFR 59 specific coating	: 2.92 lbs/gal or min VOC level for each
	APPEARANCE	
14.	Ultraviolet/Condensation ASTM D4587 (3000 hrs 8 hour/4 hour condensation UVA 340)	: No more 20% loss of gloss, and less than 5 CIE Lab DE units color change for each type and color selection

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service, application, and the local climatic conditions of high wind (typhoon), high UV and humidity, and marine environment as recommended by the manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names 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 substitutions.

C. Colors: Match colors and texture indicated by reference to manufacturer's color designations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
   1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will not be construed as the 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 the Architect about anticipated problems using the materials specified over substrates primed by others. Failure to notify will mean the Contractor's acceptance of the substrates primed by others.
   2. Coordinate with other trades including trades "by Others" to ensure that precautions are taken to minimize inconvenience and to maintain reasonable access to the site.

3.2 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 the 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 the substrates of substances that could impair the bond of the various coatings. Remove 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.
   2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, bituminous coatings and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition by washing surface with dilute muriatic acid before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
      c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
   3. Wood (Softwoods): 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.
      a. 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.
      b. Prime and stain wood to be painted. Prime edges, ends, faces, undersides, and backsides of wood, including ceiling trims and boards, cabinets, and trims.
      c. Backprime wood surfaces where masonry, plaster, or other wet wall construction abut the wood on backside.

3. Wood (Hardwoods: Merbau (Ifit) and Ipe): 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.
    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of clear or other recommended sealer before applying finish wax coat.
    b. Apply paste finishing wax to sealed surfaces, edges, ends, faces, undersides, and backsides of wood, including floor decking, cabinets, counters, door and frames, shutter and frames and standing/running trims and casing. Provide drying time in compliance with manufacturer's recommendations prior to hand-buffing the waxed surface with cloth to the desired finish and appearance.
    c. At new hardwood material at exposed locations, apply two coats of paste finishing wax to mitigate uneven or blotchy appearance. Where occurs, remove excess wax and lightly sand smooth rough surfaces prior to the second coat.
    d. At concealed hardwood locations, apply water-repellent sealer to the wood surfaces. At end grain surfaces, apply 2 coats of sealer or dip the ends of the wood in the sealer solution for 15 minutes.
    e. At existing ifit floor decking at Flores house, repair any damage and remove any oils, dirt, and excess or alien materials. Refinish the floor decking by reapplying a coat of paste finishing wax and hand-buff to achieve the desired finish and appearance.
    f. Provide a final sealer coat to finished waxed surfaces to protect the finished waxed coating.
4. 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 the Steel Structures Painting Council's (SSPC) recommendations.
    a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. 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 the same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials 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.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the 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.

3.3 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 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, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
7. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
8. Paint other surfaces not indicated in the Drawings but required to achieve a complete, finish and consistent appearance to the satisfaction of the GPT representative.
9. Sand lightly between each succeeding stain and/or wax coat.

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 the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. 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 edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by hand-cloth, brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.Unless otherwise indicated, visible brush strokes or marks are not acceptable.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
4. Hand cloth: Smear and rub wax paste with soft and non-staining hand-cloth. Remove excess wax.

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

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

F. Mechanical items to be painted include, but are not limited to, the following:
   1. Piping, pipe hangers, and supports.
   2. Insulation.
   3. Motors and mechanical equipment.
   4. Accessory items.
   5. Exposed Downspouts or Rain water conductor

G. Electrical items to be painted include, but are not limited to, the following:
   1. Conduit and fittings.
   2. Switchgear.
   3. Panelboards.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the 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.

J. 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.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster for top coat at all exterior location. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
   1. Provide satin finish for final coats unless otherwise indicated.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

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

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

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

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

3.7 EXTERIOR PAINT SCHEDULE

A. Lime Based Plaster and Mortar: Do not Paint.

B. Concrete, Stucco and Masonry (Not CMU) not scheduled to receive Special Coatings: Provide the following finish systems over exterior concrete, stucco, and brick masonry surfaces:
   1. Low-Luster Acrylic Finish: 2 finish coats over a primer.

a. Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).
b. First and Second Coats: Low-luster (eggshell), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils (0.058 mm).

B. Concrete Masonry Units: Provide the following finish systems over exterior concrete masonry units:
1. Low-Luster Acrylic Finish: 2 finish coats over a block filler.
a. Block Filler: High-performance, latex block filler applied at spreading rate recommended by the manufacturer to achieve a total dry mill thickness of not less than 4.0 mils (0.102 mm).
b. First and Second Coats: Low-luster (eggshell), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils (0.058 mm).

C. Exterior Hardwoods (Merbau and Ipe): Provide the following paint finish systems over new, exterior wood surfaces and trims:
1. Low-Luster Wax Finish: Sealer top coat on 2 finish coats over a primer.
a. Primer: Water repellent sealer as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
b. First and Second Coats: Low-luster (eggshell), paste finishing wax applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).
c. Sealer: Apply a clear water-repellent top coat to exterior surfaces to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

D. Painted Woods: Provide the following finish systems over smooth wood siding and other smooth, exterior wood surfaces:
1. Low-Luster Acrylic Finish: 2 finish coats over a primer.
a. Primer: Exterior latex, wood primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
b. First and Second Coats: Low-sheen (eggshell), exterior, latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils (0.058 mm).

E. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:
1. Low-Luster Finish: 2 finish coats over a galvanized metal primer.
a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
b. First and Second Coat: Low-luster (eggshell of satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

F. Aluminum: Provide the following finish systems over uncoated exterior aluminum surfaces:
1. Acrylic-Enamel or Flourourethane Finish: 2 finish coats over a primer.
a. Primer: Rust-inhibitive, acrylic- or alkyd-based, metal primer, as recommended by the manufacturer for use over aluminum, applied at spreading rate recommended

by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

3.8 INTERIOR PAINT SCHEDULE

A. Lime Based Plaster and Mortar: Do Not Paint.

B. Concrete and Masonry (Other than Concrete Masonry Units) Not scheduled to receive special coatings: Provide the following paint systems over interior concrete and brick masonry surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
   a. Primer: Alkali-resistant, acrylic-latex, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.0 mil (0.025 mm).
   b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

C. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a block filler.
   a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 5.0 mils (0.13 mm).
   b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

D. Cementitious Backer Boards: Provide the following finish systems over interior mineral-fiber-reinforced cement panels:

1. Low-Luster Acrylic Finish: 2 finish coats over a primer.
   a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
   b. First and Second Coats: Low-luster (eggshell), acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).

E. Cement Plaster: Provide the following finish systems over new jinterior plaster surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
   a. Primer: Alkali-resistant, alkyd- or latex-based, interior primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
   b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

F. Interior Hardwoods (Merbau and Ipe): Provide the following paint finish systems over new, interior wood surfaces and trims:

1. Low-Luster Wax Finish: 2 finish coats over a primer.
   a. Primer: Water repellent sealer as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

b. First and Second Coats: Low-luster (eggshell), paste finishing wax applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).
c. At interior floor/decking, applying a clear water-repellent low-luster (eggshell) sealer top coat to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

G. Stained Woodwork: Provide the following stained finishes over new, interior woodwork:
1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sealer coat and an alkyd-based, opaque interior wood stain. Wipe wood filler before applying stain.
a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.
b. Stain Coat: Alkyd-based, opaque interior wood stain applied at spreading rate recommended by the manufacturer.
c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
d. First and Second Finish Coats: Alkyd-based or polyurethane low luster (eggshell) varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.

H. Painted Woodwork: Provide the following finish systems over smooth wood surfaces:
1. Low-Luster Acrylic Finish: 2 finish coats over a primer.
a. Primer: Acrylic-latex, wood primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
b. First and Second Coats: Low-sheen (eggshell), acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils (0.058 mm).

I. Ferrous Metal: Provide the following finish systems over ferrous metal:
1. Low-Luster, Acrylic-Enamel or Flourourethane Finish: 2 finish coats over a primer.
a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

J. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:
1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

END OF SECTION 09900

SECTION 10430

EXTERIOR SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 GENERAL

All exterior signage shall be provided by a single manufacturer. Exterior signage shall be of the design, detail, sizes, types, and message content shown on the drawings, shall conform to the requirements specified, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation.

1.3 WIND LOAD REQUIREMENTS

Shapes and thicknesses of framing members shall be sufficient to withstand dead and live loads caused by positive and negative pressure of 175 mph basic wind speed, exposure category "C", Gust Factor = 1.66, Importance Factor = 1 as calculated in accordance with International Building Code, latest edition, ASCE 7, with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65.

1.2 SUMMARY

A. This Section includes the following types of signs:

1. Panel signs.
2. Dimensional letters and numbers.
3. Cast metal plaques.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
4. Furnish full-size rubbings for metal plaques.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Samples for initial selection of color, pattern, and texture:

.a. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.

2. Samples for verification of color, pattern, and texture selected and compliance with requirements indicated:

a. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
b. Dimensional Letters: Provide full-size representative samples of each dimensional letter type required, showing letter style, color, and material finish and method of attachment.

1.4 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Manufacturers of Panel Signs:

a. ABC Architectural Signing System.
b. Andco Industries Corp.
d. APCO Graphics, Inc.
e. ASI Sign Systems, Inc.

f. Best Manufacturing Company.
g. Mohawk Sign Systems.

2. Manufacturers of Dimensional Letters:

a. Andco Industries Corp.
b. A.R.K. Ramos Manufacturing Company, Inc.
c. ASI Sign Systems, Inc.

3. Manufacturers of Cast Plaques:

a. Andco Industries Corp.
b. A.R.K. Ramos Manufacturing Company, Inc.
c. ASI Sign Systems, Inc.
d. Best Manufacturing Company.

2.2 MATERIALS

A. Aluminum Sheet: Provide aluminum sheet of alloy and temper recommended by the sign manufacturer for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.

B. Aluminum Extrusions: Provide aluminum extrusions of alloy and temper recommended by the sign manufacturer for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5.

C. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for the use and finish indicated.

D. Stainless Steel Plate, Sheet, and Strip: Provide stainless steel plate, sheet, or strip, AISI Type 302, complying with requirements of ASTM A 167.

E. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

F. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 PANEL SIGNS

A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.

B. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:

1. Edge Condition: Beveled.
2. Corner Condition: Square corners.

C. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit sign panel construction and mounting conditions indicated. Factory-paint brackets in a color matching the background color of the sign panel.

D. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

E. Engraved Copy: Machine-engrave letters, numbers, symbols, and other graphic devices into sign panel on the face indicated to produce precisely formed copy, incised to uniform depth. Use high-speed cutters mechanically linked to master templates in a pantographic system or equivalent process capable of producing characters of the style indicated with sharply formed edges.

1. Engraved Metal: Fill engraved copy with enamel

2.4 DIMENSIONAL LETTERS AND NUMBERS

A. Cast Letters and Numbers: Form individual letters and numbers by casting. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Cast lugs into the back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.

1. Metal: Bronze Anodized Aluminum.

B. Cutout Letters and Numbers: Cut letters and numbers from solid plate material of thickness indicated. Produce precisely cut characters with square cut, smooth edges. Comply with requirements indicated for finish, style, and size.

1. Metal: Bronze Anodized Aluminum.

C. Fabricated Letters and Numbers: Fabricate letters and numbers to required sizes and styles, using metals and thicknesses indicated. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with requirements indicated for finish, style, and size.

1. Aluminum Sheet: Not less than 0.090 inch thick. Fabricate by the heliarc welding process.

2.5 CAST METAL PLAQUES

A. Plaques: Castings shall be free from pits, scale, sand holes, or other defects. Comply with requirements specified for metal, border style, background texture, and finish and with requirements shown for thickness, size, shape, and copy. Hand-tool and buff borders and raised copy to produce the manufacturer's standard satin polished finish. Refer to the "Finishes" Article for other finish requirements.

1. Metal: Aluminum.
2. Border Style: Plain bevel.
3. Border Style: Raised flat band
4. Border Style: Background Texture: Manufacturer's standard matte finish.
5. Background Texture: Manufacturer's standard stipple finish.

2.6 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance,

provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.

1. Flush Mounting: Mount letters with backs in contact with the wall surface.
2. Projected Mounting: Mount letters at the projection distance from the wall surface indicated.

C. Cast Metal Plaques: Mount plaques using the standard method recommended by the manufacturer for the type of wall surface indicated.

1. Concealed Mounting: Mount the plaques by inserting threaded studs into tapped lugs on the back of the plaque. Set in predrilled holes filled with quick-setting cement.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10430

SECTION 11401

ELECTRIC KITCHEN EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electrical Code

UNDERWRITERS LABORATORIES INC. (UL)

UL 430	Waste Disposers
UL 749	Household Dishwashers
UL 858	Household Electric Ranges
UL 921	Commercial Electric Dishwashers

1.2 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.2.1 Manufacturer's Catalog Data

a. Kitchen equipment

1.2.2 Instructions

a. Kitchen equipment
b. Exhaust hood

1.2.3 Operation and Maintenance Manuals

a. Kitchen equipment

Submit operation and maintenance data in accordance with Section 01730, “Operation and Maintenance Data.”

PART 2 PRODUCTS

2.1 KITCHEN EQUIPMENT

2.1.1 Materials

Except as modified herein, provide manufacturer's standard materials for kitchen equipment. Provide quantities, physical dimensions, colors, and electrical characteristics as indicated. Colors of materials shall be from standard manufacturer’s colors.

2.1.2 Refrigerator

Whirlpool, 66 inches high, 27 inches deep and 31 inches wide, 19 cubic feet capacity, with automatic defrost, two side by side doors, two sliding adjustable wire shelves, a meat keeper pan with one trivet, two ice trays and four cabinet rollers, model number 4110-00-085-1496, or equal. Provide 4 foot extension cord. Provided and installed by the Contractor.

2.1.3 Electric Range and Oven

White Westinghouse Electric, 30 inches, 240V, with automatic oven control, viewing window and decorative backguard, model number 7310-00-823-7386, or equal. Provide 4 foot extension cord. Provided and installed by the Contractor.

2.1.4 Range Hood

UL 858, vented, with two-speed fan, permanent washable aluminum filter, top exhaust; eye level up-front push button controls, with on indicating lights; full width of electric range.

2.1.6 Household Garbage Disposal

UL 430, stainless steel continuous feed model, heavy duty, ½ hp motor, and stainless steel grinding element with two 360-degree stainless steel swivel impellers. Provide polyethylene or polyester drain flow chamber. Equip motor with manual reset, thermal overload protection, and sound insulation. Provide on/off wall switch and self-service wrench for impeller.

