

SPECIFICATIONS

PUHO 5478/113

**REPLACE
PU'UHONUA O' HONAUNAU
ADMINISTRATIVE BUILDING**

Construction Documents
Final Submittal
June 2005

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Not Used

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Not Used

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Not Used

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SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this contract consists of the general construction of the Pu'uhonua O' Honaunau Administration Building, a single story wood frame building of approximately 2725 enclosed square feet, with 1270 square feet of lanai and deck.
- B. Related mechanical and electrical site work.
- C. All work will be performed under a single contract.

1.2 LOCATION

- A. The project is located at the Pu'uhonua O' Honaunau National Historic Site, District of Kona, Island of Hawaii, State of Hawaii

1.3 CONTRACTOR'S USE OF PREMISES

- A. Contractor shall at all times conduct his operations to ensure the least inconvenience to the public. Standard hours of construction activity shall be from ½ hour following sunrise to ½ hour prior to sunset. Park closures will not be permitted.
- B. Storage of Materials: Storage of materials shall occur within the project work area, unless otherwise agreed upon with National Park Service. Said area shall be fenced. Security of items stored in this area shall be the responsibility of the Contractor. See Section 01560 Barriers.
- C. Preservation of Natural Features: Confine ALL operations to work limits of the project. Prevent damage to natural surroundings. Restore damaged areas, repairing or replacing damaged plants, at no additional expense to the Government.
 - 1. Provide temporary barriers to protect existing trees and plants and root zones.
 - 2. Do not remove, injure, or destroy trees or other plants without prior approval. Consult with Contracting Officer and remove agreed-on roots and branches that interfere with construction.
 - 3. Do not fasten ropes, cables, or guys to existing trees.
 - 4. Carefully supervise excavating, grading, filling, and other construction operations near trees to prevent damage.
- D. Existing Utilities: Notify Contracting Officer and utility companies of proposed locations and times for excavation.
 - 1. Contractor shall be responsible for locating and preventing damage to known utilities. If damage occurs, repair utility at no additional expense to the Government.

- 2. If damage occurs to an unknown utility, repair utility. An equitable adjustment will be made in accordance with the Changes clause of the contract.
- 3. Interruption of Existing Utility Service: Interruption of electricity, water and wastewater to the existing Visitor Center and Administration Buildings for 4 hours or less is acceptable, and must not last longer than 24 hours. Interruptions in the electrical service will be allowed for up to 4 hours for the connection of the new transformer. Provide at least 24 hours notice for any disruption of utilities. Coordinate with the Contracting Officer.
- E. Hauling Restrictions: Comply with all legal load restrictions in the hauling of materials and refuse disposal. Load restrictions on park roads are identical to the state load restrictions with such additional regulations as may be imposed by the Park Superintendent. Information regarding rules and regulations for vehicular traffic on park roads may be obtained from the Office of the Park Superintendent. A special permit will not relieve Contractor of liability for damage that may result from moving of equipment.

1.4 SPECIAL CONSTRUCTION REQUIREMENTS

- A. Importation of material and equipment will be subject to inspection by Park environmental resource personnel for organic matter, and subject to the requirements set forth by said personnel, prior to the material being delivered to the project site.
- B. NPS will require the Contactor to thoroughly wash all equipment and material prior to entering the Park to ensure removal of organic material. Park personnel will conduct periodic inspections of construction equipment and materials.

1.5 FIELD VERIFICATION

- A. Field verify all new and existing dimensions affecting the work of this contract before ordering products.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 01270

DEFINITION OF BID ITEMS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The intent of this section is to explain, in general, what is and what is not included in a bid item, and the limits or cut-off points where one bid item ends and another begins.
- B. If no bid item exists for a portion of the work, include the costs in a related bid item.

1.2 BID ITEM NO. 1

- A. The bid item consists of all required work as defined in the Contract Document to provide for the completion of the following:
 - 1. Construction of a new Administration Building, a single story wood frame building with a concrete pier foundation system of approximately 2725 enclosed square feet, 3675 square feet including lanais and construction of the entry bridge and mechanical and electrical site work as defined on the drawings for construction.

1.3 BID OPTIONS:

- A. No. 1: Provide fiberglass reinforced window frames instead of vinyl frames; see Section 08520 2.1, C.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION NOT USED.

END OF SECTION

SECTION 01310

PROJECT MEETINGS

PART 1 GENERAL

1.1 PRECONSTRUCTION CONFERENCE

A. Before start of construction, Contracting Officer will arrange an on-site meeting with Contractor. The meeting agenda will include the following as a minimum:

1. Correspondence procedures
2. Designation of responsible personnel
3. Labor standards provisions
4. Payroll reports
5. Changes
6. Payments to Contractor
7. Subcontractors
8. National Park Service regulations
9. Accident prevention program (including name of responsible supervisor)
10. Accident reporting
11. Contractor's Quality Control Program
12. Documents required under the contract
13. Park rules and regulations
14. Recycling Program
15. Saturday, Sunday, holiday and night work
16. Safety program (compliance with the "Accident Prevention" clause of the contract)
17. Cultural Survey and Natural Resource Compliance requirements.
18. Tentative construction schedule
19. Submittal of shop drawings, project data, samples, and approved equals
20. Project closeout requirements
21. Relationship of Division 1 to other divisions

1.2 PROGRESS MEETINGS

- A. The Contracting Officer will schedule weekly meetings with the Contractor and subcontractors.
- B. Subcontractors will not be allowed to work until they have attended a meeting.
- C. Additional meetings will be held as needed or for new subcontractors.
- D. The meeting agenda will include the following as a minimum:
 - 1. Approval of minutes of previous meetings
 - 2. Review of work progress
 - 3. Field observations, problems, and decisions
 - 4. Identification of problems which impede planned progress
 - 5. Review of Contractor's Quality Control Program and activities
 - 6. Review of submittals schedule and status of submittals
 - 7. Review of off-site fabrication and delivery schedules
 - 8. Status of project record drawings (monthly)
 - 9. Status of operation and maintenance data manuals (monthly)
 - 10. Maintenance of progress schedule
 - 11. Corrective measures to regain projected schedules
 - 12. Planned progress during succeeding work period
 - 13. Coordination of projected progress
 - 14. Maintenance of quality and work standards
 - 15. Effect of proposed changes on progress schedule and coordination
 - 16. Other business relating to work

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION NOT USED.

END OF SECTION

SECTION 01312

MECHANICAL AND ELECTRICAL COORDINATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The following schedule clarifies the division of labor and materials between Division 15, Mechanical, and Division 16, Electrical. Contractor shall have overall control for assignment of work and responsibility for completeness and proper operation of work as specified and shown on drawings. MD indicates Mechanical Division and ED indicates Electrical Division.

Items	Products Under	Execution Under	Power Wiring Under	Control Wiring Under
Equipment Motors	MD	MD	ED	ED
Motor Starters and Overload Relays Not Included with Equipment	ED	ED	ED	ED
Disconnect Switches Not Included with Equipment	ED	ED	ED	
Time Clocks and Switches	ED	ED	ED	
Thermostats, Control Relays, Control Transformers, Damper Motors	MD	MD	ED	MD
Fan Speed Controls	MD	ED	ED	ED
Duct Smoke Detectors	ED	MD	ED	ED
Electric Heaters	MD	MD	ED	MD
Fire Protection Alarm and Tamper Switches	MD	MD	ED	ED

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION NOT USED.

END OF SECTION

SECTION 01323

PROJECT SCHEDULE AND MONTHLY INSPECTIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Summary: The work of this section consists of project schedule requirements including preparation of a project schedule, schedule updates, schedule revisions and time impact analysis. The project schedule shall be based upon the Critical Path Method (CPM) for planning, scheduling and reporting progress of the Work.
- B. Purpose: The purpose of the project schedule is to ensure adequate planning, coordination, scheduling, and reporting during execution of the work by the Contractor. The project schedule will assist the Contractor and Contracting Officer in monitoring the progress of the work, evaluating proposed changes, and processing the Contractor's monthly progress payment.
- C. Software: The software shall be the latest version of Primavera Project Planner (P3), SureTrak Project Scheduler, Microsoft Project, or approved equal. The Contractor shall provide to the Contracting Officer a licensed copy of the software used for the project schedule and a software reference manual. The software and reference manual will be returned to the Contractor at completion of the Contract.

1.2 SUBMITTALS:

- A. As specified in Section 01330.
- B. Project Schedule: Within 5 calendar days after Notice to Proceed, submit one electronic copy on PC compatible CD-ROM and 2 paper copies of the proposed project schedule, and accompanying CPM Schedule Reports.
- C. Project Schedule Updates: On or before the 7th day preceding the progress payment request date, submit estimates of the percent completion of each schedule activity and necessary supporting data. Provide two paper copies and one electronic copy.
- D. Project Schedule Revisions and Time Impact Analysis: Submit one electronic copy and two paper copies of a Time Impact Analysis. Each Time Impact Analysis shall include a Fragmentary Network (Fragnet) demonstrating how the Contractor proposes to incorporate a modification, change, delay, or Contractor request into the project schedule.
- E. Schedule of Values
 - 1. Within 14 calendar days after the date of the Notice to Proceed, submit a schedule of dollar values based on the Contract Bid Schedule. Breakdown each lump-sum bid item into component parts of work for which progress payments may be requested. The total costs for the component parts of work shall equal the bid amount for that lump-sum item. The Contracting Officer may request data to verify accuracy of dollar values. Include mobilization, general condition costs, overhead and profit in the total dollar value of unit price items and in the component parts of work for each lump-sum item, as described below. Do not include mobilization, general condition costs, overhead or profit as a separate item.

2. Do not break down unit price bid items. Use only the bid amount for unit price items.
3. The total cost of all items shall equal the contract sum. The Schedule of Values will form the basis for progress payments.
4. An acceptable Schedule of Values shall be agreed upon by the Contractor and Contracting Officer before the first progress payment is processed.

1.3 PRELIMINARY REQUIREMENTS

- A. Meeting: The Contractor shall meet with the Contracting Officer on the day of the preconstruction conference to conduct a joint review of the project schedule requirements of the contract to assure the Contracting Officer of the Contractor's and subcontractors' understanding of the requirements of this section.
- B. Contractor's Schedule Representative: Before or at the preconstruction conference, designate in writing and provide the qualifications of an authorized representative in the Contractor's organization who shall be responsible for coordinating with the Contracting Officer during the preparation and maintenance of the project schedule.

1.4 PROJECT SCHEDULE

- A. Schedule Development:
 1. The late finish date shown on the schedule shall be the same date as the last day of the contract period.
 2. The Contractor shall use the Precedence Diagram Method (PDM) with limited use of lead or lag duration's between schedule activities. The Contractor's project schedule shall consist of procurement activities (including mobilization, submittal, and the fabrication and delivery of key and long-lead procurement items) and construction activities.
 3. The Contractor's project schedule shall consist of, but not be limited to, the following for each activity:
 - a. Identify each and every activity number with numerical designations (maximum 5-digit). Numbering of activities shall be in increments of 10 digits.
 - b. Concise description of the work represented by the activity (maximum 48 characters). Avoid the use of non-standard abbreviations. The work related to each activity shall be limited to one work trade.
 - c. Activity duration in whole working days with a maximum duration of 15 work days each, unless otherwise approved by the Contracting Officer, except for non-construction activities including mobilization, shop drawing and sample submittals, fabrication of materials, delivery of materials and equipment, and concrete curing.
 4. In developing the project schedule, ensure that subcontractor work at all tiers, as well as the prime contractor's work, is included and coordinated in the project schedule.

5. The project schedule as developed shall show the sequence and interdependence of activities required for complete performance of the work. Ensure all work sequences are logical and the project schedule shows a coordinated plan of the work.
6. Proposed duration assigned to each activity shall be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity.
7. Resource loading of each activity shall list all personnel by labor category and equipment type and capacity proposed to complete the activity in the duration shown.
8. Consider seasonal weather conditions in planning and scheduling all work influenced by high or low ambient temperatures, wind and/or precipitation to ensure completion of all work within the contract time. Show anticipated weather conditions on project calendar.

B. Joint Review, Revision, and Acceptance:

1. Within seven calendar days of receipt of the Contractor's proposed project schedule, the Contracting Officer and Contractor shall meet for joint review, correction, or adjustment of the proposed project schedule. Any areas which, in the opinion of the Contracting Officer, conflict with timely completion of the project shall be subject to revision by the Contractor.
2. In the event the Contractor fails to define any element of work, activity, or logic, and the Contracting Officer review does not detect this omission or error, such omission or error, when discovered by the Contractor or Contracting Officer, shall be corrected by the Contractor at the next monthly project schedule update and shall not affect the contract time.
3. Within seven calendar days after the joint review between the Contractor and Contracting Officer, the Contractor shall revise and resubmit the project schedule in accordance with agreements reached during the joint review.
4. Upon acceptance of the project schedule by the Contracting Officer, the project schedule will be used to evaluate the Contractor's monthly applications for payment based upon information developed at the monthly project schedule update meeting.

1.5 PROJECT SCHEDULE UPDATES

- A. General: Update the project schedule on a monthly basis throughout the entire contract time and until project substantial completion. The status date of each schedule update shall be the 7th day preceding the progress payment request date.
- B. Procedure: The Contractor shall meet with the Contracting Officer each month at a project schedule update meeting to review actual progress made through the status date of the project schedule update, including dates activities were started and/or completed and the percentage of work completed on each activity started and/or completed.
- C. Progress Payments: The monthly updating of the project schedule shall be an integral part of the process upon which progress payments will be made under this contract. If the contractor fails to provide schedule updates or revisions, then a portion of his monthly payment may be retained until such corrections have been made.

1.6 PROJECT SCHEDULE REVISIONS

- A. Required Revisions: If, as a result of the monthly schedule update, it appears the project schedule no longer represents the actual prosecution and progress of the work, the Contracting Officer will request, and the Contractor shall submit, a revision to the project schedule. The Contractor may also request reasonable revisions to the project schedule in the event the Contractor's planning for the work is revised. If the Contractor desires to make changes in the project schedule, the Contractor shall notify the Contracting Officer in writing, stating the reason for the proposed revision. Accepted revisions will be incorporated into the project schedule at the next monthly schedule update.
- B. Procedure: If revision to the project schedule is contemplated, the Contractor or Contracting Officer shall so advise the other in writing at least seven calendar days prior to the next schedule update meeting, describing the revision and setting forth the reasons therefore. Government-requested revisions to the project schedule will be presented in writing to the Contractor, who shall respond in writing within seven calendar days.

1.7 TIME IMPACT ANALYSIS FOR CONTRACT MODIFICATIONS, CHANGES, DELAYS, AND CONTRACTOR REQUESTS

- A. Requirements: When contract modifications or changes are initiated, delays are experienced, or the Contractor desires to revise the project schedule, the Contractor shall submit to the Contracting Officer a written time impact analysis illustrating the influence of each modification, change, delay, or Contractor request on the contract time.
- B. Time Extensions: Activity delays shall not automatically mean that an extension of the contract time is warranted or due the Contractor. It is possible that a modification, change, or delay will not affect existing critical path activities or cause non-critical activities to become critical. A modification, change, or delay may result in only absorbing a part of the available total float that may exist within an activity chain of the project schedule, thereby not causing any effect on the contract time. Time extensions will be granted in accordance with the terms of the contract.
- C. Float: Float is not for the exclusive use or benefit of either the Government or the Contractor. Extension of the contract time will be granted only to the extent the equitable time adjustments to the activity or activities affected by the modification, change, or delay exceeds the total (positive or zero) float of a critical path activity and extends the contract completion date.
- D. Procedure: Each time impact analysis shall be submitted within the time period stated in a request for proposal, or the time period designated under the clauses entitled Changes or Default. In cases where the Contractor does not submit a written request for extension of time and a time impact analysis within the designated time, it is mutually agreed that the particular modification, change, delay, or Contractor request does not require an extension of the contract time. Upon acceptance, the time impact analysis shall be incorporated into the project schedule at the next monthly schedule update.

1.8 MONTHLY INSPECTIONS

- A. Project record drawings as specified in Section 01770.
- B. Operation and maintenance data binders as specified in Section 01785.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION NOT USED.

END OF SECTION

SECTION 01330

SUBMITTALS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of submittal requirements before and during construction.

1.2 RELATED REQUIREMENTS

1.3 SUBMITTAL AND APPROVAL PROCEDURES

- A. All submittals shall be transmitted using National Park Service form CM-16, dated 4/00. (A copy of the form is included at the end of this section.) No action will be taken on a submittal item unless accompanied by the transmittal form.

- B. As specified in the individual sections, forward submittals to Contracting Officer at least 30 days before need for approval. Unless a different number is specified, submit one reproducible original and three copies of each shop drawing, four copies of manufacturer's catalog sheets (cut sheets), four specimens of each sample, and four copies of all other submittals requested.

1. Shop Drawings: Include the following information with each copy of shop drawings:
 - a. Date.
 - b. Date of revisions (when applicable).
 - c. Contractor's certification that shop drawing has been checked for compliance with contract documents.
 - d. Details of fabrication, assembly and erection including connections and engagement to contiguous work.
 - e. Materials used.
 - f. All required dimensions.
 - g. The term "by others" shall not be used. All work to be performed by others shall be identified by Contractor or subcontractor name, discipline, or trade.
2. Samples: Samples shall be large enough to illustrate clearly the functional characteristics and full range of color, texture, or pattern.
3. Manufacturers' Catalog Sheets: Submit only pertinent pages; mark each copy of standard printed data to identify specific products proposed for use.
4. Manufacturer's Installation Instructions: When contract documents require compliance with manufacturer's printed instructions, provide one complete set of instructions for Contracting Officer and keep another complete set of instructions at the project site until substantial completion.

- C. Contracting Officer reserves the right to require submittals in addition to those called for in individual sections.
- D. Approved Equals:
 - 1. For each item proposed as an "approved equal," submit supporting data, including:
 - a. Drawings and samples as appropriate.
 - b. Comparison of the characteristics of the proposed item with that specified.
 - c. Changes required in other elements of the work because of the substitution.
 - d. Name, address, and telephone number of vendor.
 - e. Manufacturer's literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.
 - 2. A request for approval constitutes a representation that Contractor:
 - a. Has investigated the proposed item and determined that it is equal or superior in all respects to that specified.
 - b. Will provide the same warranties for the proposed item as for the item specified.
 - c. Has determined that the proposed item is compatible with interfacing items.
 - d. Will coordinate the installation of an approved item and make all changes required in other elements of the work because of the substitution.
 - e. Waives all claims for additional expenses that may be incurred as a result of the substitution.
 - 3. Construction Materials: The Contractor is encouraged to submit for approval products made out of recycled or environmentally responsible material. Every effort will be made by the National Park Service to approve these materials.
- E. Coordinate all submittals and review them for legibility, accuracy, completeness, and compliance with contract requirements. Forward submittals that are related to or affect one another as a package to facilitate coordinated review. Each transmittal shall contain only data specific to that individual submittal.

F. Submittal Identification:

1. Contracting Officer will provide a project identification stamp which shall be applied by the Contractor. Identification shall include the park name-package number, project title, contract number, and transmittal number.
2. All sets of shop drawings, manufacturer's catalog sheets, samples, and other documents submitted to the Contracting Officer must have the identification information stamped on the submittal.
3. Identification information shall be applied to the bottom right margin on each page. Identification information on samples shall be applied to the most readily visible area on the sample or on tags attached to sample.

G. Submittal Numbering:

1. Number each submittal consecutively.
2. For re-submittals use the original submittal number, plus a letter suffix beginning with A.
3. Additional re-submittals of the same item shall contain the original number with the next consecutive letter.

H. Contracting Officer's Review:

1. Submittals will be returned disapproved without technical review if identification information is missing, not filled in, or if placed on the back of the submittal; an incorrect number or format of submittals is provided; the transmittal form is incorrectly filled out; submittals are not coordinated; or submittals do not show evidence of Contractor's approval.
2. Any work done or orders for materials or services placed before approval shall be at the Contractor's own risk.
3. After reviewing submittals, the Contracting Officer will return one copy of form CM-16 and one copy of applicable (marked up) submittal sheets to the Contractor. Shop drawing review notations will be returned on the reproducible original shop drawing. All other submitted items will be retained. The Contractor is responsible for producing additional copies for his/her own use.
4. The returned submittal will be marked in one of three ways as defined below:
 - a. **APPROVED:** Acceptable with no corrections.
 - b. **APPROVED WITH NOTATIONS:** Minor corrections or clarifications required. All comments are clear and no further review is required. The Contractor shall address all review comments when proceeding with the work.
 - c. **DISAPPROVED - RESUBMIT:** Rejected as not in accordance with the contract or as requiring major corrections or clarifications. The Contracting Officer will identify the reasons for disapproval. The Contractor shall revise and resubmit with changes clearly identified.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION NOT USED.

END OF SECTION

TRANSMITTAL - NATIONAL PARK SERVICE

Transmittal No.:
Sheet: 1 of:

Park: _____ Project: _____ Contract No.: _____

Pkg. No.: _____ Date: _____

Contractor: _____ Subcontractor/Supplier: _____

NPS ACTION

Item No.	Specification Section No.	Paragraph No.	Description of Item (Size, Type, Name, Manufacturer, Use, Etc.)	No. of Copies Submitted	No. of Copies Returned	Approved	Approved with Notations	Disapproved - Resubmit

Contractor Signature _____ Recommended by _____

Title, Date _____ Title _____ Date _____

I hereby certify that this submittal has been reviewed for accuracy, completeness, and compliance with contract requirements (FAR 52.236-21)

Review Comments _____ Action By _____ Date _____

Contracting Officer's Representative

Approval of this submittal is subject to the provisions of the contract drawings and specifications. This action is for general concurrence only and the Government is not responsible for errors or omission.

SUBMITTAL LOG DATES: From contractor [____], To reviewer [____], From reviewer [____], To Contractor [____]

Distribution: () Contractor () DSC File () COR () A/E () DSC Interim () COR Interim () Contractor Interim

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TRANSMITTAL CONTINUATION - NATIONAL PARK SERVICE

Transmittal No.:

Sheet: 1 of:

Park: _____ Project: _____ Contract No.: _____

Pkg. No.: _____

Date: _____

Contractor: _____

Subcontractor/Supplier: _____

NPS ACTION

Item No.	Specification Section No.	Paragraph No.	Description of Item (Size, Type, Name, Manufacturer, Use, Etc.)	No. of Copies Submitted	No. of Copies Returned	Approved	Approved with Notations	Disapproved - Resubmit

Review Comments

SECTION 01350

ARCHEOLOGICAL PROTECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of protecting petroglyphs carved into the lava rock surface, and any other archeological resources contained in soil deposits.

1.2 DEFINITIONS

- A. Resources: Prehistoric, historic, and recent 20th century artifacts, including charcoal, human bones, ash, fire rocks, and building materials that indicate the presence of past human occupation.
- B. Archeologically Sensitive Areas: Areas that have been determined to contain significant in-the-ground archeological resources.
- C. Nonsensitive Areas: Areas that have a low likelihood of containing significant in-the-ground archeological resources.
- D. Archeological Monitor: Representative of the Government designated to record and collect cultural resources for compliance with Government regulations to protect in-the-ground resources.

1.3 SUBMITTALS

- A. 30 days before start of ground-disturbing site work, submit a Daily Work Schedule, detailing construction work in archeologically sensitive areas. Key schedule to drawings and include the following information.
 - 1. Starting and ending dates of ground-disturbing construction.
 - 2. Locations of temporary facilities, such as barriers, field offices, staging areas, sanitary facilities, borrow pits, and haul and access roads.
 - 3. Types of construction, such as clearing, topsoil stripping, structure or trench excavation, landscaping, and post construction clean-up.
 - 4. Methods and equipment used for each type of construction.
 - 5. Plan for relocating work in the event of temporary work stoppages at each archeologically sensitive area.
- B. In consultation with the Park administration, propose a method for the protection of archeological resources for approval by the Park before any site work begins.

1.4 QUALITY ASSURANCE

- A. At least one week before on-site work begins, Contractor shall meet with Contracting Officer and Archeological Monitor to discuss Daily Work Schedule and equipment and special methods to be

used in archeologically sensitive areas. Contractor shall ensure that approved Daily Work Schedule is followed throughout construction.

- B. At least one week before on-site work begins, Contractor shall meet with NPS representative on-site to identify all petroglyphs within 100 feet of any site work area. Contractor shall take precautions necessary to ensure that petroglyphs are protected, by the NPS-approved method, from construction work.

PART 2 PRODUCTS

2.1 BARRICADES

- A. Section 01560.

PART 3 EXECUTION

3.1 BARRICADES

- A. Construct as specified in Section 01560. Locate as directed by Contracting Officer.

3.2 OBSERVATION

- A. Archeological Monitor will observe all ground-disturbing site work, including construction of temporary facilities, at all archeologically sensitive areas, from a safe location mutually agreed on by Contractor and Monitor. As new ground is broken, Monitor will examine excavated materials, using construction layout centerline and perimeter staking as a reference point to record locations of findings.

3.3 DISCOVERY OF RESOURCES

- A. If Archeological Monitor discovers resources, immediate relocation of the work to a nonsensitive area may be required to allow Monitor to take soil samples and record resources. While Archeological Monitor is documenting resources in sensitive areas, Contractor shall relocate work to nonsensitive areas where monitoring is not normally required.
- B. If resources are discovered while Archeological Monitor is absent, stop work immediately and report the discovery to the Contracting Officer.