2.1.7 Washer/Dryer

2.1.7.1 Washer

Whirlpool, 14 pounds capacity, 42 3/8 inches high, 25½ inches deep, 26 7/8 inches wide, 4 load sizes - extra small, small, medium and large, model number 3510-00-892-3933, or equal. Provide 4 foot extension cord. Provided and installed by the Contractor.

2.1.7.2 Dryer

Whirlpool, electric, 42 3/8 inches high, 25 3/16 inches deep, 29 inches wide, 14 pound capacity, model number 3510-01-315-9749, or equal. Provide 4 foot extension cord. Provided and installed by the Contractor.

PART 3 EXECUTION

3.1 INSTALLATION

Refer to Section 15400, "Plumbing Systems," and Section 16402, "Interior Wiring Systems." Install kitchen equipment in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

Conduct inspection and testing in the presence of the Owner.

3.2.1 Field Inspection

Before and after installation, inspect each piece of kitchen equipment for compliance with specified requirements.

3.2.2 Operation Tests

Upon completion, but before final acceptance, perform operation tests on each piece of equipment to determine that components, including controls, safety devices, and attachments, operate properly and in accordance with specified requirements.

END OF SECTION 11401

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Basic Mechanical Requirements specifically applicable to Division 15 Sections, in addition to Division 1 - General Requirements.

1.2 ALTERNATE

Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in an Owner-Contract Agreement.

1.3 REFERENCES

Refer to individual sections.

1.4 DEFINITIONS

A. FURNISH: The term furnish means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation and similar operations.
B. INSTALL: The term install describes operations at the Project Site including the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
C. PROVIDE: The term provides means to furnish and install, complete and ready for intended use.

1.5 SUBMITTALS

A. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
B. Mark dimensions and values in units to match those specified.
C. Indicate on submittals; features, accessories and options pertinent to this project.
D. Indicate on shop drawings; equipment manufacturer's installation requirements for operation, service and maintenance. Indicate connection of piping, ductwork and wiring. Indicate supports and reinforcements necessary for equipment, ductwork and piping to withstand 170-mph typhoon winds and earthquake forces anticipated in seismic zone based on the latest International Building Code.

1.6 REGULATORY REQUIREMENTS

A. General: Conform to applicable International Building Code regulations.
B. Fire Protection: Conform to applicable NFPA regulations.
C. Plumbing: Conform to applicable International Plumbing Code regulations.
D. Mechanical: Conform to applicable International Mechanical Code Regulations.
E. Electrical: Conform to applicable National Electrical Code (NEC) Regulations.
F. Obtain permits, and requests inspections from authority having jurisdiction.

1.7 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

1.8 MATERIALS AND WORKMANSHIP

A. Contractor shall furnish necessary materials in ample quantities and as frequently as required to avoid delay in the progress of the Work, and shall so store them as to prevent interference with other work.

1.9 DEFECTIVE WORK AND MATERIAL

A. All materials or work found to be defective or not in strict conformity with the drawings or different from requirements of the drawings and specifications or defaced or injured through negligence of Contractor or his employees, or through action of fire or weather will be rejected and shall be immediately removed from premises by Contractor and satisfactory materials and work substituted without delay.
B. All defective work or imperfect work shall be corrected immediately on notice from the project manager. No previous inspection or certificate on account shall be held to relieve Contractor from his obligation to furnish sound materials and to perform good and satisfactory work.

1.10 COOPERATION AND COORDINATION

A. Contractor shall confer with other contractors and school officials at the site before installing his work to avoid interferences so that maximum head room and clearances may be maintained. In event that interferences develop between work of various contractors, Project Manager's decision will be final and no additional compensation will be allowed for changes required.
B. Particular attention shall be paid to situations where recessed equipment, pipes and lights occur, or where the work of several trades occurs together above suspended ceilings, in pipe shafts or in areas where space is limited.
C. All fixtures, equipment, devices, switches, outlets, pumps, etc., shall be positioned to avoid all interferences with and to assure proper coordination with work of all other trades, cases, partitions, wall, floor and ceiling patterns, architectural features, etc. All recessed devices, fixtures, etc., shall be coordinated with all wall, floor and ceiling patterns. Project manager will reconcile conflicts and adjustments where such adjustments are warranted.

1.11 PROTECTION OF EQUIPMENT AND SYSTEMS

A. Contractor shall keep all his respective pipe openings closed by means of plugs or caps to prevent entrance of foreign matter during construction and cover all fixtures, equipment, and apparatus as required to protect them against dirt, water, chemical or mechanical damage both before and after installation. Any such fixtures, equipment or apparatus damaged prior to final acceptance of the Work shall be restored to its original condition or replaced by Contractor at no cost to Project Manager.

1.12 CONTRACT DRAWINGS

A. The layout shown on the Contract Drawings is necessarily diagrammatic but shall be followed as closely as actual construction and as other work will allow. The dimensions of work as shown on the Contract Drawings are not as-built dimensions. No measurements shall be scaled from the drawings and used as definite dimensions for laying-out or fitting work in place.
B. The layout of manufactured equipment as shown on the drawings shall be checked and the

exact location shall be determined from the dimensions of equipment shop drawings approved by the Project Manager.

1.13 MAINTENANCE MANUAL AND OPERATING INSTRUCTIONS

A. Upon completion of the Work, Contractors shall provide the Project Manager with three copies of maintenance manual for all equipment furnished and installed under his Work. Manuals shall be in substantial 3-ring binders with project name and number inscribed on face and hinged back.

B. The manual shall include manufacturer's lubricating and operating instructions and parts list and serial numbers for all operating machinery, including drive information, and motor horsepower, amperage, and voltage readings on all phases, valve chart, sequence of operation, index following the order listed in the specifications, warranties in the name of the Installation, and a list of manufacturers, service firms and subcontractors names and telephone numbers.

C. Training attendance rosters for each training session shall be included in manuals. Roster will identify training subject, date, attendees name, job title, office symbol, grade/rank, and telephone number.

D. All switches, controls, and safety devices shall be clearly and permanently marked with embossed or printed plates as to purpose and as to operation and shall be tested in the presence of the Project Manager and the schools designated representative to ensure that he understands their function and purpose.

E. Upon completion of the Work, Contractors shall put the systems into service. Contractors shall be entirely responsible for the equipment during all testing operations including the lubricating and turning on and off of such apparatus.

1.14 SUBSTITUTION OF EQUIPMENT

A. The contractor may offer to substitute equipment other than those listed in the drawings for approval of the Project Manager. The request for substitution of equipment shall be submitted by the Contractor to the Project Manager within fifteen (15) calendar days after award of the contract. It is incumbent on the Contractor to submit technical data that will fully establish the equality of the proposed substitute equipment with that listed and evidence to substantiate the availability of the required repair and maintenance service. Each request for substitution shall be accompanied by the following information for each piece of equipment:

1. Statement indicating that this substituted equipment will not increase the contract cost nor extend the completion date.
2. Manufacturer's name and model number.
3. Catalog cuts, diagrams and other data published by the manufacturer with the particular model identified and the pertinent design data for that model highlighted or underlined for easy reference.
4. Parts lists and recommended spare parts required for preventive maintenance and minor field repairs.
5. Each request for substitution shall also include the following information relating to service maintenance and repair:
    a. Name, address and telephone number of nearest factory authorized technical representative.
    b. Name, address and telephone number of firm(s) qualified to perform preventive maintenance, minor or major repairs in the locale of the project.
    c. Name, address and telephone number of firm(s) from whom spare parts and major components are available.
    d. Building name and address, and the name, address and telephone number of its representative where equipment of the same manufacturer as that requested for substitution has been installed and in operation for two or more years. Two or

more such installations shall be listed and the location should be in the vicinity of the proposed project.

B. In the event of Project Manager approval of a substitution of equipment, the Contractor will be notified by telephonic message by the Project Manager (or authorized representative), followed by the issuance of an amendment to the contract incorporating the equipment by name and model number.

1.15 PROJECT RECORD AND CLOSEOUT DOCUMENTS

A. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

B. Mark Specifications to indicate addenda, approved substitutions, change orders, actual equipment and materials used.

1.16 DELIVERY, STORAGE AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.17 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided in accordance with NEC. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements NEC.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

3.2 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.3 MECHANICAL INSTALLATIONS

A. General: sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate mechanical equipment and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components to allow for mechanical installation.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
5. Sequence, coordinate and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
6. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.
7. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide maximum headroom possible.
8. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
9. Coordinate the installation of mechanical materials and equipment above ceiling with suspension system, light fixtures, and other installations.
10. Install access panel or doors where units are concealed behind finished surface.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
12. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
13. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Project Manager.
14. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed expose in finished spaces.

3.4 CUTTING AND PATCHING

A. This Article specifies the cutting and patching of mechanical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.

B. Refer to Division 16 for requirements for cutting and patching electrical equipment, components, and materials.
C. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.
E. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
F. Perform cuttings, fittings, and patching of mechanical equipment and materials required to:
    1. Uncover Work to provide for installation of ill-timed work.
    2. Remove and replace defective work.
    3. Remove and replace Work not conforming to requirements of the Contract Documents.
    4. Remove samples of installed Work as specified for testing.
    5. Upon written instruction for the Project Manager, uncover and restore Work to provide for Contracting Officer observation of concealed work.
G. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

END OF SECTION 15010

SECTION 15260

PIPING INSULATION

PART 1 - GENERAL

1.1 SECTIONS INCLUDES

A. Piping insulation
B. Jackets and accessories

1.2 RELATED REQUIREMENTS:

Section 15010, "Basic Mechanical Requirements", applies to this section with the additions and modification specified herein.

1.3 SUBMITTALS

A. Product Data: Provide product description, list of materials and thickness for each service, and locations.
B. Samples: Submit two samples of any representative size illustrating each insulation type.
C. Manufacturer's Installation Instructions: Indicate procedures, which ensure acceptable workmanship and installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255, UL 723.

1.5 QUALIFICATIONS

A. Application: Company specializing in performing the work of this section with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site in accordance with the applicable provisions of General Conditions and General Requirements.
B. Deliver materials to site in original factory packaging, labeled with manufacturer's identifications, including product density and thickness.
C. Store insulation in original wrapping and protect from weather and construction traffic.
D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 CELLULAR FOAM

A. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
   1. 'K' Valve: ASTM C177 or C518; 0.27 at 75 degrees F.
   2. Minimum Service Temperature: -40 degrees F.
   3. Maximum Service Temperature: 220 degrees F.
   4. Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
   5. Moisture Vapor Transmission: ASTM E96; 0.20 perm inches.
   6. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.2 MINERAL FIBER

A. Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
   1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory applied, all-purpose, vapor-retarder jacket.
   2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
   3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
      a. Class 1, Grade A for bonding glass cloth and tape to un-faced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to un-faced glass fiber insulation.
      b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
      4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
      5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
      6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
      7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.3 JACKETS

A. Stainless Steel Jacket: Type 316 stainless steel.
   1. Thickness: 0.016 inch.
   2. Finish: Smooth.
   3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.
B. Verify that surfaces are clean, foreign materials removed, and dry.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer’s instructions.
B. On exposed piping, locates insulation and cover seams in least visible locations.
C. Insulate cold pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory applied or field applied.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as

adjacent pipe.

3. Finish with glass cloth and vapor barrier adhesive.
4. PVC fitting covers may be used.
5. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
6. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and insert.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 12 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: ASTM C640 cork or other heavy density insulating material suitable for the planned temperature range.

E. Finish insulation at supports, protrusion, and interruptions.

F. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with stainless steel jacket with seams located on bottom side of horizontal piping.

3.3 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.4 CELLULAR FOAM INSULATION SCHEDULE

PIPING SYSTEMS	PIPE SIZE (Inches, IPS)		
	Up to 1.25	1.5-3	3.5-5
Cooling Systems			
Condensate Drains from Cooling Coils	0.5	0.5	0.75
Refrigerant Suction	1.5	2	2

3.5 MINERAL FIBER

PIPING SYSTEMS	PIPE SIZE (Inches, IPS)		
	Up to 1.25	1.5-3	3.5-5
Hot Water Systems			
Domestic Hot Water Piping	1.0	1.0	1.5

END OF SECTION 15260

SECTION 15410

PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.

1.2 SUBMITTALS FOR REVIEW

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.3 SUBMITTALS AT PROJECT CLOSEOUT

A. Project Record Documents: Record actual locations of valves.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with International Plumbing Code.
B. Valves: Manufacturer's name and pressure rating marked on valve body.
C. Welding Materials and Procedures: Conform to ASME SEC IX and applicable state labor regulations.
D. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.5 REGULATORY REQUIREMENTS

A. Perform Work in accordance with International plumbing code and Guam Water Works Authority.
B. Conform to[applicable code for installation of backflow prevention devices.
C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Transport, handle, store, and protect products.
B. Accept valves on site in shipping containers with labelling in place. Inspect for damage.
C. Provide temporary protective coating on cast iron and steel valves.
D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet.

1.8 EXTRA MATERIALS

A. Provide two repacking kits for each size valve.

PART 2 - PRODUCTS

2.1 SANITARY SEWER AND VENT PIPING, WITHIN 5 FEET OF BUILDING

A. ABS Pipe: ASTM D2751 or ASTM F628.
   1. Fittings: ABS.
   2. Joints: ASTM D2235, solvent weld.
B. ABS Pipe: ASTM D2661 or ASTM D2751.
   1. Fittings: ABS.
   2. Joints: ASTM D2235, solvent weld.

2.2 WATER PIPING, WITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B88 (ASTM B88M), Type K, hard drawn for underground.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, solder, Grade 95TA.
B. Copper Tubing: ASTM B88 (ASTM B88M), Type L hard drawn for above ground.
   1. Fittings: Cast iron, coated.
   2. Joints: Grooved mechanical couplings.

2.3 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 3 Inches (80 mm) and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
B. Pipe Size Over 1 Inch (25 mm):
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
B. Grooved and Shouldered Pipe End Couplings:
   3. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
   4. Sealing gasket: "C" shape composition sealing gasket.
C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.4 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - Drain, Waste, and Vent:
   5. Conform to ASME B31.9.
   6. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (15 to 40 mm): Malleable iron, adjustable swivel, split ring.
   7. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
   8. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   9. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
   10. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
   11. Vertical Support: Steel riser clamp.
   12. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   13. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
B. Plumbing Piping - Water:
   1. Conform to[ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (15 to 40 mm): Malleable iron, adjustable swivel,

split ring.

3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
14. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
15. Vertical Support: Steel riser clamp.
16. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
17. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
18. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
19. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.5 GATE VALVES

A. Up To and Including 3 Inches (80 mm):
   1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, [solder] [or] [threaded] ends.