3.4 WORK STOPPAGE

- A. The Contractor shall plan, schedule, and execute the work to prevent stoppages at one area from stopping all work at the construction site.

END OF SECTION

SECTION 01360

ACCIDENT PREVENTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of establishing an effective accident prevention program and providing a safe environment for all personnel and visitors.

1.2 SUBMITTALS

- A. Accident Prevention Program: Before on-site work begins, submit for approval an accident prevention program. The Contracting Officer will review the proposed program for compliance with OSHA and project requirements. If the program requires any revisions or corrections, the Contractor shall resubmit the program within 10 days. No progress payments will be made until the program is approved. The program shall include:
 - 1. Name of responsible supervisor to carry out the program.
 - 2. Weekly and monthly safety meetings.
 - 3. First aid procedures.
 - 4. Outline of each phase of the work, the hazards associated with each major phase, and the methods proposed to ensure property protection and safety of the public, National Park Service personnel, and Contractor's employees. Identify the work included under each phase by reference to specification section or division numbers.
 - 5. Training, both initial and continuing.
 - 6. Planning for possible emergency situations, such as floods, fires, cave-ins, slides, explosions, power outages, and wind storms. Such planning shall take into consideration the nature of construction, site conditions, and degree of exposure of persons and property.
 - 7. Housekeeping: Section 01570.
 - 8. Fire Protection: Section 01510.
- B. Certificates: Provide certificates from a mechanic that all mechanical equipment has been inspected and meets OSHA requirements.
- C. Submit a copy of test reports, as required by OSHA, for personnel working with hazardous materials.
- D. Submit a report of safety meetings and of inspections.
- E. Upon request, submit proof of employees' qualifications to perform assigned duties in a safe manner.

1.3 QUALITY ASSURANCE

- A. Clauses entitled "Accident Prevention" and "Permits and Responsibilities" of the contract. In case of conflicts between Federal, state, and local safety and health requirements, the most stringent shall apply. Equipment or tools not meeting OSHA requirements will not be allowed on the project sites. Failure to comply with the requirements of this section and related sections may result in suspension of work.
- B. Qualifications of Employees:
 - 1. Ensure that employees are physically qualified to perform their assigned duties in a safe manner.
 - 2. Do not allow employees to work whose ability or alertness is impaired because of drugs, fatigue, illness, intoxication, or other conditions that may expose themselves or others to injury.
 - 3. Operators of vehicles, mobile equipment, hoisting equipment, and hazardous plant equipment shall be able to understand signs, signals, and operating instructions, and be capable of operating such equipment. Provide operating instructions for all equipment. Newly hired operators shall be individually tested by an experienced operator or supervisor to determine if they are capable of safely operating equipment.

1.4 ACCIDENT REPORTING

- A. Reportable Accidents: A reportable accident is defined as death, occupational disease, traumatic injury to employees or the public, property damage by accident in excess of \$100, and fires. Notify Contracting Officer immediately in the event of a reportable accident. Within 7 days of a reportable accident, fill out and forward to Contracting Officer an Accident/Property Damage Report (Form CM-22). Form may be obtained from the Contracting Officer.
- B. All Other Accidents: The Contractor shall report all other accidents to the Contracting Officer as soon as possible and assist the Contracting Officer and other officials as required in the investigation of the accident.

PART 2 PRODUCTS

2.1 FIRST AID FACILITIES

- A. Provide adequate facilities for the number of employees and the type of construction at the site.

2.2 PERSONNEL PROTECTIVE EQUIPMENT

- A. Meet requirements of NIOSH and MSHA.

2.3 BARRIERS

- A. Section 01560.

PART 3 EXECUTION

2.4 EMERGENCY INSTRUCTIONS

- A. Post telephone numbers and reporting instructions for ambulance, physician, hospital, fire department, and police in conspicuous locations at the work site.

2.5 FIRE AND LIFE SAFETY

- A. Provide and maintain the fire and life safety requirements in NFPA 241 (Standard for Safeguarding Construction, Alteration, and Demolition Operations).
- B. Contractor shall have a Hazard Communications Plan; store hazardous materials in accordance with manufacturer's and OSHA recommendations; immediately report all spills of hazardous materials to the park; and maintain a spill emergency response kit.

2.6 PROTECTIVE EQUIPMENT

- A. Inspect personal protective equipment daily and maintain in a serviceable condition. Clean, sanitize, and repair, as appropriate, personal items before issuing them to another individual.
- B. Inspect and maintain other protective equipment and devices before use and on a periodic basis to ensure safe operation.

2.7 SAFETY MEETINGS

- A. As a minimum, conduct weekly 15-minute "toolbox" safety meetings. These meetings shall be conducted by a foreman and attended by all construction personnel at the worksite.
- B. Conduct monthly safety meetings for all levels of supervision. Notify the Contracting Officer of meeting dates and times. These meetings shall be used to review the effectiveness of the Contractor's safety effort, to resolve current health and safety problems, to provide a forum for planning safe construction activities, and for updating the accident prevention program. The Contracting Officer will attend the meeting and enter the results of the meetings into the daily log.

2.8 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

- A. A hard hat area will be designated by the Contracting Officer. The hard hat area shall be posted by the Contractor in a manner satisfactory to the Contracting Officer.
- B. It is the Contractor's responsibility to require all those working on or visiting the site to wear hard hats and other necessary protective equipment at all times. As a minimum, provide six hard hats for use by visitors. Change liners before reissuing hats.

2.9 TRAINING

- A. First Aid: Provide adequate training to ensure prompt and efficient first aid.
- B. Hazardous Material: Train and instruct each employee exposed to hazardous material in safe and approved methods of handling and storage. Hazardous materials are defined as explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful substances that could cause death or injury.

END OF SECTION

SECTION 01420

REFERENCE STANDARDS

PART 1 GENERAL

1.1 The following abbreviations, which may be used in the construction specifications, refer to the organizations and specifications of the organizations listed below:

AA	Aluminum Association 900 19th Street, NW, Suite 300 Washington, D.C. 20006-2168
AABC	Associated Air Balance Council 1518 K Street, NW, Suite 503 Washington, D.C. 20005
AAMA	American Architectural Manufacturers Association 1827 Walden Office Square, Suite 104 Schaumburg, Illinois 60173-4268
AAN	see ANLA
ABA- ADA	Americans With Disabilities Act Accesibility Guidelines U.S. Government Printing Office 732 N. Capitol Street, NW Washington, DC 20401
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, Michigan 48333-9094
ADC	Air Diffusion Council 11 South LaSalle Street, Suite 1400 Chicago, Illinois 60603
AFPA	American Forest and Paper Association 1111 19th Street, NW, Suite 800 Washington, D.C. 20036
AGA	American Gas Association 1515 Wilson Boulevard Arlington, Virginia 22209
AHA	American Hardboard Association 1210 W. Northwest Highway Palatine, Illinois 60067-1897
AHAM	Association of Home Appliance Manufacturers 20 N. Wacker Drive, Suite 1500 Chicago, Illinois 60606
AISC	American Institute of Steel Construction 1 East Wacker Drive, Suite 3100 Chicago, Illinois 60601-2001
AISI	American Iron and Steel Institute 1101 17th Street, NW Washington, D.C. 20036-4700

- AITC American Institute of Timber Construction
7012 S. Revere Parkway, Suite 140
Englewood, Colorado 80112
- ALSC American Lumber Standards Committee
P.O. Box 210
Germantown, Maryland 20875
- AMCA Air Movement and Control Association International, Inc.
30 W. University Drive
Arlington Heights, Illinois 60004-1893
- ANLA American Nursery and Landscape Association
1250 I Street, NW, Suite 500
Washington, D.C. 20005
- ANSI American National Standards Institute
11 West 42nd Street, 13th Floor
New York, New York 10036
- APA American Plywood Association (See EWA)
- ARI Air-Conditioning and Refrigeration Institute
4301 Fairfax Drive, Suite 425
Arlington, Virginia 22203
- ARMA Asphalt Roofing Manufacturers Association
Center Park, 4041 Powder Mill Road, Suite 404
Calverton, Maryland 20705
- ASC Adhesive and Sealant Council
1627 K Street, NW, Suite 1000
Washington, D.C. 20006-1707
- ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers
1791 Tullie Circle, NE
Atlanta, Georgia 30329-2305
- ASME American Society of Mechanical Engineers
345 East 47th Street
New York, New York 10017
- ASPE American Society of Plumbing Engineers
3617 Thousand Oaks Boulevard, Suite 210
Westlake, California 91362-3649
- ASSE American Society of Sanitary Engineering
28901 Clemens Road, Suite 100
Westlake, Ohio 44145
- ASTM American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken, Pennsylvania 19428-2959
- AWI Architectural Woodwork Institute
1952 Isaac Newton Square
Reston, Virginia 20190
- AWPA American Wood-Preservers' Association
3246 Fall Creek Highway, Suite 1900
Granbury, Texas 76049-7979

AWPI American Wood Preservers Institute
1945 Old Gallows Road, Suite 550
Vienna, Virginia 22182

AWS American Welding Society, Inc.
550 NW LeJeune Road
Miami, Florida 33126

AWWA American Water Works Association
6666 W. Quincy Avenue
Denver, Colorado 80235

BHMA Builders Hardware Manufacturers Association, Inc.
355 Lexington Avenue, 17th Floor
New York, New York 10017-6603

BOCA Building Officials Code Administrators
4051 W. Flossmoor Road
Country Club Hills, Illinois 60478-5795

CBM Certified Ballast Manufacturers
1422 Euclid Avenue, Suite 402
Cleveland, Ohio 44115-2851

CDA Copper Development Association, Inc.
260 Madison Avenue, 16th Floor
New York, New York 10016-2401

CE Corps of Engineers
20 Massachusetts Avenue, NW
Washington, D.C. 20314

CID Commercial Item Description
See contract clauses

CISPI Cast Iron Soil Pipe Institute
5959 Shallowford Road, Suite 419
Chattanooga, Tennessee 37421

CLFMI Chain Link Fence Manufacturers Institute
9891 Broken Land Parkway, Suite 300
Columbia, Maryland 21046

CRA California Redwood Association
405 Enfrente Drive, Suite 200
Novato, California 94949

CRI Carpet and Rug Institute
310 S. Holiday Avenue
Dalton, Georgia 30722-2048

CRSI Concrete Reinforcing Steel Institute
933 N. Plum Grove Road
Schaumburg, Illinois 60173-4758

CS Commercial Standard of NBS
(U.S. Department of Commerce)
Government Printing Office
Washington, D.C. 20402

DHI Door and Hardware Institute
14170 Newbrook Drive
Chantilly, Virginia 22021-2223

EPA Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460

EWA APA- The Engineered Wood Association
P.O. Box 11700
Tacoma, Washington 98411-0700

FHVA Fine Hardwood Veneer Association
260 S. First Street, Suite 2
Zionsville, Indiana 46077

FM Factory Mutual System
1151 Boston-Providence Turnpike
P.O. Box 9102
Norwood, Massachusetts 02062-9102

FS Federal Specifications
See contract clauses

GA Gypsum Association
810 First Street, NE, Suite 510
Washington, D.C. 20002

GANA Glass Association of North America
3310 SW Harrison Street
Topeka, Kansas 66611-2279

HMA Hardwood Manufacturers Association
400 Penn Center Boulevard, Suite 530
Pittsburgh, Pennsylvania 15235-5605

HPMA Hardwood Plywood Manufacturers Association
P.O. Box 2789
Reston, Virginia 22090-2789

IA Irrigation Association
1911 N. Fort Myer Drive, Suite 1009
Arlington, Virginia 22209-1630

ICBO International Conference of Building Officials
5360 S. Workman Mill Road
Whittier, California 90601

ICEA Insulated Cable Engineers Association, Inc.
P.O. Box 440
South Yarmouth, Massachusetts 02664

IEEE The Institute of Electrical and Electronics Engineers
345 E. 47th Street
New York, New York 10017-2394

IES Illuminating Engineering Society of North America
120 Wall Street, 17th Floor
New York, New York 10005-4001

IGCC See ITS

ITS Internek Testing Services
3393 Route 11
P.O. Box 2040
Cortland, New York 13045-7902

KCMA Kitchen Cabinet Manufacturers Association
1899 Preston White Drive
Reston, Virginia 22091-4326

LIA Lead Industries Association, Inc.
295 Madison Avenue
New York, New York 10017

MIMA Mineral Insulation Manufacturers Association
1420 King Street
Alexandria, Virginia 22314

MLSFA Metal Lath/Steel Framing Association - A Division of NAAMM
8 South Michigan Avenue, Suite 1000
Chicago, Illinois 60603

MSS Manufacturers Standardization Society of the Valve and Fittings Industry
127 Park Street, NE
Vienna, Virginia 22180-4602

NAAMM The National Association of Architectural Metal Manufacturers
8 South Michigan Avenue, Suite 1000
Chicago, Illinois 60603

NACE National Association of Corrosion Engineers
1440 South Creek Drive
P.O. Box 218340
Houston, Texas 77218-8340

NAIMA North American Insulation Manufacturers Association
44 Canal Center Plaza, Suite 310
Alexandria, Virginia 22314

NAPCA National Association of Pipe Coating Applicators
8th Floor, Commercial National Bank Building
333 Texas Street, Suite 800
Shreveport, Louisiana 71101-3673

NBS National Bureau of Standards
(U.S. Department of Commerce)(See NIST)

NCMA National Concrete Masonry Association
2302 Horse Pen Road
Herndon, Virginia 20171-3499

NEC National Electrical Code (by NFPA)

NECA National Electrical Contractors Association
3 Bethesda Metro Center, Suite 1100
Bethesda, Maryland 20814

NELM Northeastern Lumber Manufacturers' Association
272 Tuttle Road
P.O. Box 87A
Cumberland Center, Maine 04021-0687

- NEMA National Electrical Manufacturers Association
1300 N. 17th Street, Suite 1847
Rosslyn, Virginia 22209
- NFPA National Fire Protection Association
1 Batterymarch Park
P.O. Box 9101
Quincy, Massachusetts 02269-9101
- NHLA National Hardwood Lumber Association
P.O. Box 34518
Memphis, Tennessee 38184-0518
- NHPMA Northern Hardwood and Pine Manufacturers Association, Inc.,
c/o Northern Softwood Lumber Bureau
Box 217
Dear River, Minnesota 56636
- NIOSH National Institute for Occupational Safety and Health
NIOSH Building 1, Room 3007
1600 Clifton Road, NE
Atlanta, Georgia 30333
- NIST National Institute of Standards and Technology
(US Department of Commerce)
Building 101, #A1134
Route I-270 and Quince Orchard Road
Gaithersburg, Maryland 20899
- Send requests for publications to:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402
- NPA National Particleboard Association
18928 Premiere Court
Gaithersburg, Maryland 20879-1569
- NRCA National Roofing Contractors Association
O'Hare International Center
10255 W. Higgins Road, Suite 600
Rosemont, Illinois 60018-5607
- NSF NSF International
(Formerly National Sanitation Foundation)
3475 Plymouth Road
P.O. Box 130140
Ann Arbor, Michigan 48113-0140
- NTMA The National Terrazzo and Mosaic Association
3166 Des Plaines Avenue, Suite 121
Des Plaines, Illinois 60018
- NWWDA National Wood Window and Door Association
1400 East Touhy Avenue, Suite G-54
Des Plaines, Illinois 60018

OSHA	Occupational Safety and Health Administration U.S. Department of Labor 200 Constitution Avenue, NW Washington, D.C. 20210
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, Illinois 60077-1083
PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Boulevard Chicago, Illinois 60604
PDI	Plumbing and Drainage Institute 45 Briston Drive, Suite 101 South Euston, Massachusetts 02375
PEI	Porcelain Enamel Institute, Inc. 4004 Hillsboro Pike, Suite 224-B Nashville, Tennessee 37215
PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, D.C. 20402
RFCI	Resilient Floor Covering Institute 966 Hungerford Drive, Suite 12-B Rockville, Maryland 20850-1714
RIS	Redwood Inspection Service (Grading Rules) 405 Enfrente Drive, Suite 200 Novato, California 94949
SDI	Steel Door Institute 30200 Detroit Road Cleveland, Ohio 44145-1967
SFPA	Southern Forest Products Association P.O. Box 52468 New Orleans, Louisiana 70152
SGCC	See ITS
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Avenue Chicago, Illinois 60611-4267
SMACNA	Sheet Metal and Air-Conditioning Contractors' National Association, Inc. 4201 Lafayette Center Drive P.O. Box 221230 Chantilly, Virginia 20151-1209
SPIB	Southern Pine Inspection Bureau (Grading Rules) 4709 Scenic Highway Pensacola, Florida 32504-9094
SSPC	Steel Structures Painting Council 40 24th Street, 6th Floor Pittsburgh, Pennsylvania 15222-4643
TIMA	Thermal Insulation Manufacturers Association (See NAIMA)

TPI Truss Plate Institute
583 D'Onofrio Drive, Suite 200
Madison, Wisconsin 53719

UBC Uniform Building Code (by ICBO)

UL Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, Illinois 60062

USDA U.S. Department of Agriculture
14th Street and Independence Avenue, SW
Washington, D.C. 20250

WCLB West Coast Lumber Inspection Bureau (Grading Rules)
P.O. Box 23145
Portland, Oregon 97281-3145

WIC Woodwork Institute of California
P.O. Box 980247
West Sacramento, California 95798-0247

WMMPA Wood Moulding and Millwork Producers Association
507 First Street
Woodland, California 95695

WRI Wire Reinforcement Institute, Inc.
203 Loudoun Street, SW
Leesburg, Virginia 20175-2718

WSFI Wood and Synthetic Flooring Institute (See MFMA)

WWPA Western Wood Products Association (Grading Rules)
Yeon Building
522 SW 5th Avenue
Portland, Oregon 97204-2122

WWPA Woven Wire Products Association
2515 Nordica Avenue
Chicago, Illinois 60635

WWPI Western Wood Preservers Institute
7017 NE Highway 99 #108
Vancouver, Washington 98665

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 01430

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of preparing and executing a quality control program.

1.2 RELATED REQUIREMENTS

- A. "Inspection of Construction" clause of the contract.

1.3 SUBMITTALS

- A. Quality Control Plan:

1. At the time of the preconstruction conference, submit for approval a written Contractor Quality Control (CQC) plan.
2. If the plan requires any revisions or corrections, the Contractor shall resubmit the plan within 10 days.
3. The Government reserves the right to require changes in the plan during the contract period as necessary to obtain the quality specified.
4. No change in the approved plan may be made without written concurrence by the Contracting Officer.
5. The plan shall include:
 - a. A list of personnel responsible for quality control and assigned duties. Include each person's qualifications.
 - b. A copy of a letter of direction to the Contractor's Quality Control Supervisor outlining assigned duties.
 - c. Names, qualifications, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms.
 - d. Methods of performing, documenting, and enforcing quality control of all work.
 - e. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.

- B. Contractor's Quality Control Daily Reports: Submit showing all inspections and tests on the first workday following the date covered by the report.

- C. Test Reports:

1. Submit Daily Test Information Sheets with Quality Control Daily Reports.

2. Submit failing test results and proposed remedial actions within four hours of noted deficiency.
 3. Submit three copies of complete test results not later than three calendar days after the test was performed.
- D. Off-Site Inspection Reports: Submit prior to shipment.
- E. If the CQC plan and Quality Control Daily Reports are not submitted as specified, the Contracting Officer may retain all payments until such time a plan is approved and implemented.

1.4 QUALITY ASSURANCE

A. General:

1. The quality of all work shall be the responsibility of the Contractor. Testing shall be the responsibility of an independent testing laboratory
2. Inspect and test all work often enough to ensure that the quality of materials, workmanship, construction, finish, and functional performance is in compliance with applicable specifications and drawings.
3. Quality Control Daily Reports shall be completed by the Quality Control Supervisor.
4. Test reports shall be completed by person performing the test.
5. The Contracting Officer may designate locations of tests.

B. Quality Control Staff:

1. The Contractor's Quality Control Supervisor shall be assigned no other duties.
2. The Contractor's designated Quality Control Supervisor shall be on the project site whenever contract work is in progress.
3. The Contractor's job supervisory staff may be used to assist the Quality Control Supervisor, supplemented as necessary by additional certified testing technicians.

C. Testing Laboratory and Equipment:

1. Employ certified independent laboratories to perform sampling and testing. The testing laboratory organization shall be certified for the type of testing work to be done.
2. All measuring devices, laboratory equipment, and instruments shall be calibrated at established intervals against certified standards in accordance with NBS requirements. Upon request, measuring and testing devices shall be made available for use by the Government for verification tests.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION

3.1 OFF-SITE CONTROL

- A. Items that are fabricated or assembled off-site shall be inspected for quality control at the place of fabrication.

3.2 ON-SITE CONTROL

- A. Notification:

- 1. Notify the Contracting Officer at least 48 hours in advance of the preparatory phase meeting.
- 2. Notify the Contracting Officer at least 24 hours in advance of the initial and follow-up phases.

- B. Preparatory Phase: Perform before beginning each feature of work.

- 1. Review control submittal requirements with personnel directly responsible for the quality control work.
- 2. Review all applicable specifications sections and drawings related to the feature of work.
- 3. Ensure that copies of all referenced standards related to sampling, testing, and execution for the feature of work are available on site.
- 4. Ensure that provisions have been made for field control testing.
- 5. Examine the work area to ensure that all preliminary work has been completed.
- 6. Verify all field dimensions and advise the Contracting Officer of discrepancies with contract documents.
- 7. Ensure that necessary equipment and materials are at the project site and that they comply with approved shop drawings and submittals.
- 8. Prepare a report on all preparatory phase activities and discussions. Attach report to Contractor's Quality Control Daily Report.

- C. Initial Phase:

- 1. As soon as work begins, inspect and test a representative portion of a particular feature of work for quality of workmanship.
- 2. Review control testing procedures to ensure compliance with contract requirements.
- 3. Prepare a report on all initial phase activities and discussions. Attach report to Contractor's Quality Control Daily Report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

- D. Follow-Up Phase: Inspect and test as work progresses to ensure compliance with contract requirements until completion of work.

- E. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be required on the same feature of work for the following reasons:
 - 1. Quality of on-going work is unacceptable.
 - 2. Changes occur in the applicable quality control staff, on-site production supervision, or work crew.
 - 3. Work on a particular feature of work is resumed after a substantial period of inactivity.

3.3 DOCUMENTATION

- A. Maintain Quality Control weekly Reports and Test Report Information.

3.4 ENFORCEMENT

- A. The Contractor shall stop work on any item or feature pending satisfactory correction of any deficiency noted by the the Contracting Officer.

END OF SECTION

CONTRACTOR'S QUALITY CONTROL DAILY REPORT

REPORT NO. _____ SHEET 1 OF _____

PROJECT		CONTRACT NO.		DATE		
PARK		CONTRACTOR'S REPRESENTATIVE ON THE JOB				
WEATHER (Rain, Snow, Cloudy, Windy, etc.)	RAINFALL Inches	TEMPERATURE MAX. MIN.		GROUND CONDITIONS (Dry, Damp, Wet, Frozen, etc.)		
1. PRIME CONTRACTOR						
NO. EMPLOYEES BY JOB CATEGORIES	Hours	HEAVY EQUIPMENT ON JOB	NO. UNITS	HRS. WORKING		
				YES	NO	Comments
WORK PERFORMED BY PRIME CONTRACTOR:						
MATERIALS DELIVERED			OFFICIAL VISITORS TO SITE			
2A. SUBCONTRACTOR, _____: (If more than one subcontractor use copies of following page.)						
NO. EMPLOYEES BY JOB CATEGORIES	Hours	HEAVY EQUIPMENT ON JOB	NO. UNITS	HRS. WORKING		
				YES	NO	Comments
WORK PERFORMED BY SUBCONTRACTOR:						
3. SPECIFIC INSPECTIONS: (Inspections performed, results, and corrective actions)						
4. TESTING: <input type="checkbox"/> Check if any testing was performed today. (Complete and attach Test Report Information Sheets.)						
Type and Location of Testing: _____						
5. VERBAL INSTRUCTION RECEIVED FROM GOVERNMENT ON CONSTRUCTION DEFICIENCIES OR RE-TESTING REQUIRED:						
6. REMARKS:						
7. CERTIFICATION:						
I certify that the above report is complete and correct and that I, or my authorized representative, have inspected all work performed this day by the prime contractor and each subcontractor and determined that all materials, equipment, and workmanship are in strict compliance with the plans and specifications except as may be noted above. _____						
						Contractor's Quality Control Representative

SUBCONTRACTOR WORK CONTINUED:

CONTRACT NO.