B. 2 Inches (50 mm) and Larger:
   1. MSS SP-70,[Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain-wheel operators for valves 6 inches (150 mm) and larger mounted over 8 feet (2400 mm) above floor.

2.6 GLOBE VALVES

A. Up To and Including 3 Inches (80 mm):
   1. MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder or threaded ends.

B. 2 Inches (50 mm) and Larger:
   1. MSS SP-85, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Provide chain-wheel operators for valves 6 inches (150 mm) and larger mounted over 8 feet (2400 mm) above floor.

2.7 BALL VALVES

A. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with union.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
B. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
C. Install piping to maintain headroom, conserve space, and not interfere with use of space.
D. Group piping whenever practical at common elevations.
E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
G. Provide access where valves and fittings are not exposed.
H. Establish elevations of buried piping outside the building to ensure not less than 1 ft of cover.
I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
K. Provide support for utility meters in accordance with requirements of utility companies.
L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
N. Install bell and spigot pipe with bell end upstream.
O. Install valves with stems upright or horizontal, not inverted.
P. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
Q. Install water piping to ASME B31.9.
R. Sleeve pipes passing through partitions, walls and floors.
S. Inserts:
    20. Provide inserts for placement in concrete formwork.
    21. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
    22. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
    23. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
    24. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
T. Pipe Hangers and Supports:
    25. Install in accordance with ASTM B31.9.
    26. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
    3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
    4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
    5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
    6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
    7. Provide copper plated hangers and supports for copper piping
    8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
    9. Support cast iron drainage piping at every joint.

3.4 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.
C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
D. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
E. Install globe, ball, or butterfly valves for throttling, bypass, or manual flow control services.

3.5 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/4 inch per minimum. Maintain gradients.
B. Slope water piping minimum 0.25 percent and arrange to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.
M. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
N. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
O. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
P. Maintain disinfectant in system for 24 hours.
Q. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
R. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
S. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SCHEDULES

A. Pipe Hanger Spacing:
27. Metal Piping:
a. Pipe size: 1/2 to 1-1/4 inches (15 to 32 mm):
1) Maximum hanger spacing: 6.5 ft (2 m).
2) Hanger rod diameter: 3/8 inches (9 mm).
b. Pipe size: 1-1/2 to 2 inches (40 to 50 mm):
1) Maximum hanger spacing: 10 ft (3 m).
2) Hanger rod diameter: 3/8 inch (9 mm).
c. Pipe size: 2-1/2 to 3 inches (65 to 75 mm):
1) Maximum hanger spacing: 10 ft (3 m).
2) Hanger rod diameter: 1/2 inch (13 mm).
d. Pipe size: 4 to 6 inches (100 to 150 mm):
1) Maximum hanger spacing: 10 ft (3 m).
2) Hanger rod diameter: 5/8 inch (15 mm).
e. Pipe size: 8 to 12 inches (200 to 300 mm):
1) Maximum hanger spacing: 14 ft (4.25 m).
2) Hanger rod diameter: 7/8 inch (22 mm).
f. Pipe size: 14 inches and Over (350 mm and Over):
1) Maximum hanger spacing: 20 ft (6 m).
2) Hanger rod diameter: 1 inch (25 mm).
28. Plastic Piping:
a. All Sizes:
1) Maximum hanger spacing: 6 ft (1.8 m).
2) Hanger rod diameter: 3/8 inch (9 mm).

END OF SECTION 15410

SECTION 15430

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Floor drains.
B. Cleanouts.
C. Hose bibs.
D. Water hammer arrestors.

1.2 RELATED SECTIONS

A. Section 15410 - Plumbing Piping.
B. Section 15440 - Plumbing Fixtures.

1.3 REFERENCES

A. ASME A112.21.1 - Floor Drains.
B. ASME A112.21.2 - Roof Drains.
C. ASME A112.26.1 - Water Hammer Arrestors.
D. ASSE 1011 - Hose Connection Vacuum Breakers.
E. ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.
F. ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
G. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
H. ASTM C478 - Precast Reinforced Concrete Manhole Sections (ASTM C478M - Precast Reinforced Concrete Manhole Sections [Metric]).
I. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
B. PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
C. PDI WH-201 - Water Hammer Arrestors.
L. PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.

1.4 SUBMITTALS FOR REVIEW

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

1.5 SUBMITTALS FOR INFORMATION

A. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

A. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.
B. Operation Data: Indicate frequency of treatment required for interceptors.
C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Transport, handle, store, and protect products.
B. Accept specialties on site in original factory packaging. Inspect for damage.

1.9 MAINTENANCE PRODUCTS

A. Section 1 - Contract Closeout.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

A. Floor Drain:
1. ANSI A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes,[reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.2 CLEANOUTS

A. Interior Finished Floor Areas:
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover.

2.3 HOSE BIBS

A. Interior:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with lockshield and removable key, integral vacuum breaker in conformance with ANSI/ASSE 1011.

2.4 WATER HAMMER ARRESTORS

A. ANSI A112.26.1; copper construction, bellows type sized in accordance with PDI WH-201, precharged suitable for operation in temperature range [34 to 250 degrees F and maximum 150 psi working pressure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
C. Encase exterior cleanouts in concrete flush with grade.
D. Install floor cleanouts at elevation to accommodate finished floor.
E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
F. Pipe relief from backflow preventer to nearest drain.
G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water

supply piping to [lavatories] [sinks] and [washing machine outlets].

H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures. Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION 15430

SECTION 15440

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Water closets.
B. Lavatories.
C. Kitchen Sinks.
D. Shower Faucets.
E. Laundry Trays.

1.2 RELATED SECTIONS

A. Section 15410 - Plumbing Piping.
B. Section 15430 - Plumbing Specialties.

1.3 REFERENCES

A. ANSI Z124.1 - Gel-Coated Glass-Fiber Reinforced Polyester Resin Bathtub Units.
B. ANSI Z124.2 - Gel-Coated Glass-Fiber Reinforced Polyester Resin Shower Receptor and Shower Stall Units.
C. ANSI Z358.1 - Emergency Eye Wash and Shower Equipment.
D. ARI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
E. ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
F. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
G. ASME A112.19.1 - Enameled Cast Iron Plumbing Fixtures.
H. ASME A112.19.2 - Vitreous China Plumbing Fixtures.
I. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
J. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
K. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
L. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

A. Product Data: Provide catalog illustrations of fixtures, sizes,[rough-in dimensions, utility sizes, trim, and finishes.

1.5 SUBMITTALS FOR INFORMATION

A. Manufacturer's Instructions: Indicate installation methods and procedures.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

A. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
B. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years' experience.

1.8 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.9 DELIVERY, STORAGE, AND PROTECTION

A. Transport, handle, store, and protect products.
B. Accept fixtures on site in factory packaging. Inspect for damage.
C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.10 WARRANTY

A. Provide five year manufacturer warranty for electric water cooler.

PART 2- PRODUCTS

2.1 FLUSH TANK WATER CLOSETS

A. Bowl:
1. ASME A112.19.2/CSA B45.1, white vitreous china, siphon jet, round bowl, pressure assisted, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 14 to 15 inches, except 17 to 19 inches for wheelchair water closets.

B. Flush Valve:
1. Lever flushing valve. Non float swing type flush tank valves are not acceptable. Provide wax bowl ring including plastic sleeve. Water flushing volume of the water closet shall not exceed 1.28 gallons per flush.

C. Seat:
1. Provide white solid plastic round open-front seat with cover.

2.2 LAVATORIES

A. Rectangular, Vitreous China, Pedestal:
1. Standard: ASME A112.19.2/CSA B45.1.
2. Rectangular Nominal Size: See architectural drawings.
3. Faucet-Hole Punching: Three holes, 2-inch centers.
4. Faucet-Hole Location: Top.
5. Color: See architectural drawings.

B. Oval, Integral Bowl, Countertop:
1. Countertop lavatory with integral bowl(s) for mounting on base unit.
2. Backsplash: Integral with countertop.
3. Overall Rectangular Top Size & Bowl Size: See architectural plans.
4. Faucet-Hole Punching: Three holes, 2-inch centers.
5. Faucet-Hole Location: Countertop.
6. Color: See architectural drawings.

C. Faucets:
1. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
2. Single-control mixing valve.
3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
5. Body Material: General-duty, copper or brass underbody with brass cover plate.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.5 gpm.

8. Centers: 4 inches.
9. Mounting: Deck, exposed.
10. Valve Handle(s): Lever.
11. Inlet(s): NPS 3/8 (DN 10) tubing, plain end.
12. Spout: Swivel, gooseneck.
13. Spout Outlet: Aerator.
14. Operation: Compression, manual.
15. Drain: Pop up.

D. Accessories:
2. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
3. Offset waste with perforated open strainer for wheelchair (ADA compliant) only.
4. Screwdriver stops.
5. Flexible supplies.

2.3 KITCHEN SINKS

A. One and Two bowl kitchen sinks, counter mounted, stainless steel.
B. Fixture:
1. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
2. Overall Dimensions: See architectural drawings.
3. Metal Thickness: 0.050 inch.
4. Bowl:
1) Dimensions: See architectural drawings.
2) Drain: 3-1/2-inch outlet for disposer.

C. Faucet:
1. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
2. Sink Faucets: Solid brass, kitchen sink.
3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
5. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
8. Mixing Valve: Single control.
9. Backflow-Prevention Device for Hand Spray: Required.
10. Centers: 4 inches.
11. Mounting: Deck, exposed.
12. Handle(s): Lever.
13. Spout Type: Swivel gooseneck.
14. Spout Outlet: Aerator.
15. Drain: Stopper with chain.

D. Accessories:
1. Chrome plated 17 gage brass P-trap and arm with escutcheon, wheel handle stop, flexible supplies.

2.4 SHOWER FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
B. Shower Faucets: Single handle, thermostatic, mixing valve.
C. Fixture:
1. Standard: ASME A112.18.1/CSA B125.1 and ASSE 1016.
2. General: Include hot- and cold-water indicators; check stops; and fixed shower head, arm, and flange. Coordinate faucet inlets with supplies.
3. Body Material: Solid brass with nonmetallic trim.

4. Finish: Polished chrome plate.
5. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
6. Mounting: Concealed.
7. Operation: Compression, manual.
8. Antiscald Device: Integral with mixing valve.
9. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

D. Supply Connections: NPS 1/2 (DN 15).

E. Shower Head:
1. Type: Ball joint and head integral with mounting flange.
2. Shower Head Material: Combined, metallic and nonmetallic with chrome-plated finish.
3. Spray Pattern: Adjustable.
4. Integral Volume Control: Required.

2.5 LAUNDRY TRAYS

A. Laundry Trays: Plastic laundry tray.

B. Fixture:
1. Standard: IAPMO/ANSI Z124.6.
2. Style: Flat-rim ledge.
3. Material: FRP.
4. Nominal Size: 24 by 21 inches.
5. Color: White.
6. Mounting: Freestanding on manufacturer's standard legs or separate, painted-steel stand.

C. Faucet:
1. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
2. Sink Faucets: Solid brass, laundry tray.
3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
7. Mixing Valve: Single control.
8. Centers: 4 inches.
9. Mounting: Deck, exposed.
10. Handle(s): Lever.
11. Spout Type: Swivel gooseneck.
12. Spout Outlet: Aerator.
13. Drain: Stopper with chain.

D. Accessories:
1. Chrome plated 17 gage brass P-trap and arm with escutcheon, wheel handle stop, flexible supplies.

PART 3- EXECUTION

3.1 EXAMINATION

A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.

B. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify that electric power is available and of the correct characteristics.

D. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.
B. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
C. Install components level and plumb.
D. Install and secure fixtures in place with wall supports or wall carriers and bolts.
E. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.
F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF FINISHED WORK

A. Do not permit use of fixtures.

3.8 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated on the architectural construction documents.
B. Fixture Rough-In

	Hot	Cold	Waste	Vent
Water Closet:		1/2 inch	4 inch	2 inch
Lavatory	1/2 inch	1/2 inch	2 inch	2 inch
Kitchen sink	1/2 inch	1/2 inch	2 inch	2 inch
Laundry tray	1/2 inch	1/2 inch	2 inch	2 inch
Shower	1/2 inch	1/2 inch	2 inch	2 inch

END OF SECTION 15440

SECTION 15450

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water Heaters.

1.02 RELATED SECTIONS

A. Section 15140 - Supports and Anchors.

1.03 REFERENCES

A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
B. ANSI/NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Include dimensions of tanks, and piping connection.
B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.
C. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01700.
B. Include operation, maintenance, and inspection data.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with Uniform Plumbing Code and in accordance with authorities having jurisdiction.
B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.
B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. Provide one year warranty under provisions of Section 01700.

PART 2 - PRODUCTS

2.01 STORAGE TANK TYPE ELECTRIC WATER HEATERS

A. Type: Factory-assembled and wired, electric, vertical storage.
B. Performance: See plumbing plans for storage capacity, heating element size, quantity, and minimum recovery rate. Maximum working pressure: 150 psig.
C. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
E. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.

PART 3 - EXECUTION

3.01 GENERAL

A. Install equipment and materials in accordance with manufacturers installation instructions.

3.02 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to UL requirements.
B. Coordinate with plumbing piping and related electrical work to achieve operating system.

END OF SECTION 15450

SECTION 15535

REFRIGERATION PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Filter-driers.

1.2 RELATED REQUIREMENTS: Section 15010, "Basic Mechanical Requirements", applies to this section with the additions and modifications specified herein.

1.3 RELATED SECTIONS

A. Section 15260 - Piping Insulation.

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

A. ANSI 15 - Safety Code for Mechanical Refrigeration (ANSI/ASHRAE 15).
B. ANSI 17 - Method of Testing for Capacity Rating of Thermostatic Refrigerant Expansion Valves (ANSI/ASHRAE 17).
C. ANSI/ARI 710 - Liquid-Line Driers.
D. ANSI/ASHRAE 34 - Number Designation of Refrigerants.
E. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
F. ANSI/ASME B31.5 - Refrigeration Piping.
G. ANSI/ASME B31.9 - Building Services Piping.
H. ANSI/AWS A5.8 - Filler Metals for Brazing and Braze Welding.
I. ARI 750 - Thermostatic Refrigerant Expansion Valves.
J. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.
K. ASTM B 88 - Seamless Copper Water Tube.
L. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
M. ASTM C 534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
N. FS OO-A-373 - (Rev C; Int A^m 1) Air Conditioners, Single Package Type.
O. FS OO-A-374 - (Rev B) Air Conditioners, with Remote Condensing Units or Remote Air-Cooled, Condenser Units, Unitary.
P. MIL-H-22547 - (Rev C) Heat Pumps, Heating and Cooling (Unitary) (8,400 to 300,000 BTU).
Q. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
R. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
S. UL 109 - Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use.