REPORT NO. _____
SHEET ____ OF ____

2 SUBCONTRACTOR,

NO. EMPLOYEES BY JOB CATEGORIES	Hours	HEAVY EQUIPMENT ON JOB	NO. UNITS	HRS. WORKING		
				YES	NO	Comments

WORK PERFORMED BY SUBCONTRACTOR:

2 SUBCONTRACTOR,

NO. EMPLOYEES BY JOB CATEGORIES	Hours	HEAVY EQUIPMENT ON JOB	NO. UNITS	HRS. WORKING		
				YES	NO	Comments

WORK PERFORMED BY SUBCONTRACTOR:

2 SUBCONTRACTOR,

NO. EMPLOYEES BY JOB CATEGORIES	Hours	HEAVY EQUIPMENT ON JOB	NO. UNITS	HRS. WORKING		
				YES	NO	Comments

WORK PERFORMED BY SUBCONTRACTOR:

2 SUBCONTRACTOR,

NO. EMPLOYEES BY JOB CATEGORIES	Hours	HEAVY EQUIPMENT ON JOB	NO. UNITS	HRS. WORKING		
				YES	NO	COMMENTS

WORK PERFORMED BY SUBCONTRACTOR:

DAILY TEST REPORT INFORMATION SHEET

CONTRACT NO. _____

REPORT NO. _____
SHEET _____ OF _____

1. Individual Making Inspection or Test: _____	
2. Testing Laboratory; Name: _____	Phone #: _____
Address: _____ _____	
3. Description of Work and Test Method: _____ _____ _____	
4. Location of Samples and Tests or Inspections: _____ _____	
5. Specification Section: _____	
6. Inspection or Test Data: _____ _____ _____	
7. Test Results and Interpretations of Test Results: _____ _____ _____	
8. Comments or Professional Opinion About Compliance of Inspected Work or Tested Work with contract Document Requirements: _____ _____ _____	
9. Recommendations: _____ _____ _____	
10. Corrective Actions Taken: _____ _____ _____	

CERTIFICATION:

I certify that the above testing report is complete and correct and that all testing performed this day for this contract is in strict compliance with the plans and specifications except as noted above.

Signature of Inspector

SECTION 01510

TEMPORARY SERVICES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of providing temporary services required for Contractor's performance of the work of this contract.

1.2 RELATED REQUIREMENTS

- A. Section 01520 - Field Offices and Sheds.
- B. Section 01570 - Temporary Controls.

PART 2 PRODUCTS

2.1 GENERAL

- A. Temporary materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.2 SANITARY FACILITIES

- A. Provide and maintain temporary toilet facilities in accordance with State Health Department and National Park Service requirements.

2.3 FIRE PROTECTION EQUIPMENT

- A. Extinguisher shall have a minimum UL rating of 2-A:10-B:C.

2.4 CONSTRUCTION REFUSE AND DEBRIS:

- A. Contractor shall be allowed one 20 – cubic yard Dumpster for construction refuse and debris

2.5 CONSTRUCTION CAMP:

- A. No construction camps will be permitted within the Park Boundary

PART 3 EXECUTION

3.1 ELECTRICITY AND LIGHTING

- A. The cost of electricity shall be borne by the Park. Connections to existing utilities shall be at the Contractor's expense.
- B. Temporary Electrical: Temporary electrical work shall meet requirements of NFPA 70 (NEC), Article 305.

3.2 TELEPHONE

- A. No telephone service is available on site for Contractor's use. Make arrangements with telephone company and pay all costs. See Section 01520 for telephone for Contracting Officer's use.

3.3 WATER

- A. The cost of water shall be borne by the Park. Connections to existing utilities shall be at the Contractor's expense.
- B. Furnish cool, potable water for construction personnel in convenient location.

3.4 SANITARY FACILITIES

- A. Place in approved locations secluded from public observation and convenient to work stations. Relocate as work progress requires.
- B. Maintain and clean toilet facilities at least weekly.

3.5 FIRE PREVENTION AND PROTECTION

- A. **Responsible Person:** A capable and qualified person shall be placed in charge of fire protection. The responsibilities shall include locating and maintaining fire protective equipment and establishing and maintaining safe torch cutting and welding procedures.
- B. **Hazard Control:** Take all necessary precautions to prevent fire during construction. Do not store flammable or combustible liquids in buildings. Provide adequate ventilation during use of volatile or noxious substances.
- C. **Spark Arresters:**
 - 1. Written determinations of periods and areas of potential fire hazard will be issued by Contracting Officer.
 - 2. Equip all gasoline or diesel powered equipment used during periods of potential fire hazards or in potential forest and grass fire locations with spark arresters approved by the USDA Forest Service.
- D. **Service and Refueling Areas:** Locate areas a minimum of 50 feet from buildings. Shut down equipment before refueling.
- E. **Smoking:** Smoking within buildings or temporary storage sheds is prohibited.
- F. **Welding:** Cutting by torch or welding shall be performed only when adequate fire protection is provided. Check with park; many require "burn permits" for welding.

3.6 PROTECTION EQUIPMENT REQUIRED

A. Buildings:

1. Furnish a minimum of one extinguisher for each 1,500 square feet of area or major fraction thereof.
2. Travel distance from any work station to the nearest extinguisher shall not exceed 75 feet.

B. Vehicles and Equipment: Provide one extinguisher on each vehicle or piece of equipment.

3.7 REMOVAL

A. Completely remove temporary facilities on completion of work.

B. When temporary connections are removed, restore existing utility services to their original condition.

END OF SECTION

SECTION 01520

FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The requirements of this section consist of furnishing, locating, and removing temporary structures, equipment, and furnishings.

1.2 RELATED REQUIREMENTS

- A. Temporary services - Section 01510.

PART 2 PRODUCTS

2.1 CONTRACTING OFFICER'S FIELD OFFICE

- A. Not Required.

2.2 CONTRACTOR'S FIELD OFFICE

- A. Contractor may provide an office for his own use. Size, location, and construction shall be subject to approval.

2.3 STORAGE SHEDS

- A. Temporary weathertight sheds or other covered facilities for storage of materials subject to weather damage. Number and size of structures shall be subject to Contracting Officer's approval.

PART 3 EXECUTION

3.1 CONTRACTOR'S FIELD OFFICE

- A. Locate where directed by Contracting Officer, a minimum of 50 feet from permanent structures.

3.2 REMOVAL

- A. Remove structures, equipment, and furnishings, and terminate services after punch list is 100 percent completed or when directed by Contracting Officer.

END OF SECTION

SECTION 01560

BARRIERS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing, installing, and maintaining barriers to protect existing facilities and the public from construction operations.

PART 2 PRODUCTS

2.1 GENERAL

- A. Material may be new or used, but shall be suitable for intended purpose. Fences and barriers shall be structurally adequate and neat in appearance. Contact Park Administration prior to barrier installation for specific requirements and coordination.

2.2 FENCING

- A. Security Fence: Chain link, 2-inch mesh, minimum height, 6 feet.
- B. Safety Barrier Fence: Orange plastic fence, minimum height, 4 feet.

2.3 BARRICADES AND SIGNS

- A. Manual on Uniform Traffic Control Devices (MUTCD), Part VI, 2003 edition.

2.4 LUMBER

- A. Free of nails, large knot holes and splinters.

2.5 BARRIER TAPE

- A. Banner Guard, imprinted with "CAUTION: CONSTRUCTION AREA", manufactured by Reef Industries, Inc., Houston, Texas, or approved equal.

PART 3 EXECUTION

3.1 PROTECTION OF PUBLIC

- A. Fence, barricade, or otherwise block off the immediate work area to prevent unauthorized entry.
- B. Erect and maintain barricades, lights, danger signals, and warning signs in accordance with MUTCD-2003.
- C. Illuminate barricades and obstructions at night; keep safety lights burning from sunset to sunrise.
- D. Adequately barricade and post open cuts in or adjacent to thoroughfares.

- E. Protect pedestrian traffic by guardrails or fences.
- F. When pedestrian traffic is detoured onto a roadway, provide temporary walkways with protection as required at ends and overhead. For walkways, use lumber running parallel to direction of traffic movement and provide ramps at changes of elevation.
- G. Cover pipes, hoses, and power lines crossing sidewalks and walkways with troughs using beveled edge boards.
- H. Erect and maintain sufficient detour signs at road closures and along detour routes.

3.2 SECURITY FENCES

- A. Before starting work, install enclosure fence with locked entrance gates.
- B. Enclose the entire project site or, if approved by Contracting Officer, the area of construction.
- C. Locate vehicular gates to avoid interference with traffic on public thoroughfares.
- D. Locate pedestrian entrance gates as required to provide controlled personnel entry.

3.3 BARRIER TAPE

- A. Install where directed by Contracting Officer. Keep a minimum of two rolls on site at all times.

3.4 REMOVAL

- A. Completely remove barriers no longer needed when approved by Contracting Officer.

END OF SECTION

SECTION 01570

TEMPORARY CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of providing temporary controls.

1.2 SUBMITTALS

- A. Before beginning on-site work, submit a recycling plan which includes a list of materials that might be recycled during the course of the contract. This list should name the material, recycling methods, and/or proposed disposal location. This list is for information only. Recycling is strictly voluntary, but highly encouraged.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION

3.1 HOUSEKEEPING

- A. Keep project neat, orderly, and in a safe condition at all times.
- B. Provide enough containers for collecting construction debris and construction materials to be recycled.
- C. Provide individually marked containers for recycling personal items, such as aluminum cans, newspapers, glass, plastic, corrugated cardboard. These items may be recycled by the Contractor or turned over to the Park recycling committee.
- D. Wet down dry materials and rubbish to prevent blowing dust.
- E. Keep volatile wastes in covered containers.
- F. Utilize excavated material as soon as possible.

3.2 DISPOSAL

- A. Dispose of excess excavated material (including rocks and boulders) that cannot be used in construction inside the Park at the direction of the contracting officer.
- B. Unless otherwise specified, all removed material becomes the property of the Contractor and shall be disposed of outside the park.
- C. Immediately remove hazardous rubbish from project site. Place other construction debris in refuse containers at least daily. Dispose of refuse at least weekly, in a legal manner, at public or private dumping areas outside the park. Do not burn or bury refuse inside the park.

3.3 AIR AND WATER POLLUTION CONTROL

- A. Take all necessary reasonable measures to reduce air and water pollution by any material or equipment used during construction.
- B. Do not dispose of volatile wastes or oils in storm or sanitary drains.
- C. Do not allow waste materials to be washed into streams or bodies of water.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of the general procedures for handling, storing, and protecting material and equipment.

1.2 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of materials in accordance with construction schedules; coordinate to avoid conflict with work and conditions at the site. Deliver materials in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible. Contractor is encouraged to obtain materials in biodegradable or recyclable/reusable packaging which uses the minimum amount of packaging possible.

1.3 STORAGE AND PROTECTION

- A. Store materials in accordance with manufacturer's instructions, with seals and labels accessible for inspection.
- B. Interior Storage: Maintain temperature and humidity within the ranges required by manufacturer's instructions.
- C. Exterior Storage:
 - 1. Store products subject to damage by the elements in weathertight enclosures.
 - 2. Store fabricated products above the ground, on blocking or skids; prevent soiling or staining. Cover products subject to damage or deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
 - 3. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- D. Protection After Installation: Provide adequate coverings as necessary to protect installed materials from damage resulting from natural elements, traffic, and subsequent construction. Remove when no longer needed.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION NOT USED.

END OF SECTION

SECTION 01720

FIELD ENGINEERING

PART 1 GENERAL

1.1 LAYOUT OF WORK

- A. Contractor will set initial construction stakes establishing lines, slopes, and grades for road work, and reference and base lines and bench marks for bridges and accessory structures. Contractor shall execute the work in accordance with these stakes, and perform all additional staking necessary to execute the work.
- B. Contractor shall preserve controls thus established. Controls that are destroyed by Contractor will be replaced by the Contractor at his expense.
- C. Existing Monuments: All bench marks, land corners, and triangulation points, established by other surveys, existing within the construction area shall be preserved. If existing monuments interfere with the work, secure written permission before removing them.
- D. Locations and elevations shown on the drawings are subject to final field adjustment by Contracting Officer before construction. Contractor shall immediately notify the Contracting Officer of apparent errors discovered on the drawings or in the initial stakeout. If changes in stakeout are required, Contractor shall cooperate with Contracting Officer in prompt establishment of the field control for altered or adjusted work.

1.2 QUANTITY SURVEYS

- A. Quantity surveys shall be conducted, and the data derived from these surveys shall be used in computing the quantities of work performed and the actual construction completed and in place.
- B. The Contractor shall conduct the original and final surveys and surveys for any periods for which progress payments are requested. All these surveys shall be conducted under the direction of a representative of the Contracting Officer, unless the Contracting Officer waives this requirement in a specific instance. The Government shall make such computations as are necessary to determine the quantities of work performed or finally in place. The Contractor shall make the computations based on the surveys for any periods for which progress payments are requested.
- C. Promptly upon completing a survey, the Contractor shall furnish the originals of all field notes and all other records relating to the survey or to the layout of the work to the Contracting Officer, who shall use them as necessary to determine the amount of progress payments. The Contractor shall retain copies of all such material furnished to the Contracting Officer.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION NOT USED.

END OF SECTION

SECTION 01770

PROJECT CLOSEOUT

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of final cleanup, closeout submittals, and final inspection procedures.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

- A. As recommended by the manufacturer of surface to be cleaned.

2.2 POSTED OPERATING INSTRUCTIONS

- A. Frame instructions under nonglare glass or approved laminated plastic. In areas where operating instructions are subject to sunlight or moisture, provide weather-resisting materials.

PART 3 EXECUTION

3.1 POSTED OPERATING INSTRUCTIONS

- A. As specified in the individual sections. Furnish operating instructions attached to or posted adjacent to equipment. Include wiring diagrams, control diagrams, control sequence, start-up, adjustment, operation, lubrication, shut-down, safety precautions, procedures in the event of equipment failure, and other items of instruction recommended by the manufacturer.

3.2 CLEANING

- A. Before scheduling the final inspection, remove all tools, equipment, surplus materials, and rubbish. Restore or refinish surfaces that are damaged due to work of this contract to original condition. Remove grease, dirt, stains, foreign materials, and labels from finished surfaces. Thoroughly clean building interiors. Pick up all construction debris from the site. At time of final inspection, project shall be thoroughly clean and ready for use.

3.3 PROJECT RECORD DRAWINGS

- A. Maintain one complete full-size set of contract drawings and one full-size set of vendor-supplied drawings. Clearly mark changes, deletions, and additions using National Park Service drafting standards to show actual construction conditions. Show additions in red, deletions in green, and special instructions in blue.
- B. Keep record drawings current. Make record drawings available to the Contracting Officer for inspection at the time of monthly progress payment requests. If project record drawings are not current, the Contracting Officer may retain an appropriate amount of the progress payment.

- C. On completion of the total project, submit complete record drawings. Include all shop drawings, sketches, and additional drawings that are to be included in the final set, with clear instructions showing the location of these drawings.

3.4 CLOSEOUT SUBMITTALS

- A. Submit before final inspection request.
 - 1. Project Record Drawings: As specified above.
 - 2. Guarantees and Bonds: As specified in individual sections.
 - 3. Spare Parts and Materials: As specified in individual sections.
 - 4. Operation and Maintenance Data: As specified in individual sections and Section 01785.
 - 5. Keys and Keying Schedule: Submit all keys including duplicates. Wire all keys for each lock securely together. Tag and plainly mark with lock number, equipment identification, or panel or switch number, and indicate location, such as building and room name or number.
 - 6. Operating Tools: As specified in the individual sections.
 - 7. Special Tools: One set of special tools required to operate, adjust, dismantle, or repair equipment. Special tools are those not normally found in possession of mechanics or maintenance personnel.
 - 8. System Demonstration and Training: As specified in individual sections and Section 01815.
 - 9. Mechanical and Electrical Systems: Verify the following in writing:
 - a. All systems are complete.
 - b. All systems have been properly started and are operational.
 - c. All controls are complete and operational, and sequences have been checked and are functioning properly.
 - 10. Testing and Balancing Report: As specified in Section 15952.

3.5 SUBSTANTIAL COMPLETION AND FINAL INSPECTION

- A. When project, or designated portion of project, is substantially complete, request in writing a final inspection. Upon receipt of written request that project is substantially complete, the Contracting Officer will proceed with inspection within 10 days of receipt of request or will advise the Contractor of items that prevent the project from being designated as substantially complete.
- B. If, following final inspection, the work is determined to be substantially complete, Contracting Officer will prepare a list of deficiencies to be corrected before final acceptance and issue a Letter of Substantial Completion. Contractor shall complete the work described on the list of deficiencies within 30 calendar days, as weather permits. If the Contractor fails to complete the work within this time frame, the Contracting Officer may either replace or correct the work with

an appropriate reduction in the contract price or charge for reinspection costs in accordance with the Inspection of Construction clause of the contract..

- C. If, following final inspection, the work is not determined to be substantially complete, Contracting Officer will notify Contractor in writing. After completing work, Contractor shall request a new final inspection. All reinspection costs may be charged against the Contractor in accordance with the Inspection of Construction clause of the contract.

3.6 FINAL ACCEPTANCE OF THE WORK

- A. After all deficiencies have been corrected, a Letter of Final Acceptance will be issued.

END OF SECTION

SECTION 01785

SECTION 01785

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing operation and maintenance data manuals.

1.2 RELATED WORK

- A. Project Record Drawings - Section 01770.

1.3 SCHEDULING

- A. At start of project, begin accumulating operation and maintenance data and initiate an index. Install and index all data in binders within 30 days after delivery of items. As custom written data and test results are produced, add them to the operation and maintenance data file.
- B. Keep operation and maintenance data current. Make operation and maintenance binders available to the Contracting Officer for inspection at the time of monthly progress payment requests. If operation and maintenance binders are not current the Contracting Officer may retain an appropriate amount of the progress payment.
- C. Before scheduling a final inspection, furnish two complete sets of operation and maintenance data to Contracting Officer for review. Should Contracting Officer find manual to be substantially incomplete, the final inspection will be delayed.
- D. Within 30 days following receipt of review comments, deliver four completed sets of Operation and Maintenance data.

PART 2 PRODUCTS

2.1 BINDERS

- A. White, commercial quality, hard back, three-ring, 2-inch maximum ring size, lever-locking type slant ring, with clear window pockets on front and side. Cardinal Slant-D Ring, manufactured by Atapco Office Products Group, St. Louis, Missouri; View SlantRing, manufactured by E-Z-D Premiere View Binder, Torrance, California; or approved equal.

2.2 INDEX SYSTEM

- A. Index sheet with mylar reinforced edges at binder holes and tabbed divider sheets with mylar reinforced edges and pre-printed numbered tabs aligned with numbers and title lines on index sheet. Cardinal One-Step, manufactured by Atapco Office Products Group, St. Louis, Missouri; Avery Ready Index, manufactured by Avery Dennison, Covina, California; or approved equal.

PART 3 EXECUTION

3.1 FORM

- A. Provide four complete sets of data.
- B. Number multiple binder volumes consecutively.
- C. Cover Sheet: Identify the project title, location, park, contract number, prime contractor's name and address, date of substantial completion, and binder volume number. Insert cover sheet into clear plastic view pocket on front of binder. Insert sheet with project title and "Operation and Maintenance" into side clear plastic view pocket.
- D. Index System: Organize data into sections by common subjects and subsystems. Place a consecutively numbered tabbed divider sheet in front of each section. Place index sheet at the beginning of each binder, listing sections by subject name. If multiple binders are used, place a table of contents of all data provided behind the index sheet in each binder.
- E. Data: Fill binders to no more than 75 percent of capacity. Punch holes shall not obscure any data. Normal sheet size shall be 8-1/2 inches by 11 inches. Fold oversize sheets and insert them in 8-1/2 by 11-inch clear pocket sheet protectors placed in binders. When the contents of a single tabbed section covers more than one item, provide colored paper sheets to separate the data for each item.
 1. Manufacturers' Data: Provide originals for color or copyrighted data. Black and white data may be originals or clean, good quality reproductions. Where originals are printed on both sides of the page, reproductions shall also be printed on both sides of the page. Copies produced by facsimile transmission and sheets with stamps, such as submittal approval stamps, will not be acceptable. Include only sheets that apply to items installed; cross out inapplicable data.
 2. Vendor Furnished As-Built Drawings: Maximum 24-inch by 36-inch sheets with minimum character or lettering size of 1/8 inch. Reduced-size reproductions may be provided instead of full-size drawings if the reproductions are clear and legible. If reduced-size drawings are used, identify as "REDUCED SIZE" and provide graphic scales, if applicable.
 3. Custom Written Data: Typewritten text, supplemented by drawings and schematics necessary to describe systems adequately.
 4. Equipment Data Sheet: Typewritten data, using form at the end of this section.
 5. Schedules: Clean, typewritten schedules reflecting final, as-installed conditions. Hand-written mark-ups of schedules submitted earlier are not acceptable.
 6. Data that is poorly reproduced or in any way illegible will be rejected.

3.2 CONTENT

- A. Manufacturers' Published Data: Provide all available data, including installation and operating instructions, parts lists, electrical and mechanical schematics, control circuit documentation, performance data, safety instructions, cleaning and care instructions, and illustrations and instructions for maintenance, including lubrication, disassembly and repair, cleaning, and service. Indicate catalog numbers, sizes, colors, options, and other information pertaining to the products

furnished which would be required when ordering replacements. For equipment assemblies, provide data for each separate item of equipment furnished as part of the assembly.

- B. Custom Written Data: For data not in manufacturer's standard literature, provide text, drawings, and schematics specifically applicable to installed systems. Include step-by-step descriptions of operating procedures; identification of individual components and their functions; descriptions of how system components relate to one another and operate together to accomplish a common process or function; and sequence of operation for system control circuits. For seasonally operated systems, provide start-up and shutdown instructions.
- C. Equipment Data Sheets: For each item of equipment included in the operation and maintenance data, provide an Equipment Data Sheet using the form at the end of this section. For equipment consisting of both a driven machine and a driver (for example, a pump and a motor), the equipment data shall cover both the driven machine and the driver. For similar type equipment (for example, multiple exhaust fans of the same model and type), provide a single equipment data sheet with an attached schedule listing the individual equipment items.
- D. Vendor Furnished As-Built Drawings: Provide for each electrical and each mechanical control system.
 - 1. For each control system, provide control circuit schematic drawings. Identify each wire and terminal block number. Show terminal numbers on all control devices. Show control wires and devices remote from the control panel.
 - 2. For each control panel, provide a general arrangement drawing showing location of each control component and terminal block on the panel front and interior. Include a materials list of all panel-mounted control components as well as field-installed control components remote from the panel, identifying components, manufacturer, model number, and initial set points or sensing ranges of devices where applicable.
 - 3. For packaged equipment systems, provide general arrangement drawings showing interrelationships of the various items of equipment and components.
 - 4. In addition to the control wiring schematic, provide a power wiring schematic drawing showing the power flow to each motor. Identify each power conductor. Show all overcurrent protection and motor starting devices.
- E. Schedules: Provide one copy of material and equipment schedules, as listed in the individual sections, in the appropriate sections of the manual.
- F. Warranties: Place a copy of each manufacturer, supplier, and installer warranty extending for a period greater than one year in a single separately identified tabbed section of the manual.
- G. Test Results: Include in the operation and maintenance data copies of test results for mechanical and electrical equipment and systems as listed in the individual specification sections.
- H. Subcontractor and Supplier List: List all subcontractors and major suppliers who worked on the project. Include each subcontractor's or supplier's address and telephone number and identify work performed.

END OF SECTION

EQUIPMENT DATA SHEET

Equipment Item: _____ Designation: _____

Function: _____

Location: _____

Project: _____

Model No.: _____ Serial No.: _____

Manufacturer Address and Phone:

Supplier Address and Phone:

Preventive Maintenance Tasks:

✓

✓

✓

✓

Nameplate Data:

Spare Parts Furnished and Other Information:

SECTION 01815

SYSTEM DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of demonstrating systems and equipment to operating personnel. It also includes training of personnel.

1.2 COORDINATION

- A. Schedule demonstrations and training periods with Contracting Officer. Conduct training sessions after the equipment or system has been accepted and turned over to the Government.

1.3 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. For each training session, the Contractor shall submit for approval a proposed outline of the subjects to be covered. The training shall not be conducted until the outline is approved.

PART 2 PRODUCTS

PART 3 EXECUTION

2.1 TRAINING

- A. As specified herein and in individual sections, furnish the services of instructors to train designated personnel in adjustment, operation, including seasonal and emergency operations, if applicable, maintenance, and safety requirements of equipment and systems. Instructors shall be thoroughly trained in operating theory as well as practical operation and maintenance work for each type of equipment or system. The sequence of the training shall follow the approved training outline.
- B. Individual sections specify the duration of training required. If no duration is listed, provide training of sufficient duration to adequately cover the subjects. When more than four days of instruction are specified, use approximately one-half of the time for classroom and the other half for hands-on instruction with the equipment or system.
- C. Use Operating and Maintenance Data as a training guide.

END OF SECTION

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of clearing, grubbing, and removing and disposing of trees, vegetation, and debris.

PART 2 PRODUCTS

2.1 TREE PAINT

- A. Approved asphalt base paint prepared especially for tree surgery.

PART 3 EXECUTION

3.1 PROTECTION OF TREES AND PLANTS TO REMAIN

- A. Section 01110.

3.2 CLEARING

- A. Remove all trees, brush, and vegetation from areas designated to be cleared. As directed, trim low hanging, unsound, or unsightly branches on trees and shrubs designated to remain. Make cuts flush with trunk or branch. Paint cuts larger than 1/2 inch in diameter with tree paint.

3.3 GRUBBING

- A. Remove all stumps, roots, and debris a minimum of 4 inches below original ground. Use hand methods for grubbing inside drip line of trees to remain.

3.4 SALVAGE

- A. Cut trees and branches 4 inches in diameter and larger into 4 -foot log lengths and stockpile where directed by Contracting Officer.