1.5 SUBMITTALS

A. Manufacturers' Catalog Data: Submit product data under provisions of Section 01300.
1. Pipe, fittings and accessories.

2. Valves.
3. Gaskets.
4. Brazing materials
5. Hangers and supports

For valves, submit the valve manufacturer's published ratings and maximum operating pressure differential. For relief valves, also submit the manufacturers published discharge capacity ratings. For level control valves, also submit manufacturers published ratings based on factory test, for a particular refrigerant application.

B. Installation Drawings/Calculations: Field-assembled refrigerant piping including equipment connections, specific pipe routing, hangers and supports, critical dimensions, pipe sizes and refrigerant system controls. Provide refrigerant pipe sizing calculations based on actual locations and distances of the equipment and pipes. Verify with air conditioning equipment manufacturer that the refrigerant pipe sizes are within the operating limits of the air-conditioning equipment.

C. Welding Procedure: Before performing welding, the Contractor shall submit three copies of welding procedure specification for each metal included in the work, together with proof of qualifications in accordance with ASME B31.5.

D. Performance Qualification Record: Before performing welding, the Contractor shall submit three copies of the Welder's Performance Qualification Record in conformance with ASME B31.5 showing that the welder or operator was tested under the approved procedure specification submitted by the Contractor. Certification dates shall be less than one (1) year old.

E. Submit test reports indicating results of leak test, vacuum and acid test.

F. Submit operation and maintenance data in accordance with Section, "Operation and Maintenance Data."

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record exact locations of equipment and refrigeration accessories on record drawings.

1.7 REGULATORY REQUIREMENTS

A. Conform to ANSI/ASME B31.9.

B. Welding Materials and Procedures: Conform to ANSI/ASME SEC 9 and applicable Guam labor regulations.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in accordance with the applicable provisions of General Conditions and General Requirements.

B. Deliver and store piping and specialties in shipping containers with labeling in place.

C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

PART 2 - PRODUCTS

2.1 PIPING

A. Dimensions and material requirements for pipe, pipe fittings and components shall conform to ANSI 15 and ASME B31.5 and shall be compatible with fluids used and capable of withstanding the pressures and temperatures of the service. Pipe, tubing, and components

used for refrigerant service shall be cleaned, sealed, capped, or plugged prior to shipment from the manufacturer's plant.

B. Provide accessories as specified in FS OO-A-374, MIL-H-22547 and this section. Provide suction line accumulators as recommended by equipment manufacturer's installation instructions. Provide a filter-drier in the liquid line.

C. Factory Charged Tubing: Provide extra soft, deoxidized, bright annealed copper tubing conforming to ASTM B 280, factory dehydrated and furnished with a balanced charge of refrigerant recommended by manufacturer of equipment being connected. Factory insulates suction line tubing with 1/2-inch minimum thickness of closed cell, foamed plastic conforming to ASTM C 534 with a permeance rating not to exceed 1.0. Provide quick-connectors with caps or plugs to protect couplings. Include couplings for suction and liquid line connections of the indoor and outdoor sections.

D. Field-Assembled Piping: Material and dimensional requirements for field-assembled refrigerant piping, valves, fittings, and accessories shall conform to ANSI 15 and ASME B31.5, except as herein specified. Provide seamless copper tubing, hard drawn, Type K or L, conforming to ASTM B 88, except that tubing with outside diameters of 1/4 inch and 3/8 inch shall have nominal wall thickness of not less than 0.30 inch and 0.032-inch, respectively. Soft annealed copper tubing conforming to ASTM B 280 may be used where flare connections to equipment are required only in nominal sizes less than one inch outside diameter. Provide schedule 80 CPVC for drain lines.

E. Fittings for Field-Assembled Piping: Wrought copper, ANSI B16.22 for solder-joint fittings. UL 109 for flared tube fittings.

F. Brazing Filler Material: AWS A5.8 brazing filler metal type BAg-5 with AWS Type 3 flux, except type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints.

G. Gaskets: ASTM D 2000, fluorinated elastomers compatible in form with grooves in the flange faces.

H. Pipe Hangers and Supports: Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58. Hanger types and supports for bare and covered pipes shall conform to MSS SP-69 for the system temperature range. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58. Provide metal protection shields and inserts for insulated piping in accordance with Section 15250, Insulation of Mechanical Systems.

I. Pipe Sleeves: Provide sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.5-inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic waterproof cement, which will dry to a firm but pliable mass, or provide a segmented elastomeric seal.

1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide Schedule 40 or Standard Weight zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 3 inches above finished floor.
2. Sleeves in Partitions and Non-Masonry Structures: Provide zinc-coated steel sheet sleeves having a nominal weight of not less than 0.90 pound per square foot, in partitions and other than masonry and concrete walls, floors, and roofs.

2.2 VALVES

A. Provide valves designed, manufactured, and tested specifically for refrigerant service. Internal parts shall be removable for inspection or replacement without applying heat or breaking pipe connections. Valves shall open when turned counterclockwise. Threaded ends shall not be used, except as specified herein.

B. Globe and Angle Valves: Forged brass, bronze alloy, forged steel, steel alloy, or ductile

iron body with packed stem and seal cap. Packless type with handwheels and forged brass or bronze alloy bodies with brazing ends may be used in sizes up to and including 7/8-inch O.D. Valves 1 1/4 inches and larger shall be tongue-and-groove flanged and shall have bolted bonnets. Valves one-inch and smaller shall have brazed or soldered ends. Refrigerant valves shall be of the backseating type making it possible to repack the valves under pressure without removal from the line.

2.3 REFRIGERANT: ANSI/ASHRAE 34; R-410A

2.4 ACCESSORIES

A. Moisture and Liquid Indicators: Double port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum working pressure of 500 psi, and maximum temperature of 200 degrees F. Indicating material shall register moisture by varying degrees of color change, based on 100 degrees F and a moisture content in the range of 45 to 180 particles per million in R410a refrigerant.

B. Filter-Driers: Sealed cartridge type, ANSI/ARI 710, UL listed, steel shell, molded desiccant filter core; for maximum working pressure of 350 psi.

C. Liquid Line Driers: ARI 710. Driers 50 cubic inches and larger shall be the cartridge refillable type, provided with a valved bypass of the same size as the liquid line. Drier body shall be of brass or steel, provided with means for holding the desiccant securely in place and distributing the liquid refrigerant evenly throughout the desiccant. Driers shall be capable of withstanding a service pressure of 350 psig. Driers may be of the combination drier-indicator type.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Maintain pipe seals until system is closed to prevent contamination by moisture and dirt.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

3.3 PIPING

A. Brazing, bending, forming and assembly of refrigerant piping shall conform to ASME B31.5.

B. Pipe Hangers and Supports: Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58. Installation of hanger types and supports for are and covered pipes shall conform to MSS SP-69 for the system temperature range. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58.

C. Refrigerant Piping: Cut pipe to measurements established at the site and work into place without springing or forcing. Install piping with sufficient flexibility to provide for expansion and contraction due to temperature fluctuation. Where pipe passes through building structure pipe joints shall not be concealed, but shall be located where they may be readily inspected. Install piping to be insulated with sufficient clearance to permit application of insulation. Install piping as indicated and detailed, to avoid interference with other piping, conduit, or equipment. Except where specifically indicated otherwise, run piping plumb and straight and parallel to walls and ceilings. Trapping of lines will not be permitted except

where indicated. Provide sleeves of suitable size for lines passing through building structure. Braze refrigerant piping with silver solder complying with AWS A5.8. Inside of tubing and fittings shall be free of flux. Clean parts to be jointed with emery cloth and keep hot until solder has penetrated full depth of fitting and extra flux has been expelled. Cool joints in air and remove flame marks and traces of flux. During brazing operation, prevent oxide film from forming on inside of tubing by slowly flowing dry nitrogen through tubing to expel air. Make provisions to automatically return oil on halocarbon systems. Installation of piping shall comply with ASME B31.5.

D. Returning Oil from Refrigerant System: Install refrigerant lines so that gas velocity in the evaporator suction line is sufficient to move oil along with gas to the compressor. Where equipment location requires vertical risers, line shall be sized to maintain sufficient velocity to lift oil at minimum system loading and corresponding reduction of gas volume. Install a double riser when excess velocity and pressure drop would result from full system loading. Larger riser shall have a trap, of minimum volume, obtained by use of 90- and 45- degree ells. Arrange small riser with inlet close to bottom of horizontal line, and connect to top of upper horizontal line. Do not install valves in risers.

E. Refrigerant Driers, Sight Glass Indicators, and Strainers: Provide refrigerant driers, sight glass liquid indicators, and strainers in refrigerant piping in accordance with MIL-H-22547 when not furnished by the manufacturer as part of the equipment. Install driers in liquid line with service valves and valve bypass line the same size as liquid line in which dryer is installed. Size of driers shall be determined by piping and installation of the unit on location. Install dryers of 50 cubic inches and larger vertically with the cover for removing cartridge at the bottom. Install moisture indicators in the liquid line downstream of the drier. Indicator connections shall be the same size as the liquid line in which it is installed.

F. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

G. Install piping to conserve building space and not interfere with use of space.

H. Group piping whenever practical at common elevations locations. Slope piping one percent in direction or oil return.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Provide clearance for installation of insulation and access to valves and fittings.

K. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.

L. Fully charge completed system with refrigerant after testing.

3.4 DRAIN CONNECTIONS AND DRAIN LINES:

A. Provide separate drain lines for the unit drain. Traps and piping to drainage disposal points shall conform to International Plumbing Code.

3.5 ACCESS PANELS:

A. Provide access panels for concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

3.6 APPLICATION

A. Provide line size liquid indicator in liquid line.

B. Provide line size filter-drier in liquid line.

3.7 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ANSI/ASME B31.5.
B. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using halide torch or electronic leak detector. Test to no leakage.

3.8 QUALITY CONTROL:

A. Prior to initial operation examine and inspect piping systems for conformance to plans and specifications and ASME B31.5. Equipment, material, or work rejected because of defects or nonconformance with plans, specifications, and ANSI Codes for pressure piping shall be corrected as directed by the Project Engineer.

3.9 FIELD-TESTS: After completion of piping installation and prior to initial operation, conduct tests on piping system. Furnish materials and equipment required for tests. Correct defects disclosed by the test. Perform test after installation and prior to acceptance in the presence of the Project Engineer and subject to his approval.

A. Refrigerant Piping System Test: Test system for tightness after installation and before insulation is applied. Temporarily remove controls and other apparatus that may be damaged by test pressure or make inoperative before tests are made and plug, or cap openings. Correct threaded, soldered, or brazed joints that leak by remaking joints. Repair welded joints that leak by cutting out faulty weld affected section and rewelding joint. Test charging, evacuation, and initial charging are not necessary for fully precharged refrigeration machinery. Provide leak testing of connections and add only enough additional refrigerant to obtain full charge.
B. Test Pressures: Refrigerant system test pressures for tightness shall not be less than test pressures specified in ANSI 15 or ASME B31.5.
C. Charging System for Test: Charge low and high pressure side of system with a dry, inert gas, such as nitrogen or anhydrous carbon dioxide using a small amount of refrigerant gas to act as a tracer. Use a pressure limiting or reducing valve with pressure gage on high pressure gas tank to limit the pressure in system to the specified test pressure for the respective refrigerant.
D. Leakage Test: With system charged to desired pressure, tightly shutoff gas supply and hold the system for 30 minutes, during which time there shall be no loss of pressure. If a pressure drop, not attributable to temperature changes, occurs during this period, check entire system with a halide torch or an electronic leak detector. When leaks are found, make repairs and provide another 30-minute period at test pressure. Testing and repair shall continue until there is no loss of pressure.
E. Evacuation: After completion's of leak testing of refrigerant system, remove all air and moisture from system with a high vacuum pump. Pump shall be capable of reducing absolute pressure in system to a point where any water present in lines will vaporize at a temperature appreciably below ambient temperature and will be withdrawn from system. Before conducting evacuation test, inspect vacuum pump oil for purity and provide new oil charge if existing charge is contaminated. Evacuate system to a maximum absolute pressure of 0.020 inches of Mercury (500 microns) or lower. During evacuation, ambient temperature shall not drop below 35 degrees F. Use pressure gages for measurement of pressure. Upon achieving evacuation of system, valve off vacuum pump from system for a period of at least 12 hours. Consider system tight and dry and free of air, if absolute pressure has not increased by more than 0.002 inches of mercury (50 microns) at the expiration of this period. Repeat pressure test if pressure rise exceeds 0.02 inches of mercury, indicating a leak in system or presence of moisture. If no leaks are found, resume evacuation test and continue until dryness of system is achieved. When a satisfactory vacuum has been obtained, break vacuum by introducing vapor (no liquid) refrigerant and subsequently seal off system.
F. Charging: Provide initial charge of refrigerant. Charge by connecting drums of refrigerant

to system charging connection, to feed liquid refrigerant into low side of system where it will be evaporated. Note gross and net weights of drum, and place drum on a scale to determine when empty. Loosely connect charging connection to system connection, so that initial flow of refrigerant will expel air from connection, and then tighten loose joint. When system vacuum has been broken by refrigerant, start and operate compressor while charging continues. Exercise the following procedures and precautions during charging operation:

1. Place refrigerant condensing system in operation.
2. Place fluid circulation system of water coolers or evaporator fans of a direct expansion system in operation.
3. Do not permit compressor discharge pressure from becoming excessive.

3.10 STARTUP AND OPERATIONAL TESTS: Start up and initially operate refrigeration system. During this time, periodically clean strainers until no further accumulation of foreign material occurs. Exercise care so that minimum loss of refrigerant occurs when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in required operation and sequence.

END OF SECTION 15535

SECTION 15671

AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Condensing unit.
B. Charge of refrigerant and oil.
C. Controls and control connections.
D. Refrigerant piping connections.
E. Motor starters.
F. Electrical power connections.

1.2 RELATED REQUIREMENTS: Section 15010, "Basic Mechanical Requirements", applies to this section with the additions and modifications specified herein.