3.5 DISPOSAL

- A. Dispose of debris and excess material as specified in Section 01570.

END OF SECTION

SECTION 02320

UTILITY TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of trenching and backfilling for the construction and installation of pipelines, conduits, and cables. All trenching will be open cut.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Written procedure for trench dewatering and disposal of fluidized materials removed.
- C. Written description of barricading, shoring, cribbing, bracing, and sloping precautions.

1.3 PROJECT CONDITIONS

- A. Obtain all required permits and licenses before installing utilities under existing roads, other than Park Service roads, and follow the rules and requirements of the authority having jurisdiction.
- B. Arrange construction sequences to provide the shortest practical time that the trenches will be open to avoid hazard to the public, and to minimize the possibility of trench collapse.

1.4 EXCAVATION CLASSIFICATION

- A. Regardless of the nature of material excavated, all excavation will be considered unclassified.

1.5 HAND EXCAVATION

- A. Contracting Officer will direct the performance of hand excavation within the drip line of selected trees shown on the drawings.

PART 2 PRODUCTS

2.1 GENERAL

- A. All backfill material shall be approved before use and be free of cinders, ashes, ice, frozen soil, large hard clods, organic debris, or other deleterious items. Trench excavation materials may be used as approved.

2.2 BACKFILL MATERIAL

- A. Materials used in backfill, as shown in trench details, are defined as follows:
 - 1. Bedding (BD): When rock, unstable material, or wet trench is encountered at the excavated grade for utility installation, bedding is required. Materials shall be predominantly sand and gravel, having a plasticity index less than 6. Bedding may be omitted if, in the opinion of the Contracting Officer, the excavated trench bottom will adequately support and not damage the utility line.
 - a. BD-1: Gradation as follows:

Sieve Size	Percent Passing
No. 4	100
No. 8	55- 85
No. 40	15- 30

b. BD-2: Gradation as follows:

Sieve Size	Percent Passing
1/2-inch	100
No. 4	50- 80
No. 40	10- 25

c. BD-3: Gradation as follows:

Sieve Size	Percent Passing
1-1/2-inch	100
1/2-inch	45- 75
No. 40	10- 25

2. Select Backfill (SB): Materials shall be predominantly sand and gravel, having a plasticity index less than 6.

a. SB-1: Gradation as follows:

Sieve Size	Percent Passing
No. 4	100
No. 8	55- 85
No. 40	15- 30

b. SB-2: Gradation as follows:

Sieve Size	Percent Passing
1/2-inch	100
No. 4	50- 80
No. 40	10- 25

c. SB-3: Gradation as follows:

Sieve Size	Percent Passing
3/4-inch	100

Sieve Size	Percent Passing
3/8-inch	55- 85
No. 40	10- 25

- d. SB-4: Gradation as follows:

Sieve Size	Percent Passing
1-1/2-inch	100
1/2-inch	45- 75
No. 40	10- 25

3. Backfill (BF):

- a. BF-1: Materials shall be predominantly sand and gravel, having a plasticity index less than 6, and graded as follows:

Sieve Size	Percent Passing
1-1/2-inch	100
1/2-inch	45- 75
No. 40	10- 25

- b. BF-2: Soils that contain no rock larger than 6 inches at greatest dimension. If expansive clays are present, such content shall not exceed one-third of the material by volume, and shall be well mixed with noncohesive soils.

- B. ASTM D422-63 shall be used for gradation analysis. ASTM D4318-95 shall be used for determination of plasticity index.
- C. Furnish required bedding, select backfill, and backfill materials listed under the appropriate types of utility line in the sections to which this work relates.

2.3 UTILITY LINE MARKING

- A. All utilities shall be marked for location and identified by marking tapes, as specified in Section 02502.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Testing required to determine compliance for the work of this section will be the responsibility of the Contractor, at no additional expense to the Government.
- B. ASTM D698-91 shall be used to determine maximum density and ASTM D1556-90 or ASTM D2922-96 shall be used to determine in-place density.

- C. The Contractor shall perform at least one test within each backfill material zone (BD, SB, BF) at the following maximum intervals. Testing at more frequent intervals may be required at the discretion of the Contracting Officer:
1. Vehicular Traffic Areas: 50 linear feet of trench.
 2. Pedestrian and Lawn Areas: 100 linear feet of trench.
 3. Nontraffic Areas: 200 linear feet of trench.

3.2 TRENCH EXCAVATION

- A. Trenching, General: Excavate the trench to the approximate level of the top of the utility line to be installed, using adequate trench width and side slopes to safely accommodate worker access. Continue excavating for the utility line, to a width not greater than is shown on the appropriate trench detail.
1. Rocky Trench Bottom: Where ledge rock, hard pan, boulders, or sharp-edged materials are encountered, over-excavate a minimum depth of 6 inches below the bottom of the utility exterior wall to permit adequate bedding preparation. The installed utility shall have at least 6 inches of clearance from any rock protrusion. Blasting shall be as specified in Section 02114.
 2. Unstable Trench Bottom: Secure approval of depth of over-excavation and stabilization method. For wet trench construction, use approved method of dewatering through diversion, damming and pumping, well points, or underdrain systems. Dispose of removed fluidized materials as approved. Use BD-3 material to build a suitable foundation to within 6 inches of finished utility grade, prior to bedding with the specified material. Compact layers to 95 percent of maximum density in not greater than 6-inch layers. Do not proceed with utility installation until wet trench and unstable conditions are under control.
 3. Hand Excavation: Perform hand excavation of trenches dug within the drip line of selected trees as shown. Carefully excavate around all roots 2 inches in diameter and larger to ensure against damage.
- B. Paved Areas: Cut existing pavement full depth to a true line before excavation, as shown, and maintain the edge suitable for repaving. Pavement removed shall not be used as backfill.
- C. Lawn Areas: Where trenches cross established lawn areas, remove turf with approved sod cutting equipment. Store and maintain the removed sod for later replacement. Cut to the lines shown or as directed.

3.3 SHORING AND SHEETING

- A. Construct and maintain all shoring, sheeting, and slope lay-back necessary to protect the excavation, as needed for the safety of the employees and as required by applicable State and Federal laws.
- B. For trenches over 5 feet deep, provide suitable barricades for worker protection. When work area is left open and unattended by Contractor, provide suitable barricades for public safety, regardless of trench depth.
- C. For trenches over 4 feet deep, provide suitable exit means in accordance with applicable provisions of OSHA.
- D. Do not remove timber or sheeting if it is in a compacted zone. Instead, trim it off at a safe level above that zone.
- E. As directed, remove all other sheeting and shoring when safe to do so.

3.4 BACKFILLING

- A. **Compaction:**
 - 1. Use vibratory compactors for sand and gravel (noncohesive soils).
 - 2. Use mechanical tampers for sand and gravel containing a significant portion of fine-grained material, such as silt and clay (cohesive soils).
 - 3. Hand tamp around pipe or cable to protect the lines until adequate cushion is attained.
 - 4. Puddling or water flooding for consolidation of backfill or compaction by wheel rolling with construction equipment will not be permitted.
- B. **Bedding:** Compact the specified material to 95 percent of maximum density, at a moisture content determined to be suitable for such density. Compaction shall be to the finished utility grade.
- C. **Utility Installation:** Shape the trench bottom to ensure uniform contact with the full length of the installed line and remove any sharp-edged materials that might damage the line. Compaction shall be maintained beneath the line.
- D. **Select Backfill:** Fill by hand placement around the utility to just over half depth, and compact in a manner to ensure against lateral or vertical displacement. Place select backfill to 12 inches above the utility line by hand placement in not more than 6-inch layers. Compact each layer to 95 percent of maximum density, at a moisture content determined to be suitable for such density.
- E. **Backfill:** Place and compact the specified material as follows:
 - 1. **Vehicular Traffic Areas:** Fill and compact in 8-inch maximum layers to 95 percent of maximum density, at moisture content determined to be suitable for such density.
 - 2. **Pedestrian and Lawn Areas:** Fill and compact in 8-inch maximum layers to 90 percent of maximum density, at moisture content determined to be suitable for such density.
 - 3. **Nontraffic Areas:** Fill and compact in 8-inch maximum layers to 90 percent of maximum density, at moisture content determined to be suitable for such density.

3.5 SURFACE FINISH WORK

- A. **Paved Areas:** Replace removed paving and base course with new material of equal or better quality and of the same texture and color as the adjacent paved areas. Saw cut pavement edge to a true line and broom as needed prior to paving.
- B. **Open and Seeded Areas:** Grade all disturbed areas to a finish ordinarily obtained from a blade grader, with no abrupt changes in grade or irregularities that will hold water.
- C. **Drainage Ditches:** Restore drainage ditches to appropriate line and grade, using approved surface erosion prevention techniques.
- D. **Clean-Up:** Prior to final inspection and acceptance, remove all rubbish and excess material for disposal as approved, and leave area in a neat, satisfactory condition.

END OF SECTION

SECTION 02501

TESTING OF WATER AND SEWER LINES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of leak testing gravity sewer lines, gravity sewer manholes, water lines, force mains, inverted siphons, and related valves and fittings. Rejected work shall be retested.
- B. Testing Methods: Manholes - water level drop test; water lines, force main, inverted siphons - high pressure water test.

1.2 QUALITY ASSURANCE

- A. Flow meters shall record the actual volume plus or minus 2 percent.
- B. Water test gauges shall be ANSI B40.1-80, Grade 2A (plus or minus 0.5 percent of full scale accuracy), dial range approximately twice the required test pressure.

1.3 SUBMITTALS

- A. As specified in Section 01330.
 - 1. Accuracy certification by approved independent testing laboratories for flow meters and test gauges. Certifications shall be dated no more than 90 days before actual system testing.
 - 2. Before testing, provide the following information:
 - a. All Tests: Describe precautions that will be taken to protect system equipment that might be damaged under test pressures, and the proposed method for rerouting sewer flows where the system must remain in service.
 - b. High Pressure Water Test: Describe the proposed method for disposal of water used in line testing.

1.4 PROJECT CONDITIONS

- A. Testing shall not be performed until each system has been flushed or thoroughly cleaned in accordance with procedures in the sections that describe water and sewer line installation.
- B. Test potable water lines before disinfecting.
- C. Water for Flushing and Testing: See Section 01510.

PART 2 PRODUCTS NONE.

PART 3 EXECUTION

3.1 GENERAL

- A. Perform testing in the Contracting Officer's presence after backfill and proper compaction of trenches. Where lines are installed under roadways and parking areas, perform tests after completion of final subgrade preparation and prior to application of surface courses. Notify Contracting Officer at least 48 hours prior to testing.
- B. Prepare each section for testing, using adequate bracing; protect system equipment susceptible to damage by test pressures; make provision for installation of Government pressure gauge in parallel with Contractor's gauge, if so requested; and maintain services where required.
- C. Water Test: After manholes have passed the leak test, perform line leakage tests. Plug all lines entering the upstream manhole and the line to be tested in the downstream manhole. Fill the line and the upstream manhole with water to the lid seat ring. Laterals entering the main line between manholes shall be tested also, making sure all air is evacuated where test plugs are inserted. During the 2-hour test period, measured quantities of water shall be added to maintain the test level within 1 inch of the reference point. Maximum allowable gallons of makeup water for pipeline leakage shall be determined by multiplying the nominal pipe diameter in inches by 1.0 gallon per inch, by the number of linear feet of pipe in the test section, and dividing the product by 1,000. The line will pass the test if the volume of makeup water during the 2-hour period does not exceed the sum of the actual manhole loss and the allowable line loss. This volume is 8 times the 15-minute manhole loss, recorded earlier, plus the calculated allowable leakage for main and lateral lines being tested.

3.2 WATER LINES, FORCE MAINS, INVERTED SIPHONS

- A. Fill line with water; eliminate all air. Allow a minimum standing time of 2 hours for materials to absorb water.
- B. Raise the internal pressure by pumping in water to 50 psig above the maximum anticipated service pressure (ignore water hammer) at the point of test gauge attachment.
- C. Maintain the test pressure within 5 psig for 2 hours by pumping in metered quantities of makeup water.
- D. The line section will have passed the test if the metered makeup water does not exceed that determined by the following formula: Leakage in gallons equals 0.00002 times the nominal diameter of pipe in inches times the length of the test section in feet times the square root of the test pressure in psig.
- E. Do not use paints, asphalts, tars, or other types of pipe compounds to eliminate leaks.
- F. Replace leaking fittings, nipples, or lengths of pipe.

END OF SECTION

SECTION 02502

UTILITY LINE MARKING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing utility line marking.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Samples: 24-inch strips of tape and 2 markers.
- C. Certification that the materials used in the tape fabrication meet the requirements of this section.
- D. Installation procedure if the cable is installed by plowing.

PART 2 PRODUCTS

2.1 MARKING TAPE

- A. Capable of being inductively detected electronically.
- B. Construction: Metallic foil laminated between two layers of impervious plastic film not less than 3 inches wide. Total thickness of tape shall not be less than 0.005 inch (5 mil) plus or minus 10 percent manufacturing tolerances.
 - 1. Film: Inert plastic. Each film layer shall be not less than 0.0005 inch thick (0.5 mil).
 - 2. Foil: Not less than 0.00035 inch thick (0.035 mil).
 - 3. Adhesive: Compatible with foil and film.
- C. Imprint: 3/4-inch or larger bold black letters.
- D. Legend: Identify buried utility line tape with imprint such as "Caution: Sewer Line Below". Repeat identification at approximately 24-inch intervals.
- E. Background Color: APWA color code and as specified below:

Color	Utility
Safety Red	Electric
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer

Color	Utility
Safety Brown	Force Mains, Reclaimed Water, and Effluent Lines

- F. Manufacturer: Lineguard, Inc., Wheaton, Illinois; Reef Industries, Inc., Houston, Texas; Thor Enterprises, Inc., Sun Prairie, Wisconsin; or approved equal.

PART 3 EXECUTION

3.1 MARKING TAPE

- A. Install tape in backfill directly over each buried utility line as shown. Place tape by plowing or during final backfilling.
- B. Where utilities are buried in a common trench, identify each line by a separate warning tape. Bury tapes side by side directly over the applicable line.

END OF SECTION

SECTION 02511

WATER PIPING AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing water system piping and appurtenances.

1.2 CONTRACTOR'S OPTION

- A. Contractor may select pipe materials from any of those listed below. The same material need not be used for all pipelines; however, only one material shall be used for main lines, one for service connection lines, and one for drain lines. Road, bridge, and sewer line crossings shall be ductile iron as shown.

1.3 DEFINITION

- A. Bedding and backfill material types (BD, SB, BF) are defined in Section 02320.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's literature and certificates of compliance with the reference standards for pipe, fittings, and couplings.
- C. Manufacturer's installation instructions or guide.
- D. Written procedure for cleaning water lines and disposing of fluidized materials removed.

1.5 PRODUCT HANDLING

- A. Delivery: Handle pipe carefully to ensure delivery at the project site in sound, undamaged condition. Contracting Officer will reject damaged pipe on site. Contractor shall replace damaged pipe at no additional expense to the Government.
- B. Storage: Do not store materials directly on the ground. Adequately support piping to prevent warpage. Use protective covers where pipe may be damaged by direct sunlight.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE, JOINTS, AND BACKFILL MATERIAL

- A. Pipe: AWWA C151-91. Pressure Class 350.
- B. Mechanical Joint: AWWA C111-90. Stuffing-box type with sealing gasket, follower gland, tee-head bolts and hexagonal nuts. Bolts and nuts shall be the high-strength, low-alloy steel type for enhanced corrosion resistance.

- C. Push-On Joint Gasket Lubricant: Manufacturer's standard nontoxic lubricant, approved for potable water systems.
- D. Adapters for Flanged Fittings: Manufactured flange coupling adapters or threaded flanges on thickness Class 53 pipe. Flange bolts and nuts shall be high-strength, low-alloy steel type for enhanced corrosion resistance.
- E. Cement Mortar Lining: AWWA C104-90. For pipe and fittings, minimum 1/16 inch thick.
- F. Bedding and Backfill: Section 02320.
 - 1. Paved Areas: BD-3, SB-4, and BF-1.
 - 2. Pedestrian and Lawn Areas: BD-3, SB-4, and BF-2.
 - 3. Nontraffic Areas: BD-3, SB-4, and BF-2.

2.2 FITTINGS

- A. Size, grade, joint type, and lining to match pipe, and as recommended by the pipe manufacturer.

2.3 COUPLINGS FOR PLAIN ENDS AND DISSIMILAR PIPES

- A. Sleeve and transition type couplings shall be factory manufactured to ensure tight fit and smooth flow transition at the joint.

2.4 CONCRETE

- A. Section 03300.

PART 3 EXECUTION

3.1 GENERAL

- A. Construct the water system to the lines and grades shown or established in the field.

3.2 TRENCHING

- A. Section 02320.

3.3 BEDDING

- A. Section 02320.

3.4 INSTALLATION

- A. Inspection: Inspect pipe for defects before lowering into the trench. Defective, damaged, or unsound pipe will be rejected.
- B. Laying: After the trench bottom has been prepared for pipe installation in accordance with Section 02320, lay pipe with bells facing in the direction of laying, unless otherwise approved. On slopes exceeding 20 percent, bells shall face upgrade and laying shall proceed upgrade. Where connections are made with other lines, bells may face as needed.

- C. Cleaning: As work progresses, clear the pipe interior of dirt and other debris by keeping swabs in the pipe and pulling them forward past each completed joint.
- D. Pipe Cutting: Cutting for closure or other reasons shall be done neatly by methods recommended by the manufacturer.
- E. Jointing: Clean gaskets, seats, and threads of foreign materials prior to joint assembly. Apply lubricant or sealing tape as recommended by the manufacturer.
 - 1. Mechanical Joint: Carefully center the spigot in the bell and position the gasket evenly in the seat. Tighten bolts alternately to an even torque, causing the follower gland to expand the gasket uniformly for a tight seal.

3.5 DEFLECTION AT DUCTILE IRON JOINTS

- A. Mechanical Joints: Deflections from a straight line or grade measured between extended centerlines of the connecting pipe shall not exceed the following:

Size of Pipe in Inches	Mechanical Joint Deflection per Linear Foot in Inches
4, 6	1-1/2
8, 10, 12	1
14, 16	3/4
18, 20	5/8

- B. If the required alignment necessitates deflection in excess of that specified above, provide either special bends or a sufficient number of shorter lengths of pipe to effect angular deflections within the limits specified.

3.6 PIPE ENDS

- A. Valve, plug, or cap future connection stubs, fittings, and taps as shown.

3.7 CONCRETE THRUST BLOCKS

- A. Construct at all bends, tees, crosses, reducers, valves, and dead ends as shown and as recommended by the pipe manufacturer.

3.8 BACKFILLING OF SELECT MATERIALS

- A. Section 02320.

3.9 BACKFILLING

- A. Section 02320.
- B. All buried water lines, metallic and nonmetallic, shall be marked with detectable identifying tape.

3 .10 WATER LINE MARKING

- A. Section 02502.

3 .11 FINAL PIPE CLEANING

- A. Before testing, clean all lines to be tested by high pressure water jet or mechanical means. Remove and dispose of fluidized materials as approved.

3 .12 TESTING

- A. Section 02501.

3 .13 SURFACE FINISH WORK

- A. Section 02320.

3 .14 DISINFECTION

- A. After completion of testing and prior to placing in service, disinfect the potable water system as specified in Section 02519.

END OF SECTION

SECTION 02519

DISINFECTION OF WATER LINES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of the disinfection of all portions of the water system, including valves and stops and any portion of the existing connecting system that might have become contaminated during construction activities.

PART 2 PRODUCTS

2.1 CALCIUM HYPOCHLORITE

- A. HTH, by Olin Chemicals, Olin Corporation, Stamford, Connecticut, or similar product having approximately 70 percent available chlorine.

2.2 MIXTURE

- A. A 5-percent solution shall be made by mixing 5 percent of powder with 95 percent water, by weight, first into a paste, then thinning to slurry by the addition of water.

PART 3 EXECUTION

3.1 DOSAGE

- A. Place enough disinfecting material in the system to ensure a chlorine dosage of 50 parts per million. This is equivalent to 10 ounces of commercial hypochlorite powder to each 1,000 gallons of water.

3.2 FILLING SYSTEM

- A. Fill entire system with the chlorine solution. Open all taps and valves and leave open until a strong odor of chlorine is noticeable in the water coming from the outlets, after which close the taps and valves.

3.3 TEST PERIOD

- A. Allow chlorinated water to remain in the system a minimum of 24 hours, then thoroughly flush the system. During retention period, operate all valves, stops, and other appurtenances to assist this disinfection.

3.4 DISINFECTING

- A. All domestic cold and hot water lines shall be thoroughly flushed and drained after installation. Sterilization shall be accomplished by opening taps at the end of all branches, and slowly filling the system adding liquid chlorine, or hypochlorite solution, to the water until water flowing from all branches indicates not less than 50 P.P.M. residual chlorine; the system allowed to stand for not less than twenty-four (24) hours, [200 PPM for 3 hours] with all valves opened and closed

several times during this period; then drained and thoroughly flushed until all traces of chlorine are eliminated (less than 0.2 P.P.M.) Certificate shall be submitted to the Contracting Officer. The Contractor shall be responsible for the proper disposal of chlorinated water to safeguard public health and environment in accordance with applicable Department of Health requirements. Disposal of water shall be off site.

3.5 BACTERIOLOGICAL EXAMINATION

- A. After the system has been thoroughly flushed, take samples from representative points in the system, in sterile bottles, and submit to proper authorities as directed for bacteriological examination. If the report is unsatisfactory, repeat the disinfection procedure until satisfactory results are obtained.

END OF SECTION

SECTION 02532

PRESSURE SEWER PIPING AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing pressure and inverted siphon sewer piping and appurtenances.

1.2 CONTRACTOR'S OPTION

- A. Contractor may select pipe materials from any of those listed below. After selection, all pressure sewer and all inverted siphon sewer shall be of the same material, with the exception of road, bridge, and water line crossings, which shall be ductile iron as shown.

1.3 DEFINITION

- A. Bedding and backfill material types (BD, SB, BF) are defined in Section 02320.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's literature and certificates of compliance with the reference standards for pipe, fittings, and couplings.
- C. Manufacturer's installation instructions or guide.
- D. Written procedure for cleaning sewer lines and disposing of fluidized materials removed.

1.5 PRODUCT HANDLING

- A. Delivery: Handle pipe carefully to ensure delivery at the project site in sound, undamaged condition. Contracting Officer will reject damaged pipe on site. Contractor shall replace damaged pipe at no additional expense to the Government.
- B. Storage: Do not store materials directly on the ground. Adequately support piping to prevent warpage. Use protective covers where pipe may be damaged by direct sunlight.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE, JOINTS, AND BACKFILL MATERIAL

- A. Pipe: ANSI/AWWA C151-91. Pressure Class 350.
- B. Mechanical Joint: ANSI/AWWA C111-90. Stuffing-box type with sealing gasket, follower gland, tee-head bolts, and hexagonal nuts. Bolts and nuts shall be the high-strength, low-alloy steel type for enhanced corrosion resistance.

- C. Push-On Joint Gasket Lubricant: Non-toxic, as furnished by the pipe manufacturer.
- D. Adapters for Flanged Fittings: Use manufactured flanged coupling adapters , or threaded flanges on thickness Class 53 pipe. Bolts and nuts shall be the high-strength, low-alloy steel type for enhanced corrosion resistance.
- E. Bedding and Backfill: Section 02320.
 - 1. Paved Areas: BD-3, SB-4, and BF-1.
 - 2. Pedestrian and Lawn Areas: BD-3, SB-4, and BF-2.
 - 3. Nontraffic Areas: BD-3, SB-4, and BF-2.

2.2 PLASTIC PIPE, JOINTS, AND BACKFILL MATERIAL

- A. Pipe:
 - 1. ASTM D2241-83 for pipe 1-1/2 to 3 inches diameter. Water pressure rating of 160 psi.
- B. Elastomeric Gasket Joint: ASTM D3139-77. Manufacturer's standard. Integrally formed bell, push-fit, rubber gasketed joint system.
- C. Lubricant: Manufacturer's standard.
- D. Bedding and Backfill - ASTM D2241-83 Piping: Section 02320.
 - 1. Paved Areas: BD-2, SB-2, and BF-1.
 - 2. Pedestrian and Lawn Areas: BD-2, SB-2, and BF-2.
 - 3. Nontraffic Areas: BD-2, SB-2, and BF-2.

2.3 FITTINGS

- A. Size, grade, joint type, and lining to match pipe, and as recommended by the pipe manufacturer.

2.4 FITTINGS FOR PLASTIC PIPE

- A. For plastic pipe use cast or ductile fittings. For cast iron O.D. pipe use standard cast fittings. For IPS O.D. pipe use IPS cast fittings or standard cast fittings with transition gaskets.

2.5 COUPLINGS FOR PLAIN ENDS AND DISSIMILAR PIPES

- A. Sleeve and transition type couplings shall be factory manufactured to ensure tight fit and smooth flow transition at the joint. Poured concrete collar and similar coupling methods will not be accepted.

2.6 CONCRETE

- A. Section 03300.

PART 3 EXECUTION

3.1 GENERAL

- A. Construct the pressure and inverted siphon sewer system, complete with appurtenances, to the lines and grades shown or established in the field.

3.2 TRENCHING

- A. Section 02320.