1.3 RELATED SECTIONS

A. Section 15535 - Refrigeration Piping and Specialties.
B. Section 15786 – Ductless Split Fan Coil Units.

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

A. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
B. ANSI/ASHRAE 90A - Energy Conservation in new Building Design.
C. ANSI/NEMA MG 1 - Motors and Generators.
D. ANSI/UL 207 - Refrigeration-Containing Components and Accessories, Non-Electrical.
E. ANSI/UL 303 - Refrigeration and Air-Conditioning Condensing, and Air-Source Heat Pump Equipment.
F. ARI DCUAC - Directory of Certified Unitary Air-Conditioner Equipment (Latest Edition).
G. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
H. ARI 360 - Commercial and Industrial Unitary Air-Conditioning Equipment.
I. ASHRAE 14 - Methods of Testing for Rating Positive Displacement Condensing Units.
J. ASTM A 123 - (Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
K. FS OO-A-374 - (Rev. B) Air Conditioners with Remote Condensing Units or Remote Air-Cooled, and Water Cooled Condenser Units, Unitary.
L. NEMA MG 1 - (Rev. 1) Motors and Generators.
M. NEMA ICS 1 - (Rev. 1-2) Industrial Control and Systems.
N. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies.
O. NEMA ICS 6 - (Rev. 1) Enclosures For Industrial Control and Systems.
P. UL 873 - (R 1990) Temperature-Indicating and -Regulating Equipment, Tenth Edition.

1.5 SUBMITTALS

A. Manufacturer's Catalog Data: Submit product data, indicating components, assembly, dimensions, weights and loadings, rated capacities, specialties and accessories, electrical

nameplate data, and wiring diagrams.

1. Air-Cooled Remote Condensing Units.
2. Filters.
3. Thermostats.

B. Submit design data, indicating pipe and equipment sizing, oil return calculations at lowest stage of unloading, required typhoon anchoring and bracing, and location and size of field connections. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for a complete system.

C. Submit manufacturer's installation instructions, indicating operating and maintenance clearances.

D. Submit Field Test Reports for Start-up and initial operational tests.

E. Submit Manufacturer’s warranty.

1.6 OPERATION AND MAINTENANCE DATA

A. Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

1.7 DELIVER, STORAGE, AND HANDLING

A. Deliver, protect, handle and store products to site in accordance with the applicable provisions of General Conditions and General Requirements.

B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

C. Protect units on site from physical damage. Protect coils.

1.8 QUALITY ASSURANCE

A. Modification of References: Accomplish work in accordance with the referenced publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "the Authority having jurisdiction," "the Administrative Authority," "the Owner," or "the Design Engineer" to mean the Project Engineer.

B. Construction and Ratings: In accordance with ARI 210/240, ANSI/UL 207 and ANSI/UL 303. Testing shall be in accordance with ASHRAE 14.

C. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ANSI/ASHRAE 90A.

D. Safety: Design, manufacture, and installation of unitary air conditioning equipment shall conform to ANSI 15.

1.9 WARRANTY

A. Provide one year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Split-System Type: FS OO-A-374, except as modified herein. Additional requirements

for various system components are specified in this paragraph; however, basic requirements for the system and system components are contained in FS OO-A-374. Provide separate assemblies designed to be used together. Base ratings on the use of matched assemblies. Units shall have a minimum SEER of 13 when tested in accordance with ARI 210/240 or ARI 360 as applicable. List units with capacities smaller than 135,000 Btu/hr in the ARI DCUAC; in lieu of listing in the ARI Directory, a letter of certification from ARI that units have been certified and will be listed in the next Directory will be acceptable. Provide capacity, electrical characteristics and operating conditions as indicated. For units larger than 135,000 Btu/hr, condensers shall provide not less than 10 degrees F liquid sub-cooling at standard ratings.

B. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of metal cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver and safety screens.

2.2 CASING

A. House components in steel frame with galvanized steel panels with weather resistant, baked enamel finish. Provide steel surfaces of equipment that do not have a zinc coating conforming to ASTM A 123, or a duplex coating of zinc and paint, with a factory applied coating or paint system. Provide a coating or paint system on actual equipment identical to that on salt-spray test specimens with respect to materials, conditions of application, and dry-film thickness.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power door is opened. Provide gasketing and seals to protect electrical components from typhoon strength wind-driven rain.

C. Provide removable access doors or panels with quick fasteners.

2.3 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen or refrigerant. Provide Bronze-Glo phenolic coil coating, or equivalent anti-corrosive coating.

B. Coil Guard: Expanded metal, louvered, PVC coat steel wire.

C. Provide a separate air cooled condenser circuit for each compressor or parallel compressor installation.

2.4 FANS AND MOTORS

A. Vertical or horizontal discharge as indicated, direct-driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.

B. Motors, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built in current and thermal overload protection.

C. NEMA MG 1, NEMA ICS 1, and NEMA ICS 2. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Provide motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, the Contractor shall make the necessary

adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide water-tight type starter enclosures in accordance with NEMA ICS 6.

2.5 COMPRESSORS

A. Variable capacity Inverter Driven technology, matched to indoor Fan Coil Unit, shall adjust the speed of the compressor to meet load requirements enabling quick cooling and reducing power consumption, while preventing frequent cycling of the unit.
B. Refrigerant: R-410A; full operating charge of refrigerant and oil.

2.6 REFRIGERANT CIRCUIT

A. Provide each unit with one or two independent refrigerant circuits as indicated, factory supplied and piped. Refer to Section 15535.
B. Provide the following for each refrigerant circuit:
    1. Filter dryer.
    2. Liquid line sight glass and moisture indicator.
    3. Insulated suction line.
    5. Charging valve.
    6. Compressor discharge service valve.

2.7 CONTROLS

A. On unit, mount weatherproof steel control panel, containing power and control wiring, molded case disconnect switch, factory wired with single point power connection.
B. For each compressor, provide across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection. For each condenser fan, provide across-the-line starter with starter relay.
C. Provide the following safety controls arranged so that operating any one will shut down machine and require manual reset:
    1. High discharge pressure switch (manual reset) for each compressor.
    2. Low suction pressure switch (automatic reset) for each compressor.
    3. Oil Pressure switch (manual reset).
D. Provide the following operating controls:
    1. Low voltage, adjustable type thermostat that conforms to applicable requirements of UL 873. Provide cooling type with contacts hermetically sealed against moisture, corrosion, lint, dust, and foreign material. Design to operate on not more than 1.5 degrees F differential and of suitable range calibrated in degrees F. Provide fixed cooling anticipation. Accomplish manual switching for system changeover from cooling and fan operation through the use of a thermostat subbase. Provide system selector switches to provide "COOL" and "OFF" and fan selector switches to provide "AUTOMATIC" and "ON". Provide relays, contractors, and transformers located in a panel or panels for replacement and service.
        a. When thermostat is in "COOL" position with fan selector switch in "AUTO" position, compressor, evaporator fan, and condenser fan shall cycle together.
        b. When thermostat is in "COOL" position with fan selector switch in "ON" position, compressor, and condenser fan shall cycle together and evaporator fan shall run continuously.
        c. When fan selector switch is in "AUTO" position with thermostat in "OFF"

position, fan shall not run.

d. When fan selector switch is in "ON" position, fan shall run continuously.

2. Locate thermostat in room or return air as indicated, to cycle compressors, or activate cylinder unloaders, and activate solenoid valves in refrigerant circuit as indicated.
3. Five minute off timer preventing compressor from short cycling.
4. Provide single acting thermostat with minimum stage to match number of compressors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

B. Provide for connection to electrical service.

C. Install units on vibration isolation as indicated.

D. Install units on concrete base as indicated.

E. Provide connection to refrigeration piping system and evaporators. Refer to Section 15535. Comply with ANSI/ASHRAE 15.

3.2 MANUFACTURER'S FIELD SERVICES

A. Provide initial start-up, including routine servicing and check out.

B. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil.

C. Inspect and test for refrigerant leaks every six months during first year of operation.

3.3 OPERATIONS

A. Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

END OF SECTION 15671

SECTION 15786

DUCTLESS SPLIT FAN COIL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductless split fan coil units.
B. Controls.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code.

1.3 RELATED SECTIONS

A. Section 15535 - Refrigeration Piping and Specialties.
B. Section 15671 – Air cooled condensing units.

1.4 SUBMITTALS FOR REVIEW

A. Product Data: Provide manufacturers literature and data indicating, drain, and electrical characteristics and connection requirements.

1.5 SUBMITTALS FOR INFORMATION

A. Submit manufacturer's installation instructions. Indicate procedures required for rigging and making service connections.
B. Manufacturer's Field Reports: Indicate conditions at initial start-up including date, and initial set points.

1.6 SUBMITTALS FOR CLOSEOUT

A. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data. Also, submit manufacturer’s one year warranty coverage.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.8 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 FAN COIL UNIT

A. Provide air handling unit of style, size, and capacities as indicated on the drawings. Units

shall consist of indoor coil, fan and motor assembly in insulated sheet metal cabinet. Fan Coil Unit shall be matched with variable capacity, inverter driven outdoor air-cooled condensing unit.

B. Unit enclosure shall be insulated and constructed of cold-rolled steel, bonderized and finished with baked enamel. Large front service access panels shall provide easy access to all components. Unit shall be equipped with permanent type filters.

C. Fan shall be forward curved with double inlet, mounted on motor shaft, dynamically and statically balanced. The multi-speed fan motor shall be factory lubricated, have internal overload protection, be resiliently mounted. Fan motor assembly shall be removable for service.

D. Cooling coil shall be constructed with aluminum plate fins mechanically bonded to nonferrous tubing with all joints brazed. Coil shall have factory installed: refrigerant metering device; refrigerant line fittings which permit mechanical connections. Condensate pans shall be equipped with primary and auxiliary drain connections.

E. Provide wireless programmable remote controller.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that wall surface is ready to receive work.

B. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide adequate drainage connections for condensate.

3.3 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems per manufacturer’s instructions/

B. Set initial temperature and humidity set points. Instruct operating personnel.

END OF SECTION 15786

SECTION 16010

GENERAL PROVISIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. This section supplements all sections of this Division and shall apply to all phases of work specified herein, shown on the drawings, or required to provide a complete installation of electrical systems.

B. Refer to Architectural, HVAC, Structural, Plumbing and other drawings and specifications to determine the full extent of related work in other divisions before contract is signed.

C. The specifications and drawings for electrical work are complementary and are for the complete interpretation of the work.

D. Unless noted or modified by specific notation to the contract, the indication and/or description of any electrical item in the document carries with it the instruction to furnish, install and connect same. It shall be understood that the intent governs the work, regardless of whether or not this instruction is explicitly stated.

E. No exclusion from or limitation in drawings or specifications for the electrical work shall be reason for omitting the appurtenances or accessories necessary to complete any required system or item of equipment.

F. Exceptions and inconsistencies in the Contract Documents shall be brought to the attention of the Owner or his designated representative before the contract is signed. Otherwise, this Contractor will be responsible for any and all changes and additions that may be necessary to accommodate his particular equipment of installation.

G. The contract drawings are shown in part diagrammatic, intended to convey the scope of work, indicating the general arrangement of equipment, conduit and outlets. Follow the drawings in laying out the work and verify places for the installation of materials and equipment. Wherever a question exists as to the exact intended location of outlets or equipment, obtain instruction from the Owner or his designated representative.

H. The electrical drawings and specifications are intended to supplement each other and any material or labor called for in one shall be furnished and supplied even though not specifically mentioned in both.

I. If the required material, installation or work can be interpreted differently from drawing to drawing, or between drawings and specifications, contractor shall provide that material, installation or work which is of higher standard.

1.2 SCOPE

A. Furnish all labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing and adjustment of all circuits and electrical equipment specified herein, or shown or noted on the drawings, and its delivery to the Owner complete in all respects ready for use.

B. Plan all work so that it proceeds with a minimum of interference with other trades. Inform all parties concerned of openings required for equipment or conduit in the building construction for electrical work and provide all special frames, sleeves and anchor bolts as required. Coordinate the electrical work with the mechanical installation.

C. Work lines and established heights shall be in strict accordance with architectural drawings and specifications insofar as these drawings and specifications extend. Verify all dimensions shown and establish all elevations and detailed dimensions not shown.

D. Lay out and coordinate all work well enough in advance to avoid conflicts or interferences with other work in progress so that in case of interference the electrical layout may be altered to suit the conditions, prior to the installation of any work and without additional cost to the Owner.

1.3 COOPERATION WITH OTHER TRADES

A. Perform this work in conformity with the construction called for by other trades and afford reasonable opportunity for the execution of their work. Properly connect and coordinate this work with the work of other trades at such time and in such a manner as not to delay or interfere with their work.

B. Examine the drawings and specifications for the general and mechanical work and the work of other similar trades. Coordinate this work accordingly.

C. Based on overall review of work, prepare and provide conduit shop drawings with comply with historic appearance of the building. An example of the general intent can be found at the end of this Section 16010.

D. Excavation or trenching two feet below the existing grade shall be coordinated with State Historic Preservation Officer (SHPO) to monitor for potential archeological items. Coordination of this work shall be scheduled early in the project to mitigate any adverse impact on the project schedule and allow for contingency time in an event of a discovery.

E. Promptly report to the Owner or his designated representative any delay or difficulties encountered in the installation of this work which might prevent prompt and proper installation, or make it unsuitable to connect with or receive the work of others.

F. Major equipment furnished under the mechanical and other sections of the specifications may require different rough-in requirements than indicated on the

plans due to the "or equal" equipment change. Secure detailed drawings from the Contractor furnishing the equipment to determine actual rough-in locations and conductor requirements to assure a proper and workmanlike installation.

G. Before connecting any piece of equipment, check the name plate data against the information shown on the drawings and report to the Owner or his designated representative if any discrepancies are encountered.

1.4 CODES, PERMITS AND FEES

A. All work shall meet or exceed the latest requirements of the National Electric Code, all local codes, and other authorities having jurisdiction over electrical construction work at the project.

B. Comply with all applicable building ordinances and codes. Where the contract documents exceed minimum requirements, the contract documents take precedence.

C. Comply with all requirements for permits, licenses, fees and codes. Permits, licenses, fees, inspections and arrangements required for the work under this contract shall be obtained by the Contractor at his expense.

D. Comply with the requirements of the Guam Power Authority. Make all arrangements for proper coordination of the work.

1.5 TEMPORARY ELECTRICAL SERVICE

A. The Electrical Contractor shall furnish, install, maintain and remove after construction is completed, electrical service for temporary power and lighting. The system shall consist of a service, distribution system panelboards, grounding, branch circuits, grounded type electrical outlets and lighting. Provide sufficient lighting and receptacles to meet section 01500.

PART 2 PRODUCTS

2.1 EQUIPMENT FURNISHED BY OTHERS AND CONNECTED BY ELECTRICAL CONTRACTOR:

A. The electrical work includes the off loading, handling and connection of equipment furnished by others.

B. The Electrical Contractor shall do the following:

1. Coordinate all requirements for providing electrical service to equipment.

2. Provide field mark-up and internal wiring necessary for intended operation.

3. Make all connections for a complete operating system.

C. Examine all items for any damage during delivery for claims prior to beginning work.

D. Foundations for apparatus and equipment will be furnished by others, unless otherwise noted or detailed.

2.2 EQUIPMENT AND MATERIALS

A. Equipment and fixtures shall be connected providing circuit continuity in accordance with applicable codes whether or not each piece of conductor, conduit, or protective device is shown between such items of equipment or fixtures and the point of circuit origin.

B. Unless otherwise specified, equipment and materials of the same type of classifications, and used for the same purpose, shall be products of the same manufacturer.

C. Use only new, unweathered and unused material, except as specifically noted.

2.3 APPLICABLE DOCUMENTS

A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications of standard rules of the following:

1. American Institute of Steel Construction	AISC
2. American Society for Testing and Materials	ASTM
3. Federal Specification	Fed. Spec.
4. Institute of Electrical and Electronic Engineers	IEEE
5. Insulated Power Cable Engineers Association	IPCEA
6. National Electrical Code	NEC
7. National Electrical Manufacture's Association	NEMA
8. National Electrical Safety Code	NESC
9. National Fire Protection Association	NFPA
10. Occupational Safety and Health Act	OSHA
11. Underwriter's Laboratories, Inc.	UL
12. United States of America Standard Institute	USASI
13. Illuminating Engineering Society	IES

14. Certified Ballast Manufacturers	CBM
15. Factory Mutual Association	FA

2.4 REVIEW OF MATERIALS

A. It is the intent of these Specifications to establish quality standards of materials and equipment installed. Therefore, specific items are identified by manufacturer, trade name or catalog designation. Where more than one manufacturer is specified, equipment shall be restricted to one of the listed manufacturers. If only one manufacturer is listed, this contractor shall feel free to submit equal manufacturer as called for below.

B. Should this Contractor propose to furnish material and equipment other than that specified, he shall submit a written request for any or all substitutions to the Engineer. Such request shall be Alternatives to the original bid, and shall be submitted complete with descriptive (manufacturer, brand name, catalog number, etc.), and technical data for all items.

C. Where such substitutions alter the design or space requirements indicated on the Drawings, the Contractor shall include all items of cost for the revised design and include cost of all trades involved.

D. Acceptance or rejection of the proposed substitutions shall be subject to the approval of the Engineer. If requested by the Engineer, the Electrical Contractor shall submit for inspection samples of both the specified and proposed substitute items.

E. In all cases where substitutions are permitted, the Contractor shall bear any extra cost of evaluating the equality of the material and the equipment to be installed.

F. The Contractor shall submit to the Engineer detailed dimensioned shop drawings covering all items of electrical equipment. No equipment should be put into manufacture or ordered until these shop drawings or brochures have been approved.

G. The Contractor shall submit six (6) complete copies of the shop drawings in a looseleaf binder for review. No partial or incomplete submittals will be reviewed.

H. In the event re-submittal is required, the Contractor shall revise the shop drawings as required. The Contractor shall then re-submit six (6) copies of the corrected shop drawings for final approval.

I. Shop drawings shall bear Contractor's certification that the item complies in all respects with the item originally specified. It is the Contractor's responsibility to procure the proper physical and electrical sizes, quantities, and arrangement as indicated and specified, and make any structural modifications or other modifications in order for the item to comply with the contract requirements. All shop drawings will be reviewed under the assumption that the Contractor has

verified all physical and electrical conditions.

Obtaining approval thereon does not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those drawings.

J. As soon as practicable and within thirty (30) days after award of contract, and before beginning fabrication of material or installation of equipment, the Contractor shall submit a complete schedule of materials, equipment, apparatus and appurtenances proposed for installation and/or use in this project to the Engineer for approval.

K. This schedule shall be in the form of a bill of materials and shall include manufacturer's name, catalog numbers, diagrams and other descriptive data as required for approval. Submittal procedure shall be the same as specified above.

L. Retain a set of drawings on the job, noting daily all changes made in these drawings in connection with the final installation.

M. Upon completion of the project deliver to the Owner one (1) set of Mylar and one (1) set bluelines of "AS-BUILT" drawings, showing all systems as actually installed, locations of all electrical conduits, ducts and cables outside and inside of the buildings, including the location of all underground junction boxes, pull boxes, handholes and manholes. All piping and conduit below grade or in the concrete slab shall be dimensioned. Make all necessary field measurements during the installation of the electrical work, and record all changes from Original Contract Drawings as work progresses.

PART 3 EXECUTION

3.1 WORKMANSHIP

A. Install equipment and material in a neat and workmanlike manner and align, level and adjust for satisfactory operation. Install equipment so that all parts are easily accessible for inspection, operation, maintenance and repair.

B. Provide the design, fabrication and erection of supplementary structural framing required for attachment of hangers or other devices supporting electrical equipment.

C. Locate switches, receptacles and pull boxes to provide easy access for operation, repair and maintenance, and, if concealed, provide access doors.

D. Provide 4" concrete equipment base for all floor-mounted equipment furnished under this contract. Concrete foundations shall be 6" wider and 6" longer than the base of the equipment being installed.

E. Provide Belleville washers on all bolted connections for all risers. Split ring washers are not acceptable.

F. Take such precautions as necessary to properly protect all apparatus, fixtures,

appliances, material, equipment and installation from damage of any kind. The Owner's Representative may reject any particular piece or pieces of material, apparatus or equipment scratched, dented or otherwise damaged.

G. Prepare all fittings, boxes, supports and panelboards exposed for painting by removing all oil, grease and dirt. Employ the necessary precautionary methods to prevent scratching or defacing of all electrical apparatus and devices.

H. Exposed conduit installed after room has been painted shall be painted to match room finish by the General Contractor.

I. Provide hot dip galvanized components for ferrous materials exposed to the weather.

J. The use of roof deck for support of lighting fixtures, conduits, raceways, and other electrical equipment is not permitted.

3.2 OUTLET LOCATION

A. Center all outlet boxes with regard to paneling, furring and trim. Repair or replace damaged finishes. Set outlet boxes plumb and extend to the finished surface of the wall, ceiling or floor without projecting beyond same.

B. Install symmetrically all receptacles, switches, and devices shown and where necessary set the long dimension of the plate horizontal or ganged in tandem.

C. More than one device installed in same location shall be grouped under common (multi-toggle) plate.

3.3 CUTTING PATCHING AND PIERCING

A. Obtain written permission of the Owner's representative before cutting or piercing structural members.

B. Use craftsmen skilled in their respective trades for cutting, fitting, repairing, patching of plaster and finishing of materials including carpentry work, metal work or concrete work required for this work. Do not weaken walls, partitions or floors with cutting. Holes required to be cut in floors must be drilled without excessive breaking out around the holes. Patching and/or refinishing to return to existing condition is required of this contractor.

C. Sleeves shall be installed flush with finished walls, finished ceilings or finished floors, sized to accommodate the raceway, unless otherwise specified.

D. Use care in piercing waterproofing. After the part which pierces the waterproofing has been set in place, seal opening and make absolutely watertight. Work shall be done according to specifications pertaining to membrane penetrations.

E. Seal equipment or components exposed to the weather and make watertight and insect proof. Protect equipment outlets and conduit openings with temporary plugs or caps at all times that work is not in progress.

F. Contractor shall coordinate services with roof mounted equipment to allow service to be routed within equipment curb wherever possible.

G. A firestop system shall be used to seal all penetrations of electrical cables, pipes, conduits or other penetrating items through fire rated walls and floors to maintain its original rating, as required by NEC 300-21 and NEC 800-52 (b).

3.4 IDENTIFICATION OF EQUIPMENT

A. Identify individually each piece of equipment with a laminated micarta nameplate black/white core and 3/16" high engraved letters. Attach plates to equipment with chromium plated screws.

B. Include the following:

1. Panelboards.

2. Disconnect Switches.

3. Any switch for load that cannot be seen from the control point.

C. Do not use abbreviated terms for identification. Spell out in full the proper name and number of each identified equipment, i.e.,

PANEL-LPA-1

FAN COIL UNIT - FCU 1

3.5 NOISE LIMITATION

A. Perform all work to assure minimal noise produced by the electrical equipment and installation.

B. Check and tighten all plates, covers, doors and trims used in conjunction with electrical equipment.

C. Remove and replace any device or equipment which is found to emit noise level higher than industry standards. Perform all work in accordance with the field instructions issued by the Owner's representative to alleviate such conditions.

3.6 TESTS

A. After all equipment and materials have been installed, test the installation for the following:

1. Short circuits and ground faults.

2. Insulation resistance at 500V DC of all feeders and subfeeders.

3. Grounding continuity.

B. Perform all other tests deemed necessary to establish full conformance with the specifications, their intent, drawings and suitable operation of each system.

C. Tests shall be conducted under the supervision of the Owner's representative and be arranged to suit their convenience.

D. Before application for final acceptance will be considered, all prescribed tests shall be performed and statement to that effect be submitted, signed by the party responsible for conducting such test and the party responsible witnessing same.

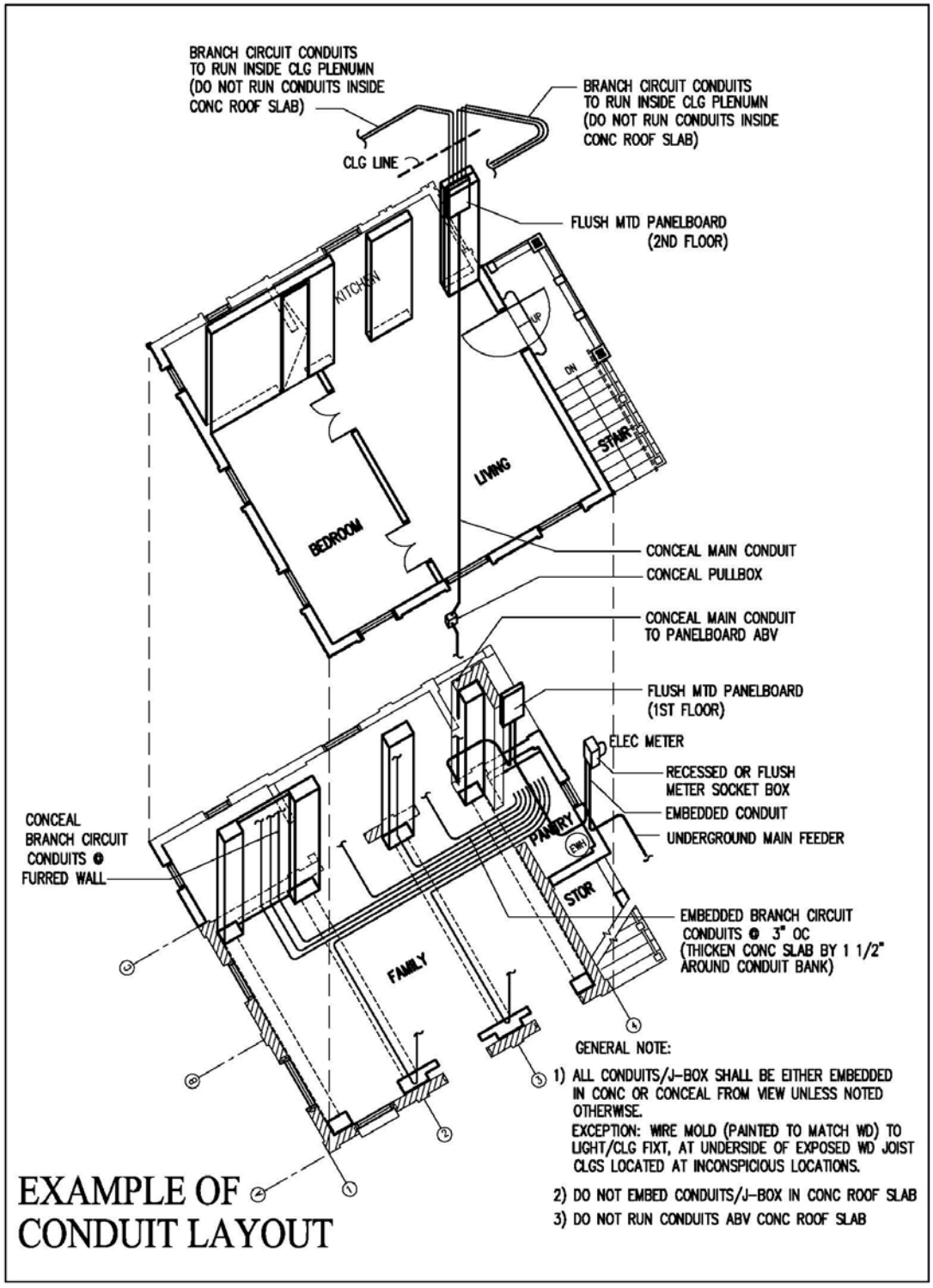
E. Correct promptly all defects and deficiencies discovered in any of the electrical work during testing, and demonstrate compliance to this effect.

F. Furnish all water, fuel, electricity, instruments, test equipment and personnel that are required for the particular test. Certify that all equipment and gauges are in good working order. Remove equipment subject to damage during test from line before test is applied.

3.7 GUARANTEE

A. This Subcontractor shall furnish a written guarantee warranting all materials, equipment and labor furnished by him to be free of all defects for a period of one year from the date of opening. He shall further furnish a written guarantee that all equipment shall meet the characteristics, capacities, and workmanship specified and should any defects appear or performance of equipment be inadequate within the warranty period, the defects and/or the equipment will be replaced or made good without cost to the Owner.

3.8 EXAMPLE OF ELECTRICAL CONDUIT LAYOUT



END OF SECTION 16010

SECTION 16110

RACEWAYS

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers raceways and fittings, complete.

B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1. RACEWAYS

A. Rigid conduit shall be zinc-coated heavy wall as manufactured by Republic, Triangle, or approved equal.

B. Electrical metallic tubing (EMT) shall be zinc-coated thin wall as manufactured by Republic, Triangle, or approved equal.

C. Flexible metallic conduit shall be galvanized steel tape formed into an industry standard interlocking coil as manufactured by Republic, Triangle, or approved equal.

D. Liquid - Tight Flexible Metal conduit shall be constructed of single strip, interlocked, and double-wrapped steel, galvanized inside and outside, coated with liquid - tight jacket of flexible polyvinyl chloride (PVC) as manufactured by Carlon, AFC, Sealtite, or approved equal.