3.3 BEDDING

- A. Section 02320.

3.4 INSTALLATION

- A. Inspection: Inspect pipe for defects before lowering into trench. Defective, damaged, or unsound pipe will be rejected.
- B. Laying: After the trench bottom has been properly prepared for pipe installation as specified in Section 02320, lay pipe with the spigot ends pointing in the direction of flow. Lay each length true to line and grade, to form smooth joint transitions and to prevent sudden offsets of the flow line.
- C. Cleaning: As work progresses, clear the pipe interior of dirt and other debris by keeping swabs in the pipe and pulling them forward past each completed joint.
- D. Pipe Cutting: Cutting for closure or other reasons shall be done neatly by methods recommended by the manufacturer. Sharp edges shall be smoothed to prevent gasket damage.
- E. Jointing: Clean gaskets and seats of foreign materials prior to joint assembly. Apply lubricant as recommended by the pipe manufacturer.
 - 1. Mechanical Joint: Carefully center the spigot in the bell and position the gasket evenly in the seat. Tighten bolts alternately to an even torque, causing the follower gland to expand the gasket uniformly for a tight seal.

3.5 DEFLECTION AT DUCTILE IRON JOINTS

- A. Push-On and Mechanical Joints: Deflections from a straight line or grade measured between extended centerlines of the connecting pipe shall not exceed the following:

Size of Pipe in Inches	Mechanical Joints Deflection per Linear Foot in Inches

4, 6	1-1/2
8, 10, 12	1
14, 16	3/4
18, 20	5/8

- B. If the required alignment necessitates deflection in excess of that specified above, provide either special bends or a sufficient number of shorter lengths of pipe to effect angular deflections within the limits specified.

3.6 DEFLECTION AT PLASTIC

- A. Follow deflection guidelines of the pipe manufacturer.

3.7 CONCRETE THRUST BLOCKS

- A. Construct at all bends and valves as shown and as recommended by the pipe manufacturer.

3.8 BACKFILLING OF SELECT MATERIALS

- A. Section 02320.

3.9 BACKFILLING

- A. Section 02320.

3.10 SEWER LINE MARKING

- A. Section 02502.

3.11 FINAL PIPE CLEANING

- A. Prior to testing, clean all lines to be tested by high pressure water jet or mechanical means. Remove and dispose of fluidized materials as approved.

3.12 TESTING

- A. Section 02501.

3.13 SURFACE FINISH WORK

- A. Section 02320.

END OF SECTION

SECTION 02534

SEWER CLEANOUTS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing sewer cleanouts.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE VALVE BOX

- A. Christy traffic valve box G8, with ring No. 2331 and lid No. C276, manufactured by Christy Concrete Products, Inc., Fremont, California, or approved equal.

2.2 DUCTILE IRON PIPE AND FITTINGS

- A. Section 02532.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

- A. Section 02320.

3.2 INSTALLATION OF CLEANOUTS

- A. Install cleanout wye and fitting at locations shown.
- B. Extend with cast iron pipe and install precast concrete box flush with finished grade.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.1 DESCRIPTION

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Cast-In-Place Concrete: Supply of concrete accessories for placement by this section.
- B. Supply of masonry accessories for placement by this section.
- C. Metal Fabrications: Supply of metal fabrications for placement by this section.

1.3 RELATED REQUIREMENTS

- A. Concrete Reinforcement: SECTION 03200
- B. Cast-in-Place Concrete: SECTION 03300
- C. Concrete Curing: SECTION 03370

1.4 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 347 - Recommended Practice For Concrete Formwork.
- D. PS 1 - Construction and Industrial Plywood.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347, 301, and 318.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for design, fabrication, erection and removal of formwork.

1.7 COORDINATION

- A. Coordinate this Section with other Sections of work which require attachment of components to formwork.
- B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Form Materials: Commercial-Standard Douglas Fir, moisture resistant concrete form plywood not less than 5 ply at least 5/8 inch thick.

2.2 FORMWORK ACCESSORIES

- A. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- B. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

- A. Earth forms are not permitted for exposed concrete surfaces.
- B. For non-exposed surfaces, hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

3.4 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive applied coverings that are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.

3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

3.10 CLEAN-UP

- A. Upon completion of the work of this Section, remove related debris from premises.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 DESCRIPTION

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 RELATED REQUIREMENTS

- A. Concrete Formwork: SECTION 03100
- B. Cast-in-Place Concrete: SECTION 03300
- C. Concrete Curing: SECTION 03370

1.3 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements For Reinforced Concrete.
- C. ACI SP-66 - American Concrete Institute - Detailing Manual.
- D. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- E. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- F. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- G. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- H. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.
- I. CRSI - Placing Reinforcing Bars.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI - Manual of Standard Practice.

1.5 COORDINATION

- A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615, 60 yield grade; deformed billet steel bars.
- B. Welded Steel Wire Fabric: ASTM A185 in flat sheets; unfinished.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
- B. Weld reinforcement in accordance with ANSI/AWS D1.4.
- C. Locate reinforcing splices not indicated on drawings, at point of minimum stress.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing per plans.
- E. Conform to applicable code for concrete cover over reinforcement, unless noted otherwise.
- F. Do not tack weld reinforcing bars.

3.2 CLEAN-UP

- A. Upon completion of the work of this Section, remove related debris from premises.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 DESCRIPTION

- A. Cast-in-place concrete foundation walls and floorings.
- B. Floors and slabs on grade.
- C. Control, expansion and contraction joint devices associated with concrete work, including joint sealants.
- D. Equipment pads.

1.2 RELATED REQUIREMENTS

- A. Concrete Formwork: SECTION 03100
- B. Concrete Reinforcement: SECTION 03200
- C. Concrete Curing: SECTION 03370

1.3 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ACI 305R - Hot Weather Concreting.
- D. ACI 308 - Standard Practice for Curing Concrete.
- E. ACI 318 - Building Code Requirements for Reinforced Concrete.
- F. ASTM C33 - Concrete Aggregates.
- G. ASTM C94 - Ready-Mixed Concrete.
- H. ASTM C150 - Portland Cement.

1.4 SUBMITTALS

- A. Submit proposed mix design of each class of concrete to architect for review prior to commencement of Work.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Acquire cement and aggregate from same source for all work.
- C. Conform to ACI 305R when concreting during hot weather.

1.6 COORDINATION

- A. Coordinate work under provisions of Coordination Section.
- B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

- A. ASTM C494, Type D water-reducing retarding admixture.

2.3 ACCESSORIES

- A. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Asphalt impregnated fiberboard or felt, tongue and groove profile

2.5 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C94.
- B. Select proportions for normal weight concrete in accordance with ACI 301.
- C. Provide concrete as indicated on the plans. Slump tolerance plus or minus 1 inch.
- D. Do not use calcium chloride.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304, ACI 301, and ACI 318.
- B. Notify Contracting Officer minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, and embedded parts, are not disturbed during concrete placement.
- D. Install joint devices in accordance with manufacturer's instructions.
- E. After batching, a one-time addition of water at the jobsite for the purpose of maintaining slump within specified limits will be limited to 10 gallons of water, maximum, per 10 cubic yard load to be immediately followed by a minimum of 30 additional revolutions at mixing speed, to be directed by the Contractor's superintendent, and noted on the batch ticket.

3.3 CONCRETE FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301.
- B. Wood float all concrete surfaces.
- C. Areas exposed and receiving concrete stain shall be steel troweled not less than two passes. Begin with power trowel as soon as little to no concrete sticks to blades. Do not dust with cement or aggregate to absorb moisture or to stiffen mix. Do not polish or burn-in with trowel machine.

3.4 PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot temperatures, and mechanical injury.

3.5 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed in accordance with ACI 301.
- B. Provide free access to Work and cooperate with testing agency.
- C. Three concrete test cylinders will be taken for every 75 or less cu yds of each class of concrete placed.
- D. One slump test will be taken for each set of test cylinders taken.

3.6 PATCHING

- A. Inspect concrete surfaces immediately upon removal of forms.
- B. Honeycomb or embedded debris in concrete is not acceptable. Notify Contracting Officer upon discovery for inspection.
- C. Patch imperfections in accordance with ACI 301.

3.7 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances, strength, or other specified requirements is not acceptable.
- B. Whether repair or replacement of defective concrete is required will be determined by the Contracting Officer. Means and methods of such may be suggested by the Contractor.
- C. Do not cover, conceal, patch, fill, touch-up, repair, or replace exposed concrete except after required notification to the Contracting Officer, review by the Contracting Officer, and express direction of Contracting Officer for each individual area.

3.8 CLEAN-UP

- A. Upon completion of the work of this Section, remove related debris from premises.

END OF SECTION

SECTION 03370
CONCRETE CURING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Initial and final curing of horizontal and vertical concrete surfaces.

1.2 RELATED REQUIREMENTS

- A. Concrete Formwork: SECTION 03100
- B. Concrete Reinforcing: SECTION 03200
- C. Cast in Place Concrete: SECTION 03300

1.3 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.
- C. ACI 308 - Standard Practice for Curing Concrete.
- D. ASTM C171 - Sheet Materials for Curing Concrete.
- E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- F. ASTM D2103 - Polyethylene Film and Sheeting.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 302.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver curing materials in manufacturer's packaging including application instructions.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Polyethylene Film. Water:
- B. Potable, not detrimental to concrete.
- C. Curing Compound: Master Builders Technologies, "Masterkure 200W" water based wax emulsion concrete curing compound.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION - HORIZONTAL SURFACES

- A. Cure floor surfaces in accordance with ACI 308.
- B. Spraying: Cover surface with wet burlap and spray water over floor slab areas and maintain wet for 7 days, at areas with stained concrete finish.
- C. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions. Completely strip all curing compounds before installation of any floor finish; and after concrete has achieved specified strength. Do not apply curing compound in areas to receive concrete stains or coloring agents.

3.3 EXECUTION - VERTICAL SURFACES

- A. Cure surfaces in accordance with ACI 308.
- B. Spraying: Spray water over surfaces and maintain wet for 7 days.

3.4 PROTECTION OF FINISHED WORK

- A. Do not permit traffic over unprotected floor surface.

3.5 CLEAN-UP

- A. Upon completion of the work of this Section, remove related debris from premises.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 DESCRIPTION:

- A. Wood and plywood furring, blocking, backing, nailers and other items indicated on Drawings.
- B. Wood framing.
- C. Laminated wood framing.
- D. Rough hardware.
- E. Related accessories and miscellaneous materials.

1.2 REFERENCES

- A. American Institute of Timber Construction (AITC):
 - 1. A.190.1-2002: American National Standard for Wood Products - Structural Glued Laminated Timber
 - 2. 117: Design Standard Specifications
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM D3737: Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber.
- C. American Wood Preservers' Association (AWPA):
 - 1. AWPA M-4: Standard for the Care of Preservative Treated Wood Products.
- D. American Wood Preservers Bureau (AWPB):
 - 1. AWPA LP-2: Softwood Lumber, Timber and Plywood Pressure Treated With Waterborne Preservatives for Above Ground Use.
 - 2. AWPB LP-22: Softwood Lumber, Timber and Plywood Pressure Treated With Waterborne Preservative for Ground Contact Use.
- E. Federal Specification (Fed. Spec.):
 - 1. Fed. Spec. TT-W-00571J: Wood Preservation Treating Practices.
- F. Underwriters' Laboratories, Inc. (UL):
 - 1. UL Building Materials Directory, Lumber, Treated (BPVV).

- G. Voluntary Product Standards (PS):
 - 1. PS 20 - American Softwood Lumber Standard.
 - 2. PS 56 - Structural Glued Laminated Timber

H. West Coast Lumber Inspection Bureau (WCLIB).

I. Western Wood Products Association (WWPA).

1.3 SUBMITTALS

A. Product Data: Manufacturer's specifications and technical data including the following:

- 1. Detailed specification of construction and fabrication.
- 2. Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with a minimum of 3 years experience with systems similar to required for this Project.

B. Product/Material Qualifications:

1. Lumber standards: Conforming to Voluntary Product Standard PS20 and PS56. Mark material with official grade mark of specified agency. Grading rules of the following agencies apply:

- a. West Coast Lumber Inspection Bureau (WCLIB).
- b. Western Wood Products Association (WWPA).

C. Factory mark each piece of lumber with type, grade mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate of conformance that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

D. Certificate of inspection and grading by a recognized agency may be submitted with each shipment, in lieu of factory marking, at Contractor's option.

E. Qualifications of Treatment Applicators: Use only a licensed wood treatment specialty contractor experienced in the application of the materials required, and employing skilled tradesmen for the work. Use only a firm which is a member of the American Wood Preservers Bureau, or is approved by the Architect. Firms in Hawaii are:

- 1. Wood Protection Company.
- 2. Hilo Wood Treating, Inc.
- 3. Honolulu Wood Treating Company, Ltd.
- 4. Hardware Hawaii

- F. Inspection and Labeling: For termite preservative treated products, label each piece of treated lumber and plywood with the A.W.P.D. Quality Control mark showing compliance with the appropriate standard.
- G. Certification:
 - 1. Furnish Architect an affidavit stating that treatment provided complies with these specifications.
 - 2. Indicate chemical used and retention retained.
- H. Qualification of Treatment: Treatments applied to exposed wood and wood products shall not discolor the wood unfavorably, nor interfere with subsequent painting, staining or other finishes.

1.5 DELIVER, STORAGE, AND HANDLING

- A. Storage and Protection: Store materials in accordance with manufacturer's recommendations.
 - 1. Store lumber minimum of 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.
 - 2. Protect corners of sheet materials from damage while handling.
 - 3. Fire retardant materials: Comply with treatment manufacturer's requirements.

PART 2 PRODUCTS

2.1 MATERIALS

Structural Framing:

- A. No. 1 Grade or better, Douglas Fir-Larch, S4S kiln dried not more than 19 percent moisture content.
- B. Blocking and Nailers:
 - 1. Construction Grade No. 2 or better Douglas Fir-Larch, S4S, Kiln dried.
 - 2. Where exposed material: Sound, straight, clean, and smooth (sand if required).
- C. Construction Plywoods and Sheathing
 - 1. Concealed Sheathing: APA touch-sanded C-D plugged, Group 1. Exposure: Exterior.
 - 2. Interior Exposed Sheathing and Panel Boards: One or both sides exposed in finished Work. Exposed sides as follows:
 - a. Exposure: Exterior.
 - b. Exposed veneer grade: If scheduled for painted finish: Veneer Grade B.
 - c. APA A-B Group 1.

D. Laminated Wood Members

1. Laminated Wood Framing: Prefabricated Douglas Fir structural laminated wood veneer beams. Parallel wood veneers bonded together with waterproof adhesive.
 - a. Conform to AITC A.190.1-2002 and AITC 117 and PS56. Submit Certificate of Conformance.
 - b. Beam Material: Douglas Fir, Fb=2400 psi with exterior glue.
 - c. Size: As indicated on Drawings.
 - d. Grade: Premium appearance grade suitable for exposed condition with opaque stain finish.
 - e. Adhesive: ASTM D2559 for wet use.

2.2 ACCESSORIES

- A. Rough Hardware - General: Furnish rough hardware required, including nails, screws, anchor bolts, J-bolts, lag screws, cinch anchors, strap anchors, toggle bolts, shot anchors, plate, connectors, and similar items.
 1. Rough hardware required to be of proper size and type for use intended and for materials to be fastened. Install adequate hardware to insure substantial and positive anchorage.
 2. Use hot dip galvanized.
- B. Nailing into wood plugs is not acceptable for any Work. Where shot anchors are used, they shall be of type and size recommended by manufacturer of use.
- C. Bolts: Coarse thread, not plated, with washers and nuts.
- D. Expansion Bolts: Emhart Corporation/Molly Division, Parasleeve for masonry; Parabolt for concrete.
- E. Nails: Galvanized steel.

2.3 PRESERVATIVE TREATMENT

- A. Water-borne Wood Preservative Treatment: Waterborne salt preservative complying with American Wood Preservers Bureau (AWPB) LP-22 or LP-2.
 1. ACQ (Alkaline Copper Quaternary) without ammonia for exposed or unexposed, interior or exterior lumber.
 2. SBX-DOT (Disodium Octaborate Tetrahydrate) for interior lumber.
- B. Oil-borne Wood Preservative Treatment: The solvent used in formulating the preservative solution shall meet the requirements of AWPA hydrocarbon solvent Type C, Standard P9, Para. 3.1.

1. Water-repellent tri-N-butyltin oxide (TBTO) in accordance with referenced AWWA Standard P8.
 2. "Tribucide II" chlorpyrifos/IPBC (3-iodo-2 Propynyl butyl carbamate).
- C. Kiln-dry at the plant all treated lumber and plywood to an average moisture content not to exceed 19 percent for framing lumber. Treat wood after cutting to shape except cutting to length may be done in the field.
- D. Treat and quality mark each piece over 1 inch by 4 inches following AWPB standards.
- E. Schedule of Preservative Treatment:
1. Treat wood used in connection with roofing, flashing, and waterproofing, LP-22 (0.40 pounds).
 2. Wood in direct contact with concrete or masonry construction including sills, plates, nailers and blocking: LP-22 (0.40 pounds).
 3. Glu-lam beams, engineered wood joists, and lumber that will be exposed to view, oil-borne preservative; maintain architectural surface appearance of glu-lam and engineered wood joists.
 4. Other materials indicated as "moisture treated" on Drawings: LP-2 (0.25 pounds).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
1. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FRAMING MEMBERS

- A. Set carpentry Work accurately to required levels and lines with members plumb, true, and accurately cut and fitted.
- B. Securely attach carpentry Work to substrates by anchoring and fastening as indicated and as required by recognized standards. Comply with manufacturer's installation recommendations.
- C. Apply 2 brush coats of same preservative used in original treatment to sawed, notched, cut, or drilled surfaces of treated lumber in Standard M4.
- D. Blocking: Coordinate locations of blocking required for attachment of accessories and for other items requiring blocking.
1. Provide wood blocking, framing, nailing strips, grounds, supports for fixtures, curbing, cants, temporary hardware, towel grab bars, cabinets, accessories, etc., required or indicated.

3.3 PLYWOOD SHEATHING INSTALLATION

- A. General Plywood Installation: Install plywood sheathing with face grain perpendicular to supports. Stagger end joints between adjacent panels. Leave 1/8 in wide space between panel edges and ends.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of finish carpentry work, including cabinet counter tops.

1.2 RELATED WORK

- A. Installation of finish hardware - Section 08710.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Shop Drawings:
 - 1. Prefabricated millwork. Include species, erection data, profiles, dimensions, construction, and fastenings.
 - 2. Cabinet Counter Tops; Shop drawings to indicate dimensions, sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

- C. Samples

- 1. One linear foot of each kind of interior trim and molding.
- 2. Cabinet Doors and Counter Tops;
 - a. Submit minimum 8-inch by 8-inch profile section of finish door, countertop, back splash, skirt edge and backing plywood materials. Sample to indicate; lamination, profile of edges, full range of color, and pattern variation for finished surfaces . Approved samples will be retained as a standard for the work.
 - b. Certification by treating plant stating preservative chemicals and process used, net amount of salts retained, and compliance with applicable standards.
 - c. Certificates for graded but unmarked lumber or plywood attesting that materials meet the grade requirements.
 - d. Cabinet Counter Tops: Product data to indicate product description, fabrication information and compliance with specified performance requirements.

1.4 QUALITY ASSURANCE

- A. Identify lumber and plywood. By grade mark of a recognized association or an independent agency that is certified by the Board of Review, American Lumber Standards Committee. A certificate will be required for material left unmarked for reasons of appearance.

1. Lumber: Grade stamp shall contain, where applicable, symbol of grading agency, mill number or name, grade of lumber, species, rules under which graded, and condition of seasoning at time of manufacture.
2. Plywood: Appropriate grade trademark of the APA, including type, grade, class, identification or span index, and inspection and testing agency mark.
3. Cabinet Counter Tops:
 - 1) Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions and maintenance video. Provide maintenance kit for gloss finish. Include in project close-out documents.
 - 2) Variation in component size: $\pm 1/8$ -inch, Location of openings $\pm 1/8$ -inch from indicated location. Provide manufacturer's warranty against defects in materials fabrication.
 - 3) Warranty shall provide for replacement or repair of material and labor for a period of ten years, beginning at Date of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials from weather.
- B. Protect treated materials from high humidity and moisture during storage and erection.
- C. Cabinet Counter Tops: Deliver no components to project site until areas are ready for installation. Store indoors. Handle materials to prevent damage to finish surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of projects.

PART 2 PRODUCTS

2.1 SIZES AND PATTERNS

- A. Yard and board lumber sizes shall meet PS-20-70. Provide shaped lumber and millwork in patterns shown. Sizes, unless otherwise shown, are nominal; actual sizes shall be within manufacturing tolerances allowed by the applicable standard specified.

2.2 MOISTURE CONTENT

- A. Air-dry or kiln-dry lumber. The maximum moisture content at time of delivery shall be as follows:
 1. Interior Finish Lumber, Trim, and Millwork 1-1/4 Inches or Less in Nominal Thickness: 12 percent on 85 percent of the pieces and 15 percent on remainder.
 2. Other Wood Products: Moisture content shall be within the ranges allowed by applicable woodworking standards.

2.3 TREATMENT OF WOOD PRODUCTS

- A. Section 06100.
- B. Pressure Treatment: Treat exterior millwork and trim and lumber and plywood in contact with masonry or concrete.

2.4 WOOD

- A. Trim, Finish, and Frames: Provide species and grades specified below for items to be paint finished.
 - 1. WWPA Standard Grading Rules, 1988
 - 2. Wood trims, door casings, and frames: C Select. Finger-jointed material is approved where opaque stains or paints are used.

2.5 PLYWOOD

- A. PS-1-83.
 - 1. Shelving: 3/4-inch-thick, interior type, A-B, any species group.
 - 2. Cabinet countertop backing sheet substrate: 1-1/4 –inch, CDX, any species group

2.6 PLASTIC LAMINATE CABINETS

- A. Plastic laminate shall be by Nevamar, WilsonArt, Formica, Pionite or other manufacturer. Factory cut openings for Cabinet fixtures.
 - 1. Type and Color:
 - a. Kitchen and Pass-thru shelf: Nevamar “Papier Au Lait,” textured.
 - b. Work/mail Room: Nevamar “Teal Slate Matrix,” textured.
- B. Adhesive: As recommended by the manufacturer.

2.7 SOLID SURFACING COUNTERTOPS

- A. Type and Color:
 - 1. Kitchen: Corian “Beige Fieldstone (F).”
 - 2. Work/mail Room: Corian “Dove (C).”

2.8 HARDWARE

- A. For hardware not specified in Section 08710, provide sizes and types recommended by the product manufacturer, stainless steel 302.

2.9 FASTENERS

- A. All fasteners shall be stainless steel.

PART 3 EXECUTION

3.1 GENERAL FINISH WORK

- A. Where practicable, shop assemble and finish items of built-up millwork. Provide a liberal brush coat of preservative treatment to field cuts or holes in treated wood. Before installation of materials, prime surfaces as specified in Section 09901. Construct tight joints in a manner that will conceal shrinkage, placed over the centerlines of support. Miter trim and moldings at exterior angles and cope at interior angles and at returns. Material shall show no warp after installation. Install millwork and trim in minimum, 4 – foot continuous run, or as continuous as provided, door and window trim in single lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty.

3.2 EXTERIOR:

- A. Machine sand exposed flat members and square edges. Machine finish semi-exposed surfaces. Construct joints to exclude water. In addition to nailing, glue joints of built-up items as necessary for weather-resistant construction. Provide well-distributed end joints in built-up members. Shoulder joints in flat work. Glue miter joints.

3.3 INTERIOR:

- A. Machine sand exposed surfaces at the mill. Run trim with channeled backs. After installation, sand exposed surfaces smooth.

3.4 SHELVING

- A. Support with end and intermediate supports at a maximum of 30-inches on center, arranged to prevent buckling and sagging. Supports shall be at 45 – degrees - 1 x 4, surfaced four sides.

3.5 KITCHEN & WORK/MAIL ROOM COUNTER TOPS:

- A. Factory fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
- B. At pass-thru shelf, fabricate below counter top trim skirt in one continuous sheet of plastic laminate. Create 3/4-inch radius at inside or outside corners, except end of counter shall be 90-degree corners.

END OF SECTION

SECTION 07210

BUILDING INSULATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing ceiling and wall insulation.

1.2 QUALITY ASSURANCE

- A. In accordance with Section 6002 of Public Law 94-580, Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act and Environmental Protection Agency's (EPA) Guideline for Federal Procurement of Building Insulation Products Containing Recovered Materials, 40 CFR Part 248, furnish building insulation products specified to contain recovered materials to the maximum extent possible, but in no case less than the minimum content percentages specified.

1.3 SUBMITTALS

- A. As specified in Section 013300.
- B. Submit certification for each type of insulation, identifying manufacturer's name, brand name, R value, and composition including percentage of recovered materials.

PART 2 PRODUCTS

2.1 WALL AND CEILING INSULATION

- A. Mineral Fiber Materials: ASTM C665-95, fibers made from mineral substances such as rock, slag, or glass processed from the molten state into a fibrous form. Fiberglass shall contain a minimum of 20 to 25 percent recovered glass cullet. Glass cullet shall conform to ASTM D5359-93. Rock wool shall contain a minimum of 75 percent slag.
 - 1. Unfaced Batt or Blankets: ASTM C665-95, Type I, friction fit type, with an installed thermal resistance of R= 19 for walls and R= 30 for ceilings.