E. Rigid polyvinyl chloride conduit (PVC) shall be heavy wall schedule 40 as manufactured by Carlon Electrical, Visqueen, or approved equal.

F. Intermediate Metallic Tubing (IMC) shall be zinc-coated as manufactured by Republic, Triangle, or approved equal. BX is not permitted.

G. Thin wall nonmetallic conduit, schedule A PVC shall be EB 120 type as manufactured by Carlon Electrical, for use as communications duct or approved equal.

H. Wireways shall be sheet steel with cover, provided with a corrosion resistant phosphatizing primer and epoxy finish. All hardware shall be plated to prevent corrosion. All screws installed towards the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage. Interior parts shall be smooth and free of sharp edges and burrs. Wireways shall be as manufactured by Square D, Hoffman or approved equal.

2.2 CONDUIT FITTINGS

A. Rigid metal conduit fittings for heavy wall conduit shall be of the threaded type. Double

locknuts and insulating bushings shall be used on all rigid conduit runs. Where necessary "Ericson" fittings or threaded split couplings will be accepted. Running threads will not be accepted.

B. EMT fittings shall be of the set screw or compression, concrete-tight or raintight type as required by location. Indenter type fittings not acceptable. No set screw type fittings permitted on conduits imbedded in the floor slab.

C. Flexible metallic conduit fittings shall be specifically designed for use with same and shall have smooth rounded ends for wire protection.

D. Liquid - Tight Flexible Metal Conduit fittings shall be specifically designed for use with same, shall provide positive liquidtight seal, have insulated throat, and be corrosion resistant, as manufactured by O-Z/Gedney, Sealtite, Carlon or approved equal.

E. PVC conduit fittings shall be recommended by the company whose conduit is used. Utilize solvent cement joints for all fittings and make all joints water-tight. Provide adapters for connections to metal components.

F. Special fittings shall be as listed or approved equal

1. Sealing Gland Assembly	OZ, Type FSK
2. Expansion Joints	OZ, Type AX or TX with bonding jumpers and clamps
3. Expansion and Deflection Fittings	OZ, Type DX
4. Cast Metal Conduit Fittings	Crouse-Hinds, Condulets

2.3 APPLICATION

A. Rigid heavywall galvanized conduit and IMC shall be used for:

1. All exterior (outside of building), exposed requirements. (Rigid heavywall aluminum conduit may be substituted for exterior exposed installations.)

2. Interior primary service or distribution. (Rigid heavywall aluminum conduit may be substituted for interior primary installations above grade and not in contact with concrete or cement mortar.)

3. Concealed within slabs on grade.

4. Exposed, below 12’ AFF.

B. Galvanized steel thinwall conduit (EMT) shall be used:

1. For branch circuits:

- Concealed within hung or furred ceilings or soffits.

- Concealed within floor slabs other than slabs on grade.

- Concealed within concrete walls.

- Concealed within block partitions, plasterboard partitions, and within wall furring.

2. For above grade, interior, feeders, subfeeders and distribution, below 600 volts, concealed or exposed as delineated above for branch circuits.

3. For interlock or control wiring, 120 volts or above:

   - Concealed in hung ceiling areas or partitions.

C. Heavywall nonmetallic conduit, Schedule 40 PVC, shall be used for:

1. Concealed within floor slabs and slabs on grade or within concrete or block walls.

D. Thinwall nonmetallic conduit, Schedule A PVC, may be used for:

1. Below grade secondary (below 600 volt) service.

2. Below grade feeders, subfeeders and distribution.

E. Flexible metallic conduit (Greenfield) shall be used for:

1. Three foot connections to the terminal boxes of motors and vibrating equipment located four feet or more above the floor.

2. Six foot tails between recessed accessible lighting fixture outlet box and recessed fluorescent lighting fixtures.

F. Weatherproof flexible conduit (Sealtite Type UA) shall be used for connection to the terminal boxes of motors and vibrating equipment located within four feet of the floor or in potentially wet locations.

G. Outdoor grade weatherproof flexible conduit (Sealtite Type HC) shall be used for:

1. Connections to motor terminal boxes and vibrating equipment outdoors, on roofs, etc.

2. Where required for connection to outdoor lighting fixtures.

PART 3 EXECUTION

3.1 INSTALLATION

A. No conduit shall be less than 1/2" trade size, except for homeruns which shall not be less than 3/4".

B. No conduit shall be larger than 4" trade size.

C. All conduits to run concealed, except as follows:

1. Mechanical and Electrical Equipment Rooms.

2. Unfinished spaces.

3. Where indicated on the contract drawings.

D. Utilize factory manufactured elbows 1-1/4" trade size and larger.

E. Make all cuts square with no reduction in trade size and ream out all burrs.

F. Make all joints tight, electrically continuous. No running threads are accepted. If necessary, use ERICKSON type couplings.

G. Provide locknut and bushing for termination. Bushing shall be insulated 1-1/4" trade size and above.

H. Provide expansion fittings for conduits crossing building expansion lines.

I. Cap all conduits with proper fittings until wires are pulled in.

J. All conduits exposed to mechanical injury shall be rigid or IMC.

K. All conduits installed in hollow metal, stud and wallboard, any movable or semi-permanent partition shall originate from ceiling plane or stub-up from floor slabs.

L. All conduits concealed in inaccessible spaces shall be minimum 3/4" trade size.

M. Conduits in or under grade slab shall be rigid hot-dip galvanized steel, Schedule 40 PVC or Schedule A PVC (refer to Section 16450, "Grounding").

N. Seal off all conduits with appropriate fittings penetrating:

1. Foundation Walls.

2. Roof Seal.

3. Waterproof Deck and/or Wall.

O. Conduits in concrete shall conform to the following.

1. They shall not displace structural steel.

2. They shall be routed not to cause structural weakness.

3. Single conduits shall be supported and tied down and multiple conduits shall be spaced, supported and tied down with manufactured spacers equal to McGraw Edison WUS Series.
4. They shall have a minimum of 1" separation from any surface of the concrete.

5. They shall be routed in accordance with field instructions issued for extenuating conditions by others.

6. No conduit shall be permitted in unreinforced concrete slabs on grade. Conduit in these locations shall be placed in gravel base beneath such slabs.

P. Exposed conduit shall run straight at right angles and parallel with building lines.

Q. Stub-ups or sleeves through concrete slab shall be 12" high rigid steel.

R. All equipment requiring motion or noise separation to be terminated with flexible metallic conduit.

S. Steel conduits installed in wet areas or underground shall be coated with bituminous paint.

T. Support all conduits with straps, hangers and clamps to provide a rigid installation. All supports to be independent from other equipment and in a manner not to impede the ready removal of other pipes.

U. Provide all empty conduits with appropriate pulling cord or wire.

V. All conduits shall be installed with acceptable workmanship, pleasing in appearance and practical in application.

W. No conduits may be run on the floor surface or in such a manner as to be hazardous to traffic.

X. Provide 2-1" empty conduits from each flush mounted lighting and receptacle panel to the hung ceiling above, terminating in elbows.

Y. Conduits above a hung ceiling shall be metallic only. Conduits shall be supported from the structure above, not from the ceiling grid system hanger wires, T-bars and cross T-members. Penetration of roof deck is not permitted for hangers, clamps, etc.

Z. All flexible metallic conduit installed exposed to weather, moist or humid atmosphere or subjected to dripping oil, grease or water shall be liquid-tight type.

AA. Owner shall be contacted prior to pouring of concrete to allow time for inspection of all underground electrical work.
BB. Steel or die cast set screw or compression type fittings shall be used for all EMT couplings and connectors.

CC. EMT connectors in sizes 1-1/4" and above shall have plastic nylon bushings.

DD. Where schedule 40 PVC conduit is turned out of concrete slabs, rigid steel elbows shall be utilized. No PVC shall be exposed unless specifically called for on the contract drawings.

EE. Seal all conduits serving roof mounted equipment with approved sealant. Do not run conduits exposed on the roof unless approval is obtained prior to installation.

FF. Flexible Metallic Conduit shall be used only for:

1. Three foot connections to the terminal boxes of vibrating equipment located four feet A.F.F.

2. Three foot connections to primary and secondary conduits of dry type transformers.

3. Six foot connections between accessible outlet boxes and recessed lighting fixtures.

GG. Conduit penetration from dry to wet environments shall be sealed to prevent moisture migration. Conduit shall be sealed internally at all connections to exterior equipment.

HH. All Schedule A PVC conduit shall be encased in a concrete envelope affording a minimum of 2" cover all around and 3" between parallel runs.

II. Do not place conduits in close proximity to equipment, systems and service lines, such as hot water supply and return lines, which could be detrimental to the conduit and its contents. Maintain a minimum 3" separation, except in crossing, which shall be a minimum 1".

JJ. Provide vapor seal fittings as shown on the drawings and as required by the NEC for all conduits entering or leaving ‘Classified’ areas.

END OF SECTION 16110

SECTION 16120

CONDUCTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers all conductors.

B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. All conductors shall be 98% minimum conductivity soft, properly refined copper. #10 AWG and smaller shall be solid, #8 AWG and larger shall be stranded.

B. Minimum size conductor for power and light circuiting shall be #12 AWG.

C. Maximum size conductor for feeders and power circuiting shall be 500 kcmil copper.

D. Minimum size conductor for control wiring shall be #14 AWG.

E. Wires and cables shall be as manufactured by Advance Wire and Cable, Rome Cable Corp., Southwire Company or approved equal.

F. Connectors shall be as manufactured by Burndy Corp., O-Z/Gedney Co., Panduit Corp., T & B Co. or approved equal.

2.2 INSULATION

A. All conductor insulation shall be rated for 600 volt, unless otherwise noted.

B. Utilization of insulation shall be as follows:

1. Lighting and appliance branch circuit conductors shall be THHN (dry or damp locations), THWN (wet locations). THW may be substituted if conductor and conduit sizes are upgraded accordingly.

2. Mains, Feeder and Subfeeder conductors shall be XHHW or THHN/THWN. THW may be substituted if conductor and conduit sizes are upgraded accordingly.

3. Fixture wires shall be TFN, TFFN, SF, RHH, or THHN.

4. Direct burial or underground shall be RHW-USE, UF or RR.

Wet locations are defined as in-conduit installations underground or in concrete slabs or

masonry in direct contact with the earth, and locations subject to saturation with water or other liquids, and locations exposed to weather and unprotected.

C. Exterior of wires shall be color coded. Color coding shall be as follows:

120/240 Volt Systems:

Phase A Black

Phase B Red

Neutral White or Grey

All ground wires shall be green.

D. In sizes and insulation types where factory applied colors are not available, colored plastic tape in overlapping turns shall be applied at all terminal points and in all points of splicing. Tape shall be applied at a minimum of 6" along the wires and cables.

2.3 SPLICING AND TERMINATING

A. Maintain all splices and joints in accessible enclosures, where easy inspection is available.

B. Join solid conductors with expandable type insulated coiled steel spring connections (wire nut).

C. Terminate solid conductor by means of a neat and fast application directly to the binding screw or post of the equipment.

D. Join, tap and terminate stranded conductors #6 AWG and larger by means of bolted saddle type or pressure indent type connectors, taps and lugs. Exclude connectors and lugs of the types which apply set screws directly to conductors. Apply pressure indent type connectors, taps and lugs utilizing tools manufactured specifically for the purpose and having features preventing their release until the full pressure has been exerted on the lug or connector. Connectors for conductors 250 kcmil and larger shall have two clamping elements or compression indents. Terminals for bus connections shall have minimum two bolt holes.

E. Except where wire nuts are used, build up insulation over conductor joint to a value, equal both in thickness and dielectric strength, to that of the factory applied conductor insulation. Insulation of conductor taps and joints shall be by means of half-lapped layers of rubber tape, with an outer layer of friction tape; by means of half-lapped layers of approved plastic electric insulating tape; or (in the case of bolted type connector joints) by means of split insulating casings molded specifically to insulate the particular connector and conductor, and fastened with stainless steel or non-metallic snaps or clips.

F. Exclude splicing procedures for neutral conductors in lighting and appliance branch circuitry which utilize device terminals as the splicing point.

G. Exclude joints or terminations utilizing solder in any conductors used for grounding or

bonding purposes.

H. Exclude all but pressure indent type joints in conductors used for signalling or communication purposes.

PART 3 EXECUTION

3.1 INSTALLATION

A. All conductors shall be continuous from outlet to outlet. Avoid unnecessary splicing except where lengths are greater than standard manufacture.

B. Leave sufficient slack on all runs to permit secure connection of equipment.

C. Provide recently manufactured wires and cables and submit evidence that they are new.

D. All conductors shall be installed simultaneously in a single raceway. Delay pulling until the project progresses to a point where conductors shall not be exposed to injury and moisture. Wire shall not be installed prior to distribution equipment being in place.

E. Use only specifically manufactured lubricant for wire pulling purposes.

F. Dress and lace wires and cables in all cabinets and pull boxes and use necessary insulated support to prevent shifting.

G. Identify feeders at each pull box and cabinets with permanent non-metallic band or tag.

3.2 VOLTAGE DROP

A. Home run wiring (from panel to first active outlet) for home runs greater than 50 feet in lengths shall be a minimum of #10 AWG.

END OF SECTION 16120

SECTION 16130

BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers junction, pull and outlet boxes.

B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIAL

A. All boxes shall be manufactured from galvanized industry standard gage steel, cast iron or cast aluminum, Steel City Electric Company, Appleton Electric Company, HUBBELL or approved equal.

B. Provide deep, round, fully adjustable before and after concrete pour, floor boxes where indicated on the contract drawings. Floor boxes shall have carpet flanges and/or other devices as required.

All floor boxes shall have covers of brass or bronze only. Boxes installed in slab on grade shall be cast iron as HUBBELL B-2536 or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. All boxes shall be installed in accessible areas with removable covers.

B. All boxes shall be firmly supported from the building structure.

C. All outlet boxes shall be set flush with the surface of the wall, floor or ceiling in concealed installation.

D. All boxes installed shall conform to the criteria governing the displacement and bending radius of wires and cables contained within them.

E. Provide segregated boxes or proper barriers where different services or systems are following the same routing.

F. Include all boxes required for a complete system regardless of indication on the contract drawings.

G. Provide pull or junction boxes to limit conduit runs to the equivalent of 360 degree bends

and to facilitate wire pulling.

H. Close up all unused openings in boxes with approved fittings.

I. Provide an outlet box for each individual wiring device, lighting fixture, and communication component, unless otherwise noted.

J. Multiple devices indicated at a single location shall utilize gang mounted under common cover where possible. Lexan or aluminum covers are not permitted.

K. Provide each outlet box with the appropriate extension ring to suit wall thickness.

L. Provide weatherproof outlet boxes, corrosion-resistant cast-metal with threaded conduit hubs where exposed to moisture, with or next to water connection and where indicated as weatherproof on drawings. Provide cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, including plate gaskets and corrosion resistant fasteners.

M. A receptacle installed outdoors where exposed to weather or in other wet locations and intended for use with plug left connected to it indefinitely, shall be in a weatherproof enclosure, the integrity of which is not affected when the receptacle is in use.

N. Provide support racks for boxes with multiple sets of conductors so conductors do not rest on any metal work inside box.

END OF SECTION 16130

SECTION 16134

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers lighting and power panels.

B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Panels shall consist of complete dead-front assemblies including the following.

1. Back Pan.

2. Bus Bars.

3. Sheet Metal Cabinet.

4. Switching and Over-Current Units.

5. Trim and Door for Lighting and Miscellaneous Power panels.

B. Sheet metal cabinets shall be minimum 20" wide for lighting panels fabricated from industry standard gauge galvanized sheet steel with corners lapped and fastened by approved methods.

C. Trims and doors shall be suitable for the required mounting. When installed the whole assembly shall present a smooth flush appearance. Provide combination catch and lock with 2 sets of keys. All panels within same facility shall be keyed alike. Mount a clear plastic cover and metal frame with a typewritten directory --identifying each circuit--inside of panel door. Trims shall be fastened with adjustable screw clamps and self-supporting on cabinets if screws are removed. Overlap flush cabinets at least 1/2" all around. Paint the inside and outside of trims and doors with factory applied rustproofing and one finished coat to which field applied paint will adhere.

D. Switching and overcurrent units shall be bolted or snap on circuit breakers as specified in the appropriate section of these specifications.

E. Bus bars for panels shall have current capacities as indicated and sized for such capacities in accordance with Underwriters' Laboratories standards.
The bussing shall be braced throughout to conform to industry standard practice. Phase bussing shall be full height and tap for sequence phasing of the branch circuit devices.

Unless otherwise noted, ground bus and full size neutral bus bar shall be included. Provide correct number, size and type of lugs or connectors for each phase bus, neutral bus, ground bus, main device and branch circuit. All panels shall be fully bussed.

F. Panelboard shall be provided with the following bus design.

1. Lighting and power panels bussing shall be copper or tin-plated aluminum.

G. The voltage, number of phases and wires, short circuit rating, size of main lugs or main device (ampacity), number of branch circuits and their rating, and the number of spares and spaces as noted on the contract drawings.

H. Panelboards shall be:

120/240 volt

I. Provide micata laminated identification plate for each panelboard. Provide temporary identification as panels are installed.

J. Provide bussing behind all spaces.

K. All elements (load and line side) of a series rated system shall have marking according to NEC-90, Sec. 110-22 and 240-88(c), L.C. with phrase "Identical Component Replacement Required" added to it.

L. MENO HOUSE: Provide Panelboard with Load Center with Plug on Breakers with Standard Depth of 3 3/4.

2.2 MANUFACTURERS

A. Accepted manufacturers are General Electric, ITE, Square "D" Company, and Westinghouse or equal.

PART 3 INSTALLATION

3.1 INSTALLATION

A. Install panels with adequate support independent of the connecting raceways.

B. Mount all panels level and plumb. Flush panels not to extend beyond the face of the wall. All trim around panels shall be furnished and installed by Electrical Contractor. Handle of top circuit breaker or switch shall not be higher than 6-6" from finished floor.

C. Protect panels during construction with adequate covering.

D. Insulate panels mounted flush on outside walls with 1/2" solid Fiberglass insulation to prevent condensation.

E. Complete all directory cards and submit a reproducible copy to the Owner.

F. Panelboard shall not be used as a raceway for any conductors not terminating therein.

G. Clean panelboard interior and remove foreign matter prior to installing cover trim.

H. Provide permanent blanking plates over unused circuit breaker positions and hole plugs over unused knockouts and conduit openings.

END OF SECTION 16134

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers line voltage wiring devices.

B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. All devices shall be specification grade, heavy duty, standard as per indication for the purpose of application.

B. Switches for local control shall be rocker arm, quiet type, with screw type terminals.

1. Rating: 120-277 volts, 20 AMPS, AC only.

2. Color: ivory.

3. They shall be rated to handle 50,000 cycles of operation without deterioration, regardless of whether inductive or resistive (including tungsten) loads are controlled.

4. Non-standard switches shall incorporate applicable requirements for the standard type and shall be as indicated.

5. Key switches where indicated shall be as follows.

a. Flush, lock type, momentary contact with positive "off" center as Arrow-Hart #4354-LA. Electrical Contractor to furnish six (6) keys.

C. Receptacles for convenience outlets shall be specification grade, heavy duty, and as specified below:

1. Rated 125 VOLTS, 20 AMPS NEMA 5-20R.

2. Colored to match wall treatment as determined by the Architect.

3. Self-grounding type, 3 or more wires, single or duplex, as indicated, with NEMA standard face slot configuration.

4. With screw type terminals only.

5. Non-standard type outlets and special purpose power supply receptacles shall incorporate applicable requirements for standard type and shall be as indicated.

6. For each non-standard receptacle or power supply outlets installed, furnish one matching attachment plug and connect same to the cord of the associated equipment at no additional compensation.

7. Provide definitive grounding method for all special outlets and power supply receptacles.

8. Flush type, Pass & Seymour Sierraplex type or equal in finished areas.

D. Plates for all devices shall be selected as follows.

1. Of the same color as their associated devices, with correct shape opening. Screw heads shall have color to match plate.

2. Phenolic plastic ivory in finished areas.

3. For recessed outlet boxes or raised surface covers for exposed outlet boxes in all unfinished areas use .030 brushed stainless steel.

E. Dimming equipment for incandescent switching shall be provided as follows.

1. Select the dimmer to match the total load served.

2. Derate dimmers if they are ganged in common enclosure.

3. Use only solid state electronic type dimmers in 600W, 1000W, 1500W, or 2000W rating, as manufactured by General Electric, Lutron or approved equal.

4. Use only slide type dimmers.

F. Floor outlets shall be as depicted in the following.

1. Flush cap combination cover as Hubbell S-2525.

2. Flush duplex screw type cover as Hubbell S-3725 with standard duplex receptacle.

2.2 MANUFACTURERS

A. Acceptable manufacturers are Arrow-Hart, General Electric, Hubbell, Pass & Seymour or Slater. Provide all devices by same manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all devices indicated complete with cover plates.

B. Where necessary, set the long dimension of the plate horizontal.

C. All devices in common enclosure shall be gang-mounted under common cover (tandem).

D. All receptacles shall maintain a consistent orientation for neutral connection; use the silvered terminal if supplied with device.

E. All plates shall have full contact with the wall and boxes.

3.2 MOUNTING HEIGHTS

A. Mounting heights of devices shall be as follows unless noted otherwise on contract drawings.

1. Receptacles - 15" to centerline above floor.

2. Switches - 48" to centerline above floor.

4. Telephone outlets - 15" to centerline above floor.

END OF SECTION 16140

SECTION 16170

DISCONNECTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers individually mounted switching and over-current devices.

B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fused disconnect switches shall be heavy duty, horse-power rated with quick-make, quick-break (QMQB) mechanism.

1. Enclosures shall be of a NEMA type as required and/or noted on the contract drawings with nameplates with a permanent record of type, size, and horse-power ratings.

2. Disconnect switches shall have operating handles with definite "OFF" indications and defeatable door interlocks in the "ON" position.

3. Provide switch assembly, where the operating handle is an integral part of the enclosure base.

4. Provide reinforced rejection type fuse clips for both standard and time delay fuses. Clips to accept Class R or L fuses only.

5. Provide multi-padlock capability for the operating handle.

6. Provide six-pole disconnects where 2 speed motors are used.

7. Provide equipment ground kit in all disconnect switches.

8. Provide neutral assemblies where required.

B. Non-fused disconnect switches shall have the same features and characteristics as the fused disconnect, except no fuse clips.

2.2 MANUFACTURERS

A. General Electric, ITE, Square D, Westinghouse.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fused or non-fused disconnect switches where indicated on the contract drawings or required by the latest issue of NEC.

B. Disconnect switches shall be installed with adequate hand access to the handle and clearance for operation and fuse replacement.

C. Seal all conduit penetrations with approved sealant where switches are installed outdoors.

D. All connections to fans shall be made thru back of switch.

E. Install disconnect switches used with motor-driven appliances, motors and controllers within sight of controller, motor, and motor driven machinery location.

F. Where manufacturer's warranty of HVAC equipment requires fuses, install disconnect switches fused as required in the warranty.

G. Unless otherwise indicated, disconnect switches shall be mounted with top of the handle while in "ON" position not higher than 6'-6" above finished floor, properly aligned and adequately supported independently of the connecting raceways. All steel shapes, etc., necessary for the support of the disconnect shall be furnished and installed where the building structure is not suitable for mounting the equipment directly thereon.

H. Disconnect switch shall not be used as a raceway or a junction box for any conductors not terminating therein.

END OF SECTION 16170

SECTION 16180

PROTECTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers circuit breakers, fuses and all over-current protecting devices.

B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Circuit breakers shall be molded case, completely enclosed bolted connection devices, with the following features:

1. Quick-break, trip free, trim indicating one-, 2- or 3-pole switching units.

2. All multi-pole breakers shall have common trip handles and all poles shall close, open or trip simultaneously. Multiple handles with clips or pins shall not be acceptable.

3. Inverse time delay overload with instantaneous short circuit protection by means of a thermal-magnetic element.

4. Rated to withstand the available short circuit current at the line side of connection.

5. With non-welding contact surfaces and arc chutes.

6. All single pole circuit breakers rated 15A and 20A shall be listed for switching duty.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install current limiting fuses in accordance with drawings and diagrams.

B. Install fuses of proper type, and voltage rating for all fusible devices, including equipment furnished by others. When selecting fuses, follow the recommendation of the protected equipment manufacturer. Coordinate selectivity with other equipment and over-current devices on line.

C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being

exerted by clamps, supports or cables.

END OF SECTION 16180

SECTION 16450

GROUNDING

PART 1 GENERAL

1.1 GENERAL

A. All electrical systems shall be grounded in accordance with the National Electrical Code, Local Codes, these specifications and the contract drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A Use green colored and coded insulated copper conductors.

B. Use approved ground clamps manufactured for such purpose.

PART 3 EXECUTION

3.1 INSTALLATION

A. Ground all systems and equipment with the best applicable industry practice.

B. Thoroughly clean all contact surfaces before making any grounding connections.

C. Install metallic raceways mechanically and electrically secure at all joints and at all boxes, cabinets, fittings and equipment. Bond all boxes as specified for equipment.

D. Provide separate green equipment ground conductor in all electrical raceways, to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and non-current carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through No. 10 AWG. Use NEC Table 250-95 for conductor size with phase conductors No. 8 and larger, if not shown on the contract drawings.

E. Permanently connect the green ground conductor to each receptacle junction box (self-tapping screw).

F. Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium-plated steel. Ground conduits to metal frame with double locknuts or grounding bushings.

END OF SECTION 16450

SECTION 16500

LIGHTING

PART 1 GENERAL

1.1 SCOPE

A. Provide lighting system, complete.

1.2 APPLICABLE DOCUMENTS

A. National Electrical Code References: Lighting Fixtures; Article 410.

B. QUALITY ASSURANCE

1. Electric Lighting Fixtures: UL 57.

2. Lampholders: UL 542.

3. Fluorescent Lamp Ballasts: UL 935.

4. High-Intensity Discharge Lamp Ballasts: UL 1029

C. Manufacturing Standards

1. Fixtures: NEMA LE1

2. Ballasts: CBM

3. Lamps: ANSI C78

4. Lampholders: ANSI C81

1.3 SUBMITTALS

A. Manufacturer's Data: Submit certified photometric data including CU. The data shall be verified by ETL or ITL reports.

B. Shop Drawings: Submit shop drawings detailing construction, dimensions and performance of lighting fixtures.

C. Samples: Submit samples upon request.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fixtures:

1. Provide lighting fixtures of rigid construction, dimensionally stable, and assembled with secure fastenings. Protect ferrous parts from corrosion by plating or finish with high reflectance enamel. Firmly support shielding materials, make tight, with no loose panels or parts, and showing no leaks of unshielded or unintentional light. All plastics used in shielding shall be virgin acrylic, minimum 0.125" thick.

2. Where fixtures are subject to moisture, providing DL or WL label on fixtures as required for the location.

B. Ballasts:

1. Provide electronic fluorescent ballasts.

2. Provide high power factor HID ballasts. Provide CWA mercury and metal halide ballasts and regulated high pressure sodium ballasts. Recessed HID lighting fixtures shall have ballasts mounted adjacent to the housing of the fixture. Ballasts shall limit starting current to a value no greater than operating current.

C. Lamps:

1. Provide lamps as scheduled in all lighting fixtures unless otherwise noted.

2. Provide energy saving, high phosphor T-8 type fluorescent lamps.

3. See fixture schedule for lamp types.

4. Only the self-extinquishing lamps shall be used when metal halide lamps are specified in open type lighting fixtures.

D. Sockets:

1. Provide sockets in fluorescent fixtures of high strength plastic construction, with heavy gage spring brass contacts.

2. Enclose screw-shell sockets for fixtures in one piece high density porcelain insulation, with corrosion resistant metal contact surfaces for corrosion resistance and low electrical resistance. Provide center contact of spring material, or supported by a spring material, to maintain good contact.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide fixture wiring suitable for the temperature rating of the fixture. Where a junction box is required to change from branch circuit to fixture wiring the Contractor may use approved feed pre-wired fixtures or install a separate junction box at his option. Provide fully accessible junction box after installation of covering materials. Where flexible conduit or portable cord is used, install a grounding jumper; ground all fixtures.

B. Suspend lighting fixtures from structural members or from ceiling structural members, by minimum 1-1/2 inch channels, by standard bar hangers, or other approved means. Under no circumstances will they be suspended from the ceiling. Coordinate fixture locations with ceiling patterns. Refer to architectural room finish schedule for ceiling construction details and mounting heights. Coordinate all recessed fixtures for specific conditions encountered.

C. Provide structural steel necessary to support the fixtures under this section. Provide plaster frames as required. Where lighting fixtures located in plaster ceilings have a square or rectangular pattern, provide necessary corner plaster frames for a complete system.

D. The lighting fixture schedule shown on the contract document indicates the type of fixture required but contractor shall provide the proper fixture for the ceiling type as indicated in the architectural finish schedule.

END OF SECTION 16500