2.2 FASTENERS

- A. In walls: Plated steel staples, plastic tape, and other fastening devices required to ensure tight fitting insulation.
- B. In roof: Stainless steel staples, plastic tape, permeable plastic or fiberglass mesh to support batts.

PART 3 EXECUTION

3.1 WALL AND CEILING INSULATION

- A. Fit insulation snugly between framing. Insulate small areas between closely spaced framing members. Carefully cut insulation and fit around pipes, conduits, and other obstructions. Where pipes or conduits are located in stud spaces, place insulation between exterior wall and pipe.

- B. Roof: install insulation on underside of roof slope using strapping, permeable mesh or netting to hold batts in place.

- C. Do not block roof (attic) vents. Install cut-offs (vent baffles) to keep insulation away from roof vents.

END OF SECTION

SECTION 07260

VAPOR RETARDER

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing vapor retarders for exterior walls.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit two copies of manufacturer's installation instructions and recommendations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.

2.2 EXTERIOR WALLS

- A. DuPont™ Tyvek® HomeWrap®: Flash spunbonded olefin, non-woven, non-perforated secondary weather resistant barrier.
- B. Sealing Tape/Fasteners: DuPont™ Tyvek® Tape, DuPont Weatherization Systems.
- C. For wood frame construction: DuPont™ Tyvek® Wrap Caps, DuPont Weatherization Systems. Nails with large heads or plastic washers. Wide staples with a 1.0 inch minimum crown may be used if applied on wood sheathing.

PART 3 EXECUTION

3.1 GENERAL

- A. Do not begin work until framing of openings is complete and wood blocking, nailers, curbs, vents, piping drains, and other projections through vapor retarder are installed.
- B. Refer to manufacturers installation instructions.

3.2 EXTERIOR WALLS

- A. A. Install Air Barrier over exterior side of exterior wall sheathing after sheathing is installed and before windows and doors are installed. Install lower level barrier prior to upper layers to ensure proper shingling of layers.
- B. Overlap Air Barrier at corners of building by a minimum of 12 inches.
- C. Overlap Air Barrier vertical seams by a minimum of 6 inches.

- D. Ensure barrier is plumb and level with foundation, and unroll extending Air Barrier over window and door openings.
- E. Attach Air Barrier to wood, insulated sheathing board or exterior gypsum with plastic cap nails every 12” to 18” on vertical stud line with wood stud framing, and screws with washers to metal stud framing. When attaching to wood sheathing, a minimum 1.0 inch crown staple may be used. When attaching to masonry, use adhesive recommended by manufacturer.
- F. Prepare window and door rough openings as follows:
 - 1. Prepare each window rough opening by cutting a modified “I” pattern in the Air Barrier.
 - 2. Horizontally cut Air Barrier along bottom of header.
 - 3. Vertically cut Air Barrier down the center of window openings from the top of the window opening down to 2/3 of the way to the bottom of the window openings.
 - 4. Diagonally cut Air Barrier from the bottom of the vertical cut to the left and right corners of opening.
 - 5. Fold side and bottom flaps into window opening and fasten every 6 inches. Trim off excess.
 - 6. Prepare each rough door opening by cutting a standard “I” pattern in the Air Barrier.
 - 7. Horizontally cut Air Barrier along bottom of door frame header and along top of sill.
 - 8. Vertically cut Air Barrier down the center of door openings from the top of the door opening (header) down to the bottom of the door opening (sill).
 - 9. Fold side flaps inside around door openings and fasten every 6 inches. Trim off excess.
- G. Tape all horizontal and vertical seam of Air Barrier with DuPont™ Tyvek® Tape.
- H. Seal all tears and cuts in Air Barrier with DuPont™ Tyvek® Tape.

END OF SECTION

SECTION 07311

ASPHALT SHINGLES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing an asphalt shingle roof on new construction.

1.2 RELATED SECTION: 07600 Flashing and Sheet Metal.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's catalog cuts and installation recommendations.
- C. Samples: Furnish three of each of the following:
 - 1. Underlayment: Full roll width by 1-foot length.
 - 2. Roll Roofing: 1-foot by 1-foot sample of each color selected.
 - 3. Shingles: Sufficient pieces to show color variation (at least 3) of each color selected in each style selected.
- D. Manufacturer's warranty for approval.

1.4 PRODUCT HANDLING

- A. Deliver shingles in manufacturer's original, unopened, protective packaging. Comply with manufacturer's recommendations for protection.

1.5 QUALITY ASSURANCE

- A. Follow recommendations of ARMA Residential Asphalt Roofing Manual, latest edition.

1.6 GUARANTEE

- A. Furnish a written 20-year minimum warranty on shingles and a 2-year guarantee against a defective roofing system, including repairing to maintain a watertight condition. Before beginning work, report to Contracting Officer if any specification requirements conflict with shingle manufacturer's warranty requirements.

PART 2 PRODUCTS

2.1 ROOFING FELT

- A. ASTM D226-89, 30 pound, unperforated.

2.2 ROLL ROOFING

- A. ASTM D249-89, 90-pound mineral surfaced.

2.3 SHINGLES

- A. Wind resistance: shingles rated to wind speed determined by ASCE 7 with a 10-year wind warranty.
- B. Construction: 2-ply algae resistant laminated shingle, conforming to ASTM D3462, with a minimum 50-year material warranty and a minimum 15-year non-prorated labor and material watertightness warranty (i.e. Certainteed-Sure Start Plus 5 Star, GAF-Golden Pledge, Malarkey-steep slope system, etc.)

2.4 FASTENERS FOR SHINGLES ON ROOF ABOVE EAVES:

- A. Roofing nails: hot dipped galvanized 12-gauge 1-1/4-inch-long barbed shanks with 3/8-inch diameter heads.

2.5 FASTENERS FOR SHINGLES ON EAVES:

- A. Use fasteners short enough to not protrude through eave deck. Increase number of fasteners per strip from 4 to 6 minimum.

2.6 METAL EDGING

- A. 28-gauge metal D-shape as shown.

PART 3 EXECUTION

3.1 INSPECTION

- A. Surface to which the roofing is to be applied shall be even, smooth, sound, clean, and dry. Do not begin roofing work until surface deficiencies have been corrected.

3.2 DRIP EDGE

- A. Install at eaves and rakes using roofing nails 9 inches on center.

3.3 FELT UNDERLAYMENT

- A. Center a 36-inch width in each valley and tack in place. Then beginning at edge of roof, lay felt parallel to eaves and lap each course 2 inches over underlying course. Lap ends 4 inches and stagger end laps 6 feet minimum. Lap felts 6 inches onto valley and lap the felt 6 inches from both sides over all hips and ridges. Where roof meets a vertical surface, carry underlayment 4 inches up the surface. Tack felts in place.

3.4 VALLEY FLASHING

- A. Center 36-inch-wide strip of roll roofing in valley, mineral side up, and tack in place.

B. ROOF PENETRATION FLASHING

- C. Install preformed metal flashing under shingles on upslope and on top of shingles on downside. Do not try to conceal downside of flashing.

3.5 LAYING SHINGLES

- A. Snap horizontal and vertical chalk guide lines on underlayment, then lay shingles following manufacturer's instructions. Construct valleys as woven. Construct hips and ridges from units cut from the strip shingles.

END OF SECTION

SECTION 07466

FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Siding panels.
- B. Soffit panels.
- C. Accessories and trim.

1.2 RELATED SECTIONS

- A. Section 06100 - Rough Carpentry: Framing and Sheathing.
- B. Section 07900 - Joint Sealers.
- C. Section 09900 - Paints and Coatings: Field painting.

1.3 REFERENCES

- A. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 1998.
- B. ASTM C 1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards; 1999.
- C. ASTM C 1186 - Standard Specification for Flat Non-Asbestos Fiber Cement Sheets; 1999.
- D. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 1998.
- E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 1999.
- F. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials; 1995.
- G. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 1999.
- H. ASTM E 228 - Standard Test Method for Linear Thermal Expansion of Solid Materials With a Vitreous Silica Dilatometer; 1995.
- I. ASTM G 26 - Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials; 1996.

1.4 SUBMITTALS

- A. Make submittals under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods, including nailing patterns.
 4. Applicable model code authority evaluation report (ICBO, BOCA, CCMC, etc.)
- C. Siding manufacturer's requirements for vapor retarders, primer, paint, etc., to be installed by others.
- D. Maintenance and periodic inspection recommendations.
- E. Manufacturer's warranty for approval.
- 1.5 QUALITY ASSURANCE
- A. Installer: Provide installer with not less than three years of experience with products similar to those specified.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Store products off the ground, on a flat surface, and under a roof or separate waterproof covering.
- 1.7 WARRANTY
- A. Register manufacturer's warranty, made out in Owner's name, with copy to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.

2.2 PANELS

- A. CertainTeed Corporation, Siding Products Group, P.O. Box 860, Valley Forge, Pennsylvania 19482. ASD. Tel: (800) 233-8990 <http://www.certainteed.com>.
- B. Fiber Cement Siding - General: Cement and cellulose fiber formed under high pressure into boards with integral surface texture, factory sealed with FiberTect and complying with ASTM C 1186 Type A Grade II; machined edges; for nail attachment.
1. Surface Burning Characteristics: Flame spread index of 0, smoke developed index of 6, maximum; when tested in accordance with ASTM E 84 (Class I/A).
 2. Flammability: Noncombustible, when tested in accordance with ASTM E 136.
 3. Flexural Strength: At least 1450 psi (10 MPa) when in equilibrium condition, and at least 1015 psi (7 MPa) when in wet condition, tested in accordance with ASTM C 1185.
 4. Coefficient of Thermal Expansion: Less than 1×10^{-5} /inch/inch/degree F (0.5×10^{-5} /degree C), when tested in accordance with ASTM E 228.

5. Water Vapor Transmission: Less than 7.0 perm-inch (10 ng/(Pa s m), when tested in accordance with ASTM E 96.
 6. Freeze Thaw Resistance: At least 80 percent flexural strength retained, when tested in accordance with ASTM C 1185.
 7. UV Resistance: No cracking, checking, or erosion, when tested for 2000 hours in accordance with ASTM G 26.
 8. Water Tightness: No water droplets on underside, when tested in accordance with ASTM C 1185.
- C. Vertical Siding: WeatherBoards FiberCement Siding.
1. Thickness: 5/16 inch (8 mm), nominal.
 2. Size: 48 by (96 to 120)inches as required
 3. Style: Cedar panel, 3/8 inch (9.5 mm) wide grooves at 8 inches (200 mm) on center.
 4. Finish: Approved manufacturer's standard factory applied solid color.

2.3 ACCESSORIES

- A. Trim: cut from 1" thick composite trim; cut edges primed.
- B. Alternate trim: Pressure preservative treated western red cedar, without knotholes, checks, or cracks, No.1 grade or better; 1 inch (25 mm) nominal thickness.
- C. Sealant: Paintable, 100 percent acrylic latex caulk complying with ASTM C 920.
- D. Sheet Metal Flashing: Minimum 26 gauge copper sheet
- E. Nails: Stainless steel; length as required to penetrate minimum 1-1/4 inch (32mm) into solid backing.
- F. Building Paper: Kraft or bituminous paper; not polyethylene or foil.
- G. Field Finish Paint: 100 percent acrylic latex as specified in Section 09901

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to commencing installation, verify governing dimensions of building and condition of substrate.

3.2 PREPARATION

- A. Examine, clean, and repair as necessary any substrate conditions that would be detrimental to proper installation.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and drawing details.
 - 1. Read warranty and comply with all terms necessary to maintain warranty coverage.
 - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 - 3. Use trim details indicated on drawings.
 - 4. Touch up all field cut edges before installing.
 - 5. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing into studs.
- C. Allow space between both ends of siding panels that butt against trim for thermal movement; seal joint between panel and trim with exterior grade sealant.
- D. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- E. Install sheet metal flashing above door and window casings and horizontal trim in field of siding.
- F. Do not install siding less than 6 inches (150 mm) from surface of ground nor closer than 1 inch (25 mm) to roofs, patios, porches, and other surfaces where water may collect.
- G. After installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.
- H. Finish Painting: as specified in Section 09901. within 24 months after installation.

3.4 CLEANING

- A. At completion of work, remove debris caused by siding installation from project site.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07600

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing flashing and sheet metal including but not limited to gutters, roof penetration flashing, roof drip edge, window flashing, louvers.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Shop Drawings: Show sheet metal items, including joints, types and locations of fasteners, and special shapes.
- C. Samples: Two 12-inch by 12-inch samples of each sheet metal material. Show pattern, finish, color, and thickness.
- D. Manufacturer's Literature: Sheet metal manufacturer's welding instructions, printed instructions, and recommendations for installation.

1.3 GUARANTEE

- A. Guarantee materials and workmanship for two years.

PART 2 PRODUCTS

2.1 MATERIAL COMPATIBILITY

- A. All metals including fasteners in contact shall be the same material or isolated with an appropriate coating, elastomeric membrane, washer or gasket to prevent electrolysis.

2.2 SHEET METAL

- A. Copper: ANSI/ASTM B370-84a, cold rolled temper, weighing minimum of 16 ounces per square foot.
- B. Stainless Steel: ASTM A167-84, Type 304, soft temper, mill finish, 20 ga. minimum.

2.3 FASTENERS

- A. Nails: FS FF-N-105B, flathead, wire barbed, or slating type.
- B. Screws: FS FF-S-107C, self-tapping sheet metal type.
- C. Rivets: type and size as recommended by sheet metal manufacturer.
- D. Bolts: FS FF-B-575C, hex or square head.
- E. Nuts: FS FF-N-836D, hex head.

2.4 SOLDER

- A. ASTM B32-83, alloy grade 50A, 50 percent tin, 50 percent lead.

2.5 FLUX

- A. For stainless steel, FS O-F-506C, or manufacturer's standard, phosphoric acid type.

2.6 SEALANT

- A. FS TT-S-227E, Type II, Class A, or FS TT-S-230A, Type II, or manufacturer's standard, one part polysulfide, silicone, or polyurethane type.

2.7 BITUMINOUS PLASTIC CEMENT

- A. FS SS-C-153C, Type I or II.

2.8 PRIMER COATING

- A. FS-TT-P-641G, Type I or II, prime coat for finished painting. FS TT-P-645A, prime coat for finished painting or for terne.

2.9 ASPHALTIC COATING COMPOUND

- A. FS TT-C-494A, Type II.

2.10 UNDERLAYMENT

- A. ASTM D226-82, asphalt saturated, unperforated roofing felt, 15 or 30-pound type.

2.11 SLIP SHEET

- A. Building paper, FS UU-B-790A, Type I, Grade A, Style 1b.

2.12 FABRICATION

- A. Cleats: Minimum width, 2 inches. Same material and thickness as sheet metal or copper, 16 ounces per square foot, or for use with weathering steel, stainless steel, 26-gauge or 28-gauge.
- B. Reglets: Manufacturer's standard or same material and thickness as sheet metal. Shop formed corners and joint connectors.

PART 3 EXECUTION

3.1 INSPECTION

- A. Determine that surfaces are smooth and clean to the extent required for sheet metal work. Correct defective surfaces or report them to the Contracting Officer. Verify that all preliminary conditions and installations are in place before commencing work.

3.2 INSTALLATION

- A. General: Install work watertight, without waves, warps, buckles, fastening stresses, or distortion. Allow for expansion and contraction. Angle bottom edges of exposed vertical surfaces to form drips. Hem exposed edges.
- B. Seams:
 - 1. Common Lock Seams: Finished width, 5/8 inch. Four ply loose lock.
 - 2. Flat Lock Seams: Finished width, 3/4 inch. Four ply flat lock, malleted tight. Sweat full with solder.
 - 3. Drive Lock Seams: Fold back abutting edges; cover joint with 1-1/8-inch-wide loose drive cap.
 - 4. Single Corner Seams: Finished width, 5/8 inch. Three ply loose lock. Lap corners and solder.
 - 5. Double Corner Seams: Finished width, 5/8 inch. Four ply double lock.
 - 6. Lap Seams: Finished width, 7/8 inch.
 - 7. Soldered Lap Seams: Finished width, 1 inch. Sweat full with solder. When using weathering steel, weld.
 - 8. Cover Plate Seams: Space abutting sheets 1/2 inch apart plus fastener thickness. Cover joint with 4-inch-wide backup with cover plate set in sealant. Match plates to flashing profile. Secure plates to substrate with screws installed through open space between flashing sheets.
 - 9. Standing Seams: Finished height, 1 inch. Five-ply double lock or three-ply single lock seams may be used.
 - 10. Capped Standing Seams: Finished height, 1 inch. Cover seams with 1-1/2-inch-wide loose drive cap.
 - 11. S-Lock Seams: Form 1-1/2-inch-wide S-shaped seam on one edge of flashing sheet for concealed fastening.
 - 12. Riveted Lap Seams: Finished width, 1 inch. Rivet 18 inches on center.
- C. Cleats: Space 2 feet on center. For copper, space 1 foot on center. Secure to substrate with fasteners and cover heads with cleat tabs. For continuous cleats, secure to substrate with fasteners spaced 1 foot on center.

- D. Reglets: Install in accurate locations, straight, in-line, and with leak-proof joints.
- E. Soldering: Clean and flux metals before soldering. Sweat solder completely through seam width.
- F. Sealant Installation: Apply 1/4-inch diameter bead, centered on full length of joint.
- G. Bituminous Plastic Cement: Trowel 1/8-inch thick.
- H. Painting: Back paint items as indicated with primer to 1.5-mil dry film thickness. Back paint zinc alloy with asphalt coating compound to 3-mil dry film thickness. Apply 7.5-mil dry film thickness asphalt coating compound to each contacting metal face of dissimilar metals.
- I. Roof Counterflashing: Overlap base flashing 4 inches minimum. Install bottom edge tight against base flashing. Lap seam vertical joints 3 inches minimum. Apply sealant. Miter, lap seam, and close corner joints with solder or sealant.
- J. Base Flashing: Extend flashing from 2 inches above top edge of base shingle to 1-1/2 inches above butt edge of covering edge of shingle. Extend up vertical surface 5 inches minimum and onto roofing 4 inches minimum. Install flashing under each shingle course. Secure top edge of flashing by nailing to substrate. At chimneys, roof hatches, and skylights, extend up vertical surface 8 inches minimum and onto roofing 4 inches minimum. Solder lap vertical seams. Miter and solder lap corners.
- K. Apron Flashing Where Roof Slopes Away From Vertical Surface: Extend up vertical surface 4 inches or to first brick joint, and onto roof surface 4 inches minimum. Secure top edge to wall sheathing. Hem bottom edge 1/2 inch. Lap seam of vertical joints 3 inches minimum and apply sealant, engaging hemmed edges. Miter and solder joints, and extend around corners 3 inches. Install bottom edge tight against roofing. Attach clips to substrate with concealed fasteners. Reinforce clips by double bending back over bottom edge of flashing. Counterflash top edge.
- L. Cricket Flashing: Form cricket to slope away from vertical surfaces. Solder lap joints. Extend up vertical surfaces 4 inches minimum, and onto roof surfaces 8 inches minimum with edges folded back over 1/2 inch. Cleat to substrate.
- M. Rake Flashing: Extend horizontal flange 3 inches under roofing. Nail to substrate. Extend vertical face over fascia. Lap seam joint in direction of water flow.
- N. Gutters: Strap hung 5" half round type. Strap hangers installed after drip edge at 30" on center. Ends to be left open, no downspouts.
- O. Roof Penetration Flashing: For base flashing, extend flange onto roof 6 inches minimum away from penetration. At shingle roof, extend roof flange 8 inches minimum away from penetration. Extend flange upward around penetration to at least 8 inches above roofing felts. Fold back upper and side roof flange edges 1/2 inch. Solder lap joints. For counterflashing, overlap base flashing 1 inch minimum with storm collar sloped away from penetration. Secure to penetration with draw band and sealant, rivet and sealant, solder, or by welding.
- P. Equipment Support Flashing: Fully cap support; overlap base flashing 4 inches. Solder lap joint. Seal around penetration through flashing.
- Q. Through-Wall Flashing: Where shown, start flashing 1/2 inch behind exposed face of wall and extend through wall. Lap seam joints and seal with sealant. Seal around penetrations through flashing.

- R. Repair or replace damaged work.
- S. CLEANING
- T. As work progresses, neutralize excess flux with 5 to 10 percent washing soda solution and thoroughly rinse. Leave work clean and free of stains and debris.

END OF SECTION

SECTION 07900

SEALANTS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing sealants to provide a barrier against air, water, moisture, or dirt, and where needed for appearance.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's technical data and application instructions.
- C. Manufacturer's warranty for approval.

1.3 QUALITY ASSURANCE

- A. Contractor shall have copies of referenced ASTM standards available on the job site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers and store in a protected area at temperatures recommended by manufacturer.

1.5 ENVIRONMENTAL CONDITIONS

- A. Install sealants only in favorable weather conditions as defined in ASTM C962-86.

PART 2 PRODUCTS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.
 - 1. Backer Rod Manufacturing and Supply Company, Denver, Colorado.
 - 2. Dow Chemical Company, Midland, Michigan.
 - 3. Dow Corning Corporation, Midland, Michigan.
 - 4. General Electric Company, Waterford, New York.
 - 5. Pecora Corporation, Harleysville, Pennsylvania.
 - 6. Sika Chemical Corporation, Lyndhurst, New Jersey.
 - 7. Sonneborn-Contech, Minneapolis, Minnesota.
 - 8. Tremco, Cleveland, Ohio.
 - 9. Williams Products, Inc., Troy, Michigan.

2.2 EXTERIOR SEALANTS

- A. Vertical Surfaces: Silicone or urethane. ASTM C920-87, Type S, Grade NS, Class 25, Use M, A, or O, as applicable.

2.3 INTERIOR SEALANTS

- A. Horizontal Surfaces in Traffic Areas: Urethane. ASTM C920-87, Type S or M, Grade P, Class 25, Use T. Grade NS, Use T, in areas with slopes exceeding 1 percent.
- B. Horizontal Surfaces in Nontraffic Areas: ASTM C920-87, Type S, Grade P, Class 25, Use NT. Grade NS, Use NT, in areas with slopes exceeding 1 percent.
- C. Vertical and Horizontal Surfaces, Dry Areas Only, No Movement Anticipated: Single component water-based latex, paintable, ASTM C834-76.

2.4 JOINT FILLERS

- A. ASTM C962-86, Type A, rod stock closed cell polyethylene foam, closed cell neoprene foam, or open cell urethane foam, recommended by sealant manufacturer for compatibility with sealant and primer.
 - 1. Polyethylene: Ethafoam SB by Dow Chemical.
 - 2. Neoprene: Neocord by Williams Products.
 - 3. Urethane: Denverfoam by Backer Rod Manufacturing and Supply.

2.5 BOND BREAKER TAPE

- A. Colored polyethylene pressure sensitive tape, minimum thickness 0.012 inch.

2.6 PRIMER

- A. Use primer if sealant manufacturer recommends it for anticipated substrates and environmental conditions. If manufacturer or Contracting Officer decides that adhesion tests are necessary to determine primer use, send substrate samples to sealant manufacturer with copy of transmittal to Contracting Officer. Testing will not be at Contractor's expense.

PART 3 EXECUTION

3.1 INSTALLATION OF SEALANTS

- A. Follow sealant manufacturer's instructions for installation of sealants, joint fillers, bond breakers, and primers. Tool joints concave.
- B. Install latex sealants in accordance with ASTM C790-84.
- C. Install elastomeric sealants in accordance with ASTM C962- 86.

END OF SECTION

SECTION 08162

ALUMINUM SLIDING GLASS DOORS & PARTITIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing ABA compliant sliding glass doors at both interior and exterior locations and an aluminum framed glass interior partition.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Shop Drawings: Show elevations and dimensions of doors, details of panels, hardware, screens, cutouts, reinforcement, and manufacturer's anchoring and installation recommendations.
- C. Samples: Submit production section samples of adequate size to establish color range.
- D. Manufacturer's warranty for approval.

1.3 QUALITY ASSURANCE

- A. Doors shall be labeled AAMA Quality Certified.

1.4 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
- C. Register manufacturer's warranty in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 DOORS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.
 - 1. Arcadia
 - 2. Fleetwood
 - 3. Kawneer

- B. Interior: Multiple Sliding 'Mall Entrance' Glass Doors.
 - 1. Fleetwood 3050
 - 2. Glass: Section 08810. Factory glaze units.
 - 3. Panels: Fixed and sliding panels shall be removable for glazing and maintenance.
 - 4. Thresholds 1/2" or under complying with ABA 404.2.5 and ABA 303
- C. Exterior: Multiple Sliding 'Mall Entrance' Glass Doors.
 - 1. Fleetwood 3070
 - 2. Glass: Section 08810. Factory glaze units.
 - 3. Panels: Fixed and sliding panels shall be removable for glazing and maintenance.
 - 4. Thresholds 1/2" or under complying with ABA 404.2.5 and ABA 303
 - 5. Comply with wind loading requirements.

2.2 PARTITION

- A. Aluminum framed glazed partition.

2.3 FINISH

- A. White enamel
- B. Accessories: Visible anchors and hardware brushed stainless steel.

PART 3 EXECUTION

3.1 INSPECTION

- A. Replace scratched, chipped, or defective units.

3.2 INSTALLATION

- A. Set doors plumb and level, in alignment with surrounding work.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors for smooth operation, ensuring accurate alignment of screen panel.
- B. Remove labels. Clean surfaces with mild solutions containing no abrasive materials or corrosive solvents. Clean aluminum with water or an approved petroleum type cleaning agent.

END OF SECTION

SECTION 08210

ARCHITECTURAL DOORS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing exterior and interior flush and rail and stile doors in various materials.

1.2 RELATED WORK

- A. Section 06220 Finish Carpentry
- B. Section 08710 Hardware

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's Data: Installation instructions and recommendations.
- C. Elevations of doors showing location of hardware (kick plate, lockset and handset) locations.
- D. Samples: Doors: Minimum 8-inch by 8-inch cross section of door. Sample to show; Finish surface for interior/exterior surface, vertical and horizontal edges, and intersection joinery and core material.
- E. Manufacturer's warranty for approval.

1.4 QUALITY ASSURANCE

- A. Certifications from manufacturer that door meets the requirements listed in PART 2 PRODUCTS.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames in labeled, protective packaging.
- B. Store doors on raised supports to prevent damage. Store only in covered interior of building area.

1.6 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Furnish a written guarantee-warranty from manufacturer for all doors, including costs of transportation, handling, refinishing, re-hanging, and other incidental charges. Guarantee period shall be minimum five years.

A.

PART 2 PRODUCTS

2.1 WOOD FLUSH DOORS

A. Meet requirements of WDMA I.S. 7-A-2004

1. Face Panels: Hardboard.
2. Core: Solid Particleboard.

2.2 WOOD RAIL AND STILE GLAZED DOORS

A. Meet requirements of ANSI/AAMA/NWDA 101/I.S.2-97

1. Rails and stiles: Solid vertical grain Douglas Fir.
2. Glazing: Factory installed insulated low-E clear safety glass units.
3. Jambs: Solid wood or composite.

PART 3 EXECUTION

3.1 INSTALLATION

A. Following manufacturer's recommendations, install doors plumb to provide free swinging operation with easy closing and secure latching.

3.2 CLEARANCE

A. At jambs and head, provide uniform clearance of 1/16 inch to 1/8 inch. Except at undercut doors, bottom clearance shall be 1-1/2 inch maximum above finish flooring.

END OF SECTION

SECTION 08520

PLASTIC FRAMED WINDOWS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing plastic framed windows.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Shop drawings: Show window locations, dimensions, types, hardware, fasteners, anchors, and screens. Include manufacturer's installation recommendations.
- C. Samples: Submit production section samples.
- D. Manufacturer's warranty for approval.

1.3 QUALITY ASSURANCE

- A. Windows shall be labeled AAMA Certified.

1.4 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
- C. Register manufacturer's warranty in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 WINDOW UNITS

- A. ANSI/AAMA/NWDA 101/I.S.2, Horizontal Sliding Windows, panel arrangement and sizes as shown.
- B. Vinyl Frames: Integral color PVC compound containing impact-resistant solid plasticizer, titanium dioxide UV inhibitor, and surface and color stabilizers. Comply with ASTM D 4216.
- C. (Alternate; See Section 01270) Fiberglass Reinforced Plastic (FRP) Frames: AAMA 305 glass fiber reinforced thermoset profile.
- D. Glass: Factory installed insulated clear low-E safety glass units.
- E. Panels: Fixed and sliding panels shall be removable for glazing and maintenance. Secure fixed panels in place at top and bottom. Sliding panels in locked position shall not be removable from the outside.
- F. Screens: Provide manufacturer's standard sliding insect screen assembly for sliding panels.

G. FINISH

1. Vinyl Frames: White.
2. FRP: Factory coated white
3. Anchors and hardware: Stainless steel.
4. Screen frames: Match windows.

2.2 SEALANTS

- A. Section 07900.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Set windows plumb and level, in alignment with surrounding work. Anchor to maintain positions when subjected to normal thermal and building movement and anticipated wind loads.
- B. Seal units to provide a weathertight installation.

3.2 ADJUSTING AND CLEANING

- A. Adjust windows for smooth operation.
- B. Remove labels. Clean surfaces without using abrasive cleaners or solutions containing corrosive solvents.

END OF SECTION

SECTION 08625

TUBULAR SKYLIGHTS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Product data
- C. Shop drawings: Include plans, elevations, sections, details and attachments to other work. Include manufacturer's installation recommendations.
- D. Samples: Production samples of aluminum large enough to show full color range of finish.

1.3 WARRANTY

- A. Provide minimum five year warranty from the date of Substantial Completion.
- B. Warranty shall be manufacturer's standard form in which the manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within the warranty period. Failures include, but are not limited to, the following:
 - 1. Water leakage.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3. Yellowing of glazing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.

2.2 TUBULAR SKYLIGHTS

- A. Tubular Skylights General : SOLATUBE or approved substitute. Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICBO/ICC AC-16. All components made and assembled by one manufacturer.
- B. Diffuser Assemblies for Tubes Penetrating Ceilings: Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination

of tube, with compression seal to minimize condensation and bug or dirt infiltration; 23.8 by 23.8 inches (605 by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.

- C. Lens: Prismatic lens design to maximize light output and diffusion. Visible Light Transmission shall be > 90 percent at 0.125 inches (3 mm) thick.
- D. ALTERNATE Lens: Frosted lens. Visible Light Transmission shall be > 90 percent at 0.125 inches (3 mm) thick.
- E. OPTIONAL Security Bars 0.375 inch (95 mm) stainless steel bar across flashing diameter opening.
- F. OPTIONAL Daylight Dimmer: Electro-mechanically actuated daylight valve.

2.3 ACCESSORIES

- A. Fasteners and flashing: Comply with Section 07600 paragraph 2.1.
- B. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Coordinate tubular unit skylight installation with installation of substrates, roof insulation, roofing and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weather tight.
- B. Where metal surfaces of units contact incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation as required by Section 07600 paragraph 2.1.
- C. Anchor units securely to supporting substrates.
- D. Remove labels. Clean surfaces without using abrasive cleaners or solutions containing corrosive solvents.

END OF SECTION

SECTION 08710

FINISH HARDWARE

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing finish hardware.

1.2 RELATED SECTIONS

- A. Section 08210 Wood Doors

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Hardware Schedule: Show item number, manufacturer, symbols and finish, kind, size, and hand of door, frame dimensions, and mounting heights for door knobs, push and pull bars, hinges, lock sets, wall latches and related items.
- C. Manufacturer warranties for approval.

1.4 PRODUCT HANDLING

- A. Deliver hardware packaged and marked for specific openings in accordance with approved schedule. Include with the package all screws, special wrenches, instructions, and installation templates for accurately locating, setting, adjusting, and attaching.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operating Tools: Furnish adjusting tools.
- C. Keys: Stamp keys for identification and deliver to Contracting Officer. Furnish two keys for each lock. The use of final keys will not be permitted during construction.
- D. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Manufacturer's operation and maintenance data for hardware.
 - 2. A final typed finish hardware schedule that includes any corrections and changes to the submittal schedule.
- E. Register manufacturer warranties in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.

2.2 HARDWARE

- A. Provide all accessories required for proper functioning.
1. Hinges: Number for each door indicated below.
 2. Strikes: On frame, box type strike plates.

2.3 SEALANT

- A. Section 07900.

2.4 KEY SYSTEM

- A. Provide Schlage Primus lock cylinders, to match existing park key system.

2.5 HARDWARE SCHEDULE

SET	ITEM	FINISH	MAKER
<u>HDWE 1 (Door 1)</u>			
3 pr Hinges 4 ½ x 4 ½	BB1191,	613	Hager
1 Lockset	AL Series Saturn Lever	613	Schlage
2 ea. Kick plates, 34"x18"	#48 beveled 4 sides	613	Quality
1 Set weatherseal gaskets	S44D	613	Pemko
1 Threshold	176B	612	Pemko
1 Door sweep	216BV	612	Pemko
2 ea. Flush extension bolts	1262	613	Quality
<u>HDWE 2 (Door 2)</u>			
1 1/2 pr Hinges 4 ½ x 4 ½	BB1191,	613	Hager
1 Lockset	AL Series Saturn Lever	613	Schlage
1 Threshold	176B	612	Pemko
1 Door sweep	216BV	612	Pemko
<u>HDWE 3 (Doors 4,5,6,7,9,11)</u>			
1 ½ pr. Hinges 3 ½ x 3 ½	BB1191,	613	Hager
1 Lockset	AL Series Saturn Lever	613	Schlage
1 ea. Strike	#10-072 w/K510-066 strike box		Schlage
1 ea. Wall Stop	W307TB,	613	Quality

HDWE 8 (Door 8)

3 pr Hinges 3 ½ x 3 ½	BB1191,	613	Hager
1 Lockset	AL Series Saturn Lever	613	Schlage
1 ea. Closer	4000 Series	613	LCN

CABINETS

2ea. Hinges, Duomatic type 17			
Pulls	117.05.620, 192mm long, US32D		Hafele
Full extension drawer glides			

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install hardware at location shown. Install items uniformly with like items in same relative positions.
- B. Follow manufacturer's instructions. Use accurately sized boring jigs, strike gauges, routers, and templates. Install locksets using a system of jigs and dado equipment capable of accurately cutting openings.
- C. Avoid marring or damaging hardware or adjacent work. Defaced screw heads and marred or imperfect hardware will not be acceptable.
- D. Clean and lubricate hardware and adjust for correct operation.

END OF SECTION

SECTION 09251

GYPSUM WALLBOARD

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing gypsum wallboard.

1.2 RELATED WORK

- A. Section 06100 Rough Carpentry

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's technical literature and installation instructions.

1.4 PROJECT CONDITIONS

- A. Minimum temperature in space shall be not less than 50 degrees F nor more than 80 degrees F. Maintain these temperatures for 48 hours before, during, and 48 hours after installation. Provide ventilation and heat as required to remove excess humidity.

1.5 QUALITY ASSURANCE

- A. Provide a copy of Gypsum Association's Recommended Specifications GA 216-93 for reference on the job site.
- B. For conditions not covered by this section, follow the recommendations in manufacturer's technical literature.

1.6 PRODUCT HANDLING

- A. Store gypsum board in covered interior of building area on raised supports, flat, taking care not to exceed load limits of floor. Leave in original wrappings or containers until ready for installation; protect against sagging or damage to edges, ends, and surfaces. Protect gypsum board from moisture and direct sunlight.

PART 2 PRODUCTS

2.1 GYPSUM WALLBOARD

- A. Exposed finish material shall have long edges tapered.

1. Water Resistant Type Gypsum Board.
- 2.2 SCREWS
 - A. ASTM C1002-93; Type W .
- 2.3 ADHESIVE
 - A. For Fastening Gypsum Board to Wood Framing: ASTM C557-73.
- 2.4 WATER
 - A. Clean, fresh, potable.
- 2.5 JOINT REINFORCING TAPE AND JOINT COMPOUND
 - A. ASTM C475-89.
- 2.6 ACCESSORIES
 - A. PVC corner and casing beads.
- 2.7 SEALANTS
 - A. Waterproof, flexible sealant as recommended by gypsum board manufacturer.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Ensure that surfaces to which gypsum board is to be applied are straight, even, smooth, all in the same plane, thoroughly clean and dry, and free from all defects that might affect proper application.
- 3.2 GENERAL INSTALLATION
 - A. Install in accordance with GA 216-93 and gypsum board manufacturer's installation recommendations.
 1. Install in maximum practicable lengths without end joints. Apply face layers horizontally for walls less than 8 feet 1 inch high, vertically for walls greater than 8 feet 1 inch high. Attach upper gypsum board first on horizontal applications. Butt joints loosely.
 2. If butt joints occur, stagger joints and locate as far as possible from center of ceilings or walls.
 3. No vertical joints shall occur within 8 inches of external corners of windows, doors, or similar openings, unless control joints are used.
- 3.3 ATTACHMENT
 - A. Secure gypsum board to framing with the screw attachment method in accordance with GA 216-93. The use of adhesives shall be as recommended by Gypsum Association.

1. Adhesives: When using adhesive in conjunction with screws, use fasteners to secure panels until adhesive cure is complete.
2. Fastener Application:
 - a. Spacing: Follow Gypsum Association's recommendations for fastener spacing.
 - b. Install fasteners no less than 3/8 inch from end or edge. Begin fastening from center of gypsum board and proceed toward outer ends or edges. Drive fasteners with shank perpendicular to face of board, applying pressure on gypsum board to ensure that it will be secured tightly to framing member. Check for looseness at fasteners.
 - c. Drive screws with a positive clutch electric power tool. Surface of head shall be slightly below surface of paper without cutting paper or stripping framing member around screw shank.

3.4 ACCESSORIES

- A. Install in maximum practicable lengths.
 1. Corner Bead: Reinforce all vertical and horizontal exterior corners.
 2. Casing Beads: Apply over gypsum panels where partitions or ceilings terminate against dissimilar materials and around windows and door jambs.

3.5 FINISHING GYPSUM WALLBOARD

- A. Finish joints and trim pieces in accordance with manufacturer's instructions to Level 4 requirements, as defined in GA 214-90.

END OF SECTION

SECTION 09510

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing a suspended acoustical ceiling system.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Shop Drawings: Layout of ceiling system, including related mechanical and electrical systems; details of intersections of members including anchorage methods.
- C. Samples: Minimum 6-inch-square samples of each type, color, and pattern of tile or panel; minimum 12-inch-long samples of main runners with moldings and hangers.
- D. Manufacturer's Data: Technical product data and installation instructions for system.
- E. Manufacturer's warranty for approval.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in original, unopened, protective packaging, with manufacturer's labels intact and legible, showing brand name, pattern, size, thickness, and fire rating.
- B. Follow manufacturer's recommendations for storage.

1.4 PROJECT CONDITIONS

- A. Install acoustical units after building is fully enclosed, components in ceiling are installed, and heating system is operating. Maintain minimum temperature of 60 degrees F and maximum humidity of 40 percent during installation of acoustical units and until final acceptance.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Furnish, in manufacturer's unopened labeled boxes, extra stock of 5 percent additional units of each type of acoustical material.
- C. Operation and maintenance data for review and approval as required by Section 01785.
- D. Register manufacturer's warranty in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Furnish system components from one manufacturer.

2.2 SUSPENSION SYSTEM

- A. ASTM C635-91, intermediate duty.
 - 1. Grid Material: Cold rolled galvanized steel.
 - 2. Grid Finish: Baked Polyester Paint.
 - 3. Support Channels and Hangers: Cold rolled galvanized steel.
 - 4. Accessories: Clips, tees, adapters, and spacers as recommended by manufacturer.

2.3 ACOUSTICAL UNITS

- A. ASTM E1264-90.
 - 1. Composition: Wet formed mineral fiber.
 - 2. Pattern: Medium texture non-directional pattern.
 - 3. Finish: Factory applied latex paint.
 - 4. Color: White
 - 5. Minimum Noise Reduction Coefficient (NRC): .55
 - 6. Minimum Ceiling Sound Transmission Class (CSTC):
 - 7. Nominal Size: 24 inches by 24 inches.
 - 8. Nominal Thickness: 5/8 inches.
 - 9. Edge: Square.
 - 10. Density: 11.5 pounds per cubic foot.
 - 11. Joint Detail: Lay-in.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ensure that major work above ceiling is complete and that surfaces to receive ceiling systems are even and dry.

3.2 INSTALLATION

- A. Suspension System:

1. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
 2. Install system as recommended by manufacturer, complying with ASTM C636-92.
 3. Install hangers supported only from building structural members, plumb and free from contact with insulation and other objects. Support main runners directly from hangers, not bearing on walls or partitions. Support fixtures independently from suspension system, or provide additional hangers for fixtures as required to prevent exceeding deflection capability.
 4. Interlock cross runners with main runners or other cross runners.
 5. Provide moldings where ceilings meet walls, partitions, and other vertical elements. Install angle type moldings with exposed leg in same plan as bottom flange of runners.
 6. Form expansion joints as shown to accommodate plus or minus 1 inch movement.
- B. Acoustical Units: Lay units flush and level, without damaged edges or corners. Scribe and accurately fit units at borders and around pipes, ducts, and other connecting work, centering lighting fixtures on units where possible.
- C. Hold-Down Clips: Install where shown and recommended by manufacturer.
- 3.3 CLEANING
- A. Clean soiled or discolored panel surfaces as recommended by manufacturer. Remove and replace damaged or improperly installed units.

END OF SECTION

SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing resilient flooring.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit samples of floor covering material in quantity sufficient to show pattern and color range, and a 4-foot length of base material.
- C. Manufacturer's warranty for approval.

1.3 PRODUCT HANDLING

- A. Delivery: Deliver in manufacturer's original, unopened protective packaging with labels intact and legible showing brand name, colors, and patterns.
- B. Storage: In accordance with manufacturer's recommendations.

1.4 PROJECT CONDITIONS

- A. Maintain a minimum temperature of 70 degrees F in space to receive flooring for 24 hours before and 48 hours after installation. Moisture content of concrete slabs and relative humidity shall be within limits recommended by flooring manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Maintenance Manuals: Submit manufacturer's data for flooring and base.
- C. Extra Stock: Furnish in unopened cartons one box of each type and color of tile of same run as installed for future replacements.
- D. Register manufacturer's warranty in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be accepted through proper substitution procedure.

2.2 TILE FLOORING

- A. FS SS-T-312B, vinyl composition, asbestos-free, 12 inches by 12 inches by 1/8 inch.

2.3 COLORS AND PATTERNS

- A. Colors: Tile to be Armstrong Vinyl Composition Tile, 12"x12" Excelon, color 51875 "Mid-grayed Blue."

2.4 ACCESSORIES

- A. Resilient Base: BurkeMercer 6" cove vinyl base
 - 1. Conference Room and Work/mail Room: color "209 Grey-Beige"
 - 2. All other rooms: color "323 Bluebonnet"
- B. Resilient Edge Strips: 1-inch-wide, 1/8-inch-thick, homogenous vinyl or rubber composition, tapered or bullnose edge, color to match flooring.
- C. Metal Edge Strips: Width and thickness as shown. Provide units of maximum available length, minimizing number of joints. Strips, extruded aluminum with mill finish.
- D. Adhesives: Waterproof, stabilized type, as recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Install flooring after finishing operations, including painting, have been completed and heating system is operating.
- B. Determine that surfaces to which flooring is to be applied are even, smooth, sound, thoroughly clean and dry, and free from defects that might affect proper installation. Report unsatisfactory surfaces to Contracting Officer, or correct defective surfaces.
- C. Before installation of flooring, broom clean or vacuum surfaces to be covered.

3.2 GENERAL

- A. Place flooring with adhesive cement complying with manufacturer's recommendations. Butt tightly to vertical surfaces, thresholds, nosings, and edgings. Scribe flooring around obstructions to produce neat joints; lay with joints tight, even, and straight. Extend flooring into toe spaces, door reveals, closets, and similar openings.

- B. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, or other surface imperfections.

3.3 TILE FLOORING

- A. Lay tile from center marks established with principal walls, adjusting as necessary to avoid cut widths less than 3 inches at perimeters, ensuring equal widths at opposite edges of room. Lay tile square to room axis. Match color and pattern of tiles, using tile from cartons in same sequence as manufactured and packaged, with grain running in same direction. Cut tile neatly to and around all fixtures. Broken, cracked, chipped, or deformed tile are not acceptable.

3.4 ACCESSORIES

- A. Resilient Base: Apply to walls, columns, pilasters, casework, and other permanent fixtures as required. Install base in as long lengths as practicable, with mitered or coped intersections. Tightly bond to backing with continuous contact at all surfaces. On masonry or irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
- B. Resilient Edge Strips: Place tightly butted to flooring; secure with adhesive. Install at all unprotected edges of flooring.
- C. Metal Edge Strips: Apply overlap or butt type, as shown, securing units to substrate with countersunk stainless steel anchors.

3.5 CLEANING

- A. Remove excessive adhesive using neutral type cleaners as recommended by flooring manufacturer. Protect installed flooring by covering.

3.6 FINISHING

- A. Before final inspection, clean floors and accessories. Wax and buff, following manufacturer's instructions.

END OF SECTION

SECTION 09680

CARPETING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing carpet and pad.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit samples of carpeting with full range of colors.
- C. Manufacturer's warranty for approval.

1.3 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770..
- B. Extra Stock: After completion of work, deliver not less than 5 percent of each type, color, and pattern of carpeting, exclusive of material required to properly complete installation. Furnish replacement materials from same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.
- C. Maintenance data for review and approval as required by Section 01785.
 - 1. Manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated traffic and use conditions. Include precautions against materials and methods which may be detrimental to finishes and performance.
 - 2. A carpeting schedule listing, for each type of carpet and pad installed, the manufacturer, product name and/or number, color name and or number, and locations installed.
- D. Register manufacturer's warranty in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.

2.2 CARPET

- A. Carpet shall be level construction, free from blemishes, streaks, poorly dyed areas, and other defects.
- B. Product and color: Lees carpet, Attribute DL456, color 808 Black Floral.

2.3 NATURAL HAIR CUSHION

- A. FS DDD-C-001023, Type II.

2.4 ANCHORS

- A. 1-1/8-inch-wide plywood strips same thickness as carpet cushion, having two staggered rows of 16-gauge steel tacks at 60-degree angles.

2.5 ADHESIVE

- A. As recommended by carpet manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ensure that surfaces on which carpet is to be laid are clean, thoroughly dry, and free from defects that might affect installation.

3.2 INSTALLATION

- A. Padding: Lay smooth and even, waffle side down, joints butted. Use continuous lengths in widths as broad as possible. Secure in place with adhesive, using solid application at edges.
- B. Carpet: Install in accordance with manufacturer's printed recommendations, using continuous lengths in widths as broad as possible to minimize placement of seams in traffic lanes. Match carpet pattern at seams. No seams shall occur perpendicular to doors or entries. Center parallel seams directly under doors. Lay carpet with pile inclination in same direction. Fit neatly into breaks and recesses, against bases, around pipes and penetrations, under saddles and thresholds, and around permanent equipment. Where edges are exposed, cut to form invisible, nonraveling joints.
- C. Anchors: Install where carpeting abuts vertical surfaces.

3.3 CLEANING

- A. Vacuum carpet using commercial machine with face-beater element. Remove spots and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors.

3.4 PROTECTION

- A. Cover carpeted areas until final acceptance.

END OF SECTION

SECTION 09901

PAINTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of painting and finishing work, including touch-up of factory or shop applied prime coats, painting mechanical and electrical work, and applying piping identification symbols and colors. The work does not include painting prefinished items, finished metal surfaces, or operating parts.

1.2 RELATED WORK

- A. Section 06100 Rough Carpentry.
- B. Section 06102 Wood Treatment.
- C. Section 06200 Finish Carpentry
- D. Section 150765 Mechanical Identification

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. A complete list of materials proposed to be provided for the work.
- C. Prepare at the job site mockups including:
 - 1. Field colors: 4 feet by 4 feet color samples of paint applied on same surface material as will be used in the work.
 - 2. Trim Colors: 4 linear feet color samples of paint applied on same surface material as will be used in the work.
- D. Manufacturer's warranty for approval.

1.4 DEFINITIONS

- A. VOC - volatile organic compounds.

1.5 PROJECT CONDITIONS

- A. Do not apply exterior materials in damp, rainy weather. Do not apply paint on surfaces in direct sunlight. Apply finishes only when air is free of dust that would speck the finish.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Block: 12 percent.
 3. Interior Wood: 15 percent.
 4. Exterior Wood: 18 percent.
 5. Concrete Floors: 10 percent.
- C. Keep fire hazard to a minimum; remove from the area daily all oily rags, waste, and other combustibles not in covered metal containers.

1.6 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Furnish one quart of each type and color of paint used.
- C. Maintenance data for review and approval as required by Section 01785.
 1. Manufacturer's cleaning instructions for painted surfaces.
 2. A final paint schedule listing, for each type of paint material used, the manufacturer, product name and/or number, color name and/or number, and locations installed.
- D. Register manufacturer's warranty in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.

2.2 PAINT AND FINISH PRODUCTS

- A. Paint specified in this section is based on products manufactured by Sherwin-Williams Company, Cleveland, Ohio. Provide primers and other undercoat paint produced by same manufacturer as finish coats. Paint products shall be fresh and well ground; shall not settle readily, cake, or thicken in the container; shall be broken up readily with paddle to a smooth consistency; and shall have easy application properties. Other materials such as linseed oil, turpentine, mineral spirits, miscellaneous thinners, varnish, and shellac shall be the highest quality of an approved manufacturer.

2.3 FILLING COMPOUNDS

- A. Use only high quality, nonshrink materials which have been approved.

2.4 COLORS

- A. Exterior:
 1. Exterior: paint to match colors of adjacent Visitor Center building. Consult with Contract Officer and NPS for colors.

B. Interior:

Colors Identified from Sherwin Williams paint company.

1. Walls:

- a. Conference Room: eggshell finish, color "SW 6206 Oyster Bay."
- b. All other rooms: eggshell finish, color "SW 7009 Pearly White."

2. Door frames: semigloss finish, color "SW 7009 Pearly White."

3. Doors: semigloss finish, color "SW 7036 Accessible Beige."

4. Wood shelves at Interior: stain SW 3121-P "Pearwood."

C. Match approved color samples.

PART 3 EXECUTION

3.1 GENERAL

- A. Cover and protect finished work and surfaces not to be painted. Use drop cloths of adequate size to protect adjacent areas.
- B. Mix and prepare painting materials in accordance with manufacturer's directions.
- C. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted, or provide surface applied protection. Reinstall removed items when final coat is thoroughly dry.
- D. Do not paint over dirt, rust, scale, grease, moisture, voids and blemishes, or other conditions detrimental to formation of a durable paint film.
- E. Apply paint in accordance with manufacturer's directions. Use techniques best suited for substrate and type of material being applied.
- F. Secure approval of each coat before proceeding with the next.
- G. Apply material evenly without runs, sags, or other defects. Leave moldings, trim, ornaments, edges, and millwork clean and true to details without excess paint in corners or depressions. Make edges of paint adjoining other materials or colors sharp and clean, without overlaps.
- H. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only.
- I. Paint interior surfaces of ducts visible through registers or grilles with a flat black paint.
- J. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
- K. Finish access panels, grilles, registers, and similar items in the same color as their surroundings.
- L. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
- M. Finish closets in the same colors as adjoining rooms.

- N. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by the manufacturer.
- O. Drying Time: Minimum time recommended by manufacturer. Do not apply succeeding coats until the undercoat is thoroughly dry.
- P. Sanding: Lightly sand between coats to ensure that surface finish is smooth to the touch. Exterior stained siding, soffits, fascia, and rough-sawn material need not be sanded.
- Q. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint. Final finish shall have uniform color and appearance.

3.2 PREPARATION AND FINISHING OF EXTERIOR AND INTERIOR WOOD

A. Preparation:

1. Remove dust by brushing and remove grease and oil by washing with mineral spirits or other solvent. Remove sap on wood surfaces by scraping and washing with turpentine. Sand all interior wood before priming.
2. Seal all knots or resinous areas with knot sealer and allow to dry at least 2 hours before priming. Fill all gouges, dents, and small openings in interior wood with plastic wood tinted for stained or natural appearance. Allow plastic wood to dry before painting.
3. Back prime backs, edges, and ends of interior and exterior wood.
4. Adjust natural finishes as necessary to obtain a like appearance on veneers and solid stock. Finish interior stained work to a furniture smooth surface.

B. Schedule:

1. General Painted Wood - Exterior:

Gloss:

- 1st coat: A-100 Alkyd Exterior Wood Primer, Y24W20. VOC 2.92 pounds per gallon.
- 2nd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.
- 3rd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

Low Luster:

- 1st coat: A-100 Alkyd Exterior Wood Primer, Y24W20. VOC 2.92 pounds per gallon.
- 2nd coat: A-100 Latex Flat, A6 Series. VOC 2.08 pounds per gallon.
- 3rd coat: A-100 Latex Flat, A6 Series. VOC 2.08 pounds per gallon.

2. Painted Wood Trim - Exterior:

Gloss for Deep Colors:

- 1st coat: A-100 Alkyd Exterior Wood Primer, Y24W20. VOC 2.92 pounds per gallon.
- 2nd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.
- 3rd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

3. Gloss for Medium Shades:

- 1st coat: A-100 Alkyd Exterior Wood Primer, Y24W20. VOC 2.92 pounds per gallon.
- 2nd coat: Industrial Enamel, B54Z Series. VOC 3.5 pounds per gallon.
- 3rd coat: Industrial Enamel, B54Z Series. VOC 3.5 pounds per gallon.

4. Painted Plywood - Exterior:

Flat:

- 1st coat: Chek-Gard Primer, B42W10. VOC 2.08 pounds per gallon.
- 2nd coat: A-100 Latex Flat, A6 Series. VOC 2.08 pounds per gallon.
- 3rd coat: A-100 Latex Flat, A6 Series. VOC 2.08 pounds per gallon.

5. Painted Woodwork and Hardboard - Interior:

Semi-Gloss:

- 1st coat: Wall and Wood Primer, B49WZ2. VOC 3.07 pounds per gallon.
- 2nd coat: ProMar Salon Alkyd Semi-Gloss Enamel, B34WZ2000 Series. VOC 2.08 pounds per gallon.
- 3rd coat: ProMar Salon Alkyd Semi-Gloss Enamel, B34WZ2000 Series. VOC 2.08 pounds per gallon.

Gloss:

- 1st coat: Wall and Wood Primer, B49WZ2. VOC 3.07 pounds per gallon.
- 2nd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.
- 3rd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

6. Stained Woodwork - Interior:

Rubbed Varnish: Quarts only.

- 1st coat: Interior Oil Stain, A48 Series. VOC 5.67 pounds per gallon.
 - 2nd coat: Oil Base Gloss Varnish, A66V91. VOC 4.50 pounds per gallon.
 - 3rd coat: Oil Base Gloss Varnish, A66V91. VOC 4.50 pounds per gallon.
- Fill open grained wood with Sher-Wood 100 Fast Dri Semi-Paste Filler, D70T1.

7. Natural Finish Woodwork - Interior:

Rubbed Varnish: Quarts only.

- 1st coat: Oil Base Gloss Varnish, A66V91. VOC 4.50 pounds per gallon.
 - 2nd coat: Oil Base Gloss Varnish, A66V91. VOC 4.50 pounds per gallon.
- Fill open grained wood with Sher-Wood 100 Fast Dri Semi-Paste Filler D70T1 and wipe before first varnish coat.

3.3 TOUCH UP OF PRE-FINISHED FIBER CEMENT SIDING AND COMPOSITE TRIM

A. Preparation: Refer to manufacturer's installation instructions

B. Schedule:

1. Fiber Cement Siding:

Low Luster:

1st coat: A-100 Latex Flat, A6 Series. VOC 2.08 pounds per gallon.

2nd coat: A-100 Latex Flat, A6 Series. VOC 2.08 pounds per gallon.

2. Composite Trim:

Low Luster:

1st coat (cut edges only):

A-100 Alkyd Exterior Wood Primer. VOC 2.92 pounds per gallon.

2nd coat: A-100 Latex Flat, A6 Series. VOC 2.08 pounds per gallon.

3rd coat: A-100 Latex Flat, A6 Series. VOC 2.08 pounds per gallon.

3.4 PREPARATION AND FINISHING OF INTERIOR AND EXTERIOR FERROUS METALS

A. Includes but is not limited to exterior fire sprinkler system and other plumbing, hangers and related hardware.

B. Preparation:

1. Clean ferrous surfaces that are not galvanized or shop coated of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning.

2. Touch up shop-applied prime coats wherever damaged or bare.

3. Clean galvanized surfaces free of oil and surface contaminants with nonpetroleum based solvent.

C. Schedule:

1. Ferrous Metal - Exterior:

Gloss:

1st coat: Kem Kromik Universal Metal Primer, B50NZ6/B50WZ1. VOC 3.50 pounds per gallon.

2nd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

3rd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

First coat is not required on items delivered shop-primed.

2. Zinc-Coated Metal - Exterior:

Gloss:

Primer: Galvite Primer, B50W3. VOC 4.00 pounds per gallon.

1st coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

3rd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

Flat:

Primer: Galvite Primer, B50W3. VOC 4.00 pounds per gallon.

1st coat: 2 coats ProMar Alkyd Flat Exterior Finish, B38 Series. VOC 4.00 pounds per gallon.

2nd coat: 2 coats ProMar Alkyd Flat Exterior Finish, B38 Series. VOC 4.00 pounds per gallon.

3. Ferrous Metal - Interior:

Gloss:

1st coat: Kem Kromik Universal Metal Primer, B50NZ6/B50WZ1. VOC 3.50 pounds per gallon.

2nd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

3rd coat: Industrial Enamel, B54Z Series. VOC 3.50 pounds per gallon.

First coat not required on item that are shop-primed.

Semi-Gloss:

1st coat: Kem Kromik Universal Metal Primer, B50NZ6/B50WZ1. VOC 3.50 pounds per gallon.

2nd coat: ProMar Salon Alkyd Semi-Gloss Enamel, B34WZ2000 Series. VOC 2.08 pounds per gallon.

3rd coat: ProMar Salon Alkyd Semi-Gloss Enamel, B34WZ2000 Series. VOC 2.08 pounds per gallon.

First coat not required on items that are shop-primed.

Flat:

1st coat: Kem Kromik Universal Metal Primer, B50NZ6/B50WZ1. VOC 3.50 pounds per gallon.

2nd coat: ProMar 200 Latex Flat, B30W200 Series. VOC 2.08 pounds per gallon.

3rd coat: ProMar 200 Latex Flat, B30W200 Series. VOC 2.08 pounds per gallon.

First coat not required on items that are shop-primed.

OR

Flat:

1st coat: Kem Kromik Universal Metal Primer, B50NZ6/B50WZ1. VOC 3.50 pounds per gallon.

2nd coat: ProMar 400 Latex Flat, B30W400 Series. VOC 2.08 pounds per gallon.

3rd coat: ProMar 400 Latex Flat, B30W400 Series. VOC 2.08 pounds per gallon.

First coat not required on items that are shop-primed.

4. Zinc-Coated Metal - Interior:

Flat:

- 1st coat: ProMar 200 Latex Flat, B30W200 Series. VOC 2.08 pounds per gallon.
2nd coat: ProMar 200 Interior Latex Flat, B30W200 Series. VOC 2.08 pounds per gallon.

OR

Flat:

- 1st coat: ProMar 400 Latex Flat, B30W400 Series. VOC 2.08 pounds per gallon.
2nd coat: ProMar 400 Latex Flat, B30W400 Series. VOC 2.08 pounds per gallon.

3.5 PREPARATION AND FINISHING OF INTERIOR AND EXTERIOR CONCRETE AND MASONRY

- A. Preparation: Remove as much efflorescence as possible using a clean dry wire or stiff fiber brush. Remove oil and grease by solvent wiping or by steam or alkali cleaning. Scrub surfaces with 5 percent to 10 percent muriatic acid to remove efflorescence and laitance, to clean the surface, to remove any glaze, and to etch the surface. Wash the acid solution from the surface using clean water.

B. Schedule:

1. Concrete, Stucco, and Masonry (Other than Concrete Masonry Units) - Exterior:

Flat:

- 1st coat: SuperPaint Latex Flat, A80 Series.
2nd coat: SuperPaint Latex Flat, A80 Series.

OR

Flat:

- 1st coat: A-100 Latex Flat, A6 Series.
2nd coat: A-100 Latex Flat, A6 Series.

3.6 PREPARATION AND FINISHING OF INTERIOR GYPSUM WALLBOARD

- A. Preparation: Fill minor irregularities with joint compound and sand to a smooth even surface.

B. Schedule:

Flat:

- 1st coat: ProMar 200 Latex Flat, B30W200 Series. VOC 2.08 pounds per gallon.
2nd coat: ProMar 200 Latex Flat, B30W200 Series. VOC 2.08 pounds per gallon.

OR

Flat:

1st coat: ProMar 400 Latex Flat, B30W400 Series. VOC 2.08 pounds per gallon.

2nd coat: ProMar 400 Latex Flat, B30W400 Series. VOC 2.08 pounds per gallon.

Semi-Gloss:

1st coat: PrepRite 200 Latex Wall Primer, B28W200 Series. VOC 2.08 pounds per gallon.

2nd coat: ProMar Salon Alkyd Semi-Gloss Enamel, B34WZ 2000 Series. VOC 2.08 pounds per gallon.

3rd coat: ProMar Salon Alkyd Semi-Gloss Enamel, B34WZ 2000 Series. VOC 2.08 pounds per gallon.

C. For wet, high washability areas (Toilet Room and Janitor Closet Wainscot):

Semi-Gloss

1st coat: PrepRite 200 Latex Wall Primer, B28W200 Series. VOC 2.08 pounds per gallon.

2nd coat: Water Based Epoxy B70 Series with B60V25 semi-gloss hardener. VOC 2.08 pounds per gallon.

3rd coat: Water Based Epoxy B70 Series with B60V25 semi-gloss hardener. VOC 2.08 pounds per gallon.

3.7 PREPARATION AND FINISHING ALUMINUM

A. Preparation:

1. Remove all oil, grease, soil, and other foreign material by solvent cleaning. Do not use steel wool or wire brushes for cleaning.

2. Apply first coat within 1 to 4 hours after cleaning.

B. Schedule:

1. Aluminum - Exterior:

Gloss:

1st coat: Zinc Chromate Primer, B50Y1. VOC 3.33 pounds per gallon.

2nd coat: Industrial Enamel, B54Z Series. VOC 3.75 pounds per gallon.

3rd coat: Industrial Enamel, B54Z Series. VOC 3.75 pounds per gallon.

3.8 CLEAN-UP

A. Remove all paint, stain, or other finish material where it has spilled or spattered.

END OF SECTION

SECTION 10200

LOUVERS AND VENTS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing fixed louvers .

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Shop Drawings: Include plans, elevations, section, details and attachments to other work. Show blade profiles, angles and spacing.
- C. Product data: Manufacturer's descriptive details and installation recommendations.
- D. For units with factory-applied color finishes: submit samples for verification.
- E. Manufacturer's warranty for approval.

1.3 QUALITY ASSURANCE

- A. Louvers are intended to provide maximum resistance to wind driven rain.
- B. Obtain louvers through one source from a single manufacturer where indicated to be of the same type, design, or factory-applied color finish.
- B. Comply with recommendations in SMACNA's "Architectural Sheetmetal Manual for fabrication, construction, and installation procedures.

1.4 PROJECT CONDITIONS

- A. Field measurements: Verify louver openings by field measurements before fabrication and indicate measurements on shop drawings.

1.5 WARRANTY

- A. Register manufacturer's warranty in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.

Wonder Metals Corporation

4351 Caterpillar Road
PO Box 4427
Redding, CA 96099
Toll Free Info: 800-366-5877
Direct & Int'l: 530-241-3251
Fax: 530-241-1738
E-mail: info@wondermetals.com
Internet: www.wondermetals.com

2.2 LOUVER:

- A. Wonder Metals SDL-4 fixed drainable blade louver with insect screen on the interior side.

2.3 MATERIALS

- A. Section 07600 , Copper or Stainless Steel.
- B. Fiberglass Reinforced Plastic (FRP): AAMA 305 glass fiber reinforced thermoset profile.

2.4 FABRICATION, GENERAL

- A. Assemble louvers in the factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances for fabrication and installation tolerances, adjoining material tolerances, and to limit the perimeter sealant joint width to less than 1/2-inch. Frame Type: Channel, unless otherwise indicated. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view.
- D. Include supports, anchorages and accessories required for complete assembly.

PART 3 EXECUTION

3.1 PREPARATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- D. Repair finishes damaged by any action. Restore finishes so no evidence remains of corrective work. Returned items that cannot be refinished in the field to the factory, make required alterations, a refinish entire unit or provide new units.
- E. Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during the construction period. Do not let soil accumulate until final cleaning. Before final inspection, clean all exposed surfaces with water and mild soap or detergent no harmful to finishes.. Thoroughly rinse surfaces and dry.

END OF SECTION

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing toilet and bath accessories.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's catalog cuts and data sheets, complete parts list, installation requirements, maintenance data, and operating instructions as applicable for each accessory item specified.
- C. Manufacturer warranties for approval.

1.3 QUALITY ASSURANCE

- A. Model numbers shown in the accessory schedule are items manufactured by Bradley manufacturing Co., P.O. Box 309, Menominee Falls, WI., Phone:262/251-6000 and are listed to represent design selection and a standard of quality.
- B. The equivalent model numbers of the following manufacturers have been determined to meet the requirements of this specification. Products from other manufacturers will be considered, provided they are approved as equal and meet the requirements of the Uniform Federal Accessibility Standards.
 - 1. American Specialties, Inc., Yonkers, New York.
 - 2. Bobrick Washroom Equipment, Inc., North Hollywood, California.
 - 3. McKinney/Parker, Scranton, Pennsylvania.
 - 4. Watrous Incorporated, Northbrook, Illinois.
- C. Provide products of a single manufacturer unless specified otherwise in the accessory schedule.

1.4 PRODUCT HANDLING

- A. Handle materials carefully to prevent damage to exposed surfaces.
- B. Keep protective covers on all units until installation is complete; remove covers at final clean-up.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Deliver two keys for each type of lock to the Contracting Officer.

- C. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Operation and maintenance data for toilet and bath accessories.
 - 2. Toilet and bath accessory schedule listing, for each accessory installed, the manufacturer, product name and/or number, and locations installed.
- D. Register manufacturer warranties in Owner's name; provide copy to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The use of proprietary product names is to establish qualities desired. Other manufacturer's products may be approved as substitutes.

2.2 METALS AND FINISHES

- A. Stainless Steel: ASTM A167-89a, Type 302/304; satin finish on exposed surfaces.
- B. Concealed Anchor Plates: Galvanized steel, ASTM A123-89a. Minimum 12-gauge, tapped to receive stainless steel machine screws.

2.3 ACCESSORY SCHEDULE:

- A. Mirrors: Bobrick B-165.
- B. Hook Strip: Bobrick B-232X24 3-hook strip.
- C. Toilet Paper Holders w/ Sanitary Napkin Disposal: Bobrick B-3094.
- D. Grab Bars: Bobrick B-6106 series, satin finish, 1 ½" diameter
- E. Paper Towel Dispensers/WR: Bobrick B-369 recessed c-fold or multi-fold towel dispenser/ waste receptacle.
- F. Mop and Broom Holder: Bobrick 224
- G. Soap Dispenser: Bobrick B-2111.
- H. Shelf Brackets: Stanley 12X8 HD welded steel, painted white.

2.4 FABRICATION

- A. Weld corners, leaving no open miters.

PART 3 EXECUTION

3.1 INSPECTION

- A. Check openings to receive recessed units for correct dimensions and plumb of blocking or frames.

- B. Check walls or partitions to receive surface mounted units for conditions that would affect quality and execution of work.
- C. Verify spacing of plumbing fixtures and toilet partitions that may affect installation of partition mounted accessories.
- D. Do not begin installation of toilet and bath accessories until openings and surfaces are acceptable.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. Drill holes to correct size and location to ensure they are concealed by the item.
- C. Install surface mounted accessories to walls or partitions with recommended fasteners, plumb and true to line.
- D. Attach grab bars to recommended anchor plates using stainless steel machine screws, or attach them to toilet partitions using through bolts and sleeves. Grab bars shall be mounted to support minimum 250 lbs.

3.3 ADJUST AND CLEAN

- A. Adjust accessories for proper operation.
- B. After completion of installation, clean and polish all exposed surfaces.

END OF SECTION

SECTION 13701

FIRE AND INTRUSION ALARM SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing, installing, and testing a complete fire and intrusion alarm system.

1.2 QUALITY ASSURANCE

- A. All work shall meet the requirements of NFPA 72 National Fire Alarm Code (2002), NEC and ADAAG.
- B. Workmen Qualifications: The work of this section shall be performed by workmen experienced in the installation and testing of commercial alarm systems.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's literature for all specified components of the security alarm system.
- C. Proof of workmen's experience in installation and testing commercial alarm systems.
- D. Written certification, signed by the manufacturer of the fire and intrusion alarm control panel, that the installer is approved for installing the system.

1.4 COORDINATION

- A. Coordinate installation of telephone dialer with local telephone company.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Manufacturer's operation and maintenance data for all intrusion alarm system components.
 - 2. As-built drawings of fire and intrusion alarm system. Drawings shall include:
 - a. Plan views showing the actual location, designation, and interconnection of all system devices, including junction boxes.
 - b. Detailed single-line wiring schematics showing wiring terminations at panels and devices remote from the panel for each loop or zone.
 - 3. Complete materials list of all fire and intrusion alarm system components installed.

4. Where programmable devices are installed, provide documentation of any custom programming entered.
5. All custom programming codes shall be delivered to the Contracting Officer upon signing of the acceptance test and turnover of the system.

PART 2 PRODUCTS

2.1 CONTROL PANEL

- A. Ademco 4080 surface mounted panel, manufactured by Ademco, Syosset, New York, or approved equal. All control panel functions shall be within enclosure. All keyed switches in the system serving the same function shall match.
- B. Panel shall include:
 1. Selectable automatic time delays, one to allow exit from building following activation of system and one to allow entry into building for shut-off without activating alarm.
 2. Automatic timer to limit audible alarm time, selectable from 5 or 10 minutes. Upon timing-out, system shall reactivate burglar loops.
 3. Burglar zones, as indicated, each with shunting on-off switches and latching alarm indicator. Burglar loops shall accept either normally open or normally closed sensors.
 4. 24-hour emergency circuit.
 5. Yelper or siren driver with relay as required.
 6. Door mounted light emitting diodes to indicate "on" and "activated".
 7. Door mounted round key switch for activating and testing system, including exterior audio alarm and battery capability.
 8. Provision for ac or dc operation.
 9. 12-volt, 5-ampere-hour sealed lead acid rechargeable battery, with mounting bracket installed inside panel.
 10. Battery charger.
 11. Separate dry output contacts for fire and burglar alarms.
 12. Provision for use of smoke detectors, 24 VDC.
 13. 24-hour fire circuit.
 14. Audible and visual warning alarms, 24 VDC.

2.2 REMOTE KEY LOCK

- A. Three-position keyed lock, in standard size stainless steel switch mounting plate, with light emitting diode for indicating "activated". Ademco 5246, manufactured by Ademco, Syosset, New York, or approved equal. Provide three keys.

2.3 PASSIVE IR SENSOR

- A. Manufactured by Ademco, or approved equal. 24-volt dc power shall be supplied from control panel.

2.4 WEATHERPROOF SPEAKER

- A. For use with yelper/siren driver. Model No. 713, manufactured by Ademco, Syosset, New York, or approved equal.

2.5 WIRE

- A. Copper stranded shielded, twisted pair with pvc jacket.
- B. Wiring of Burglar Loop Between Sensors and Control Panel: No. 22 AWG or larger, as recommended by manufacturer.
- C. Wiring to Alarm Devices: No. 16 AWG or larger.
- D. Wiring Between Dialer and Telephone System: No. 22 AWG or larger.

2.6 TELEPHONE DIALER

- A. Manufactured by Ademco, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install at locations shown or as directed by Contracting Officer, and according to manufacturer's recommendations.

3.2 WIRING

- A. Route as approved by Contracting Officer. Wire shall be installed concealed in EMT. No splicing of wiring is permitted, except where necessary for connection at sensors.

3.3 TELEPHONE DIALER

- A. Install where shown or as directed by Contracting Officer. Connect to telephone system as directed by the Contracting Officer. Program dialer with telephone numbers and voice message as directed.

3.4 OPERATING INSTRUCTIONS

- A. As specified in Section 01785.
- B. Provide 2 hours of operating instructions.

- C. Following installation and before final inspection of the system, demonstrate system to Contracting Officer and selected park personnel. At time of final inspection, again fully describe and demonstrate the following:
 - 1. Switches, sensors, lights, and alarms.
 - 2. Operation of system on loss of ac power.
 - 3. Telephone dialer; include playing recorded messages.
 - 4. Transmission of remote alarm to specified agency as applicable.

3.5 TESTING AND FINAL ACCEPTANCE

- A. The Contractor shall test all initiating, reporting, and transmitting devices and verify that they are in working order prior to scheduling fire acceptance test with the Contracting Officer.
- B. The final acceptance test shall be performed in accordance with, and with the use of acceptance test sheets from NFPA 72 (2002).

PART 4 MEASUREMENT AND PAYMENT

4.1 FIRE AND INTRUSION ALARM SYSTEM

- A. Payment will be made at the contract lump-sum price.

END OF SECTION

SECTION 13930

WET PIPE FIRE SPRINKLER SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of designing, furnishing, and installing an automatic wet pipe fire sprinkler system for entire building, including combustible attics, crawl spaces, and concealed spaces.

1.2 RELATED WORK

- A. Fire detection and alarm system - Section 13701.

1.3 QUALITY ASSURANCE

- A. All work shall meet requirements of NFPA 13-96.
- B. Devices and equipment shall be UL listed or FM approved.
- C. Design shall be performed by a NICET Level III or IV Technician, Registered Fire Protection Engineer, or Registered Professional Engineer with experience in fire protection systems design.
- D. Installer shall be regularly engaged in installation of automatic fire sprinkler systems and employ workmen experienced and skilled in this trade.
- E. Maintain a copy of NFPA 13-96 on site for reference.

1.4 SYSTEM DESIGN

- A. Base design on requirements of NFPA 13-96, including Appendices.
- B. Verify fire hydrant flow test according to NFPA 13-96 and NFPA 291-95. Use results for system design calculations.
- C. Base design of sprinkler system on hydraulic calculations for light hazard. Outside hose flows shall be based on light hazard occupancy. No allowance will be made for inside hose station flows. The room design method is not acceptable.

1.5 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's literature for the following:
 - 1. Pipe and fittings.
 - 2. Alarm pressure switch.
 - 3. Fire department connection.

4. Valves.
 5. Backflow preventer.
 6. Sprinklers.
 7. Valve supervisor.
- C. Sample of each type and finish of sprinkler and escutcheon plate to be installed.
- D. Shop drawings showing all details as defined by NFPA 13-96. Show pipe routing and coordination of all building components.
- E. Hydraulic calculations including summary sheet, detailed work sheets, graph sheet, and water supply information as outlined in NFPA 13-96. Hydraulic calculations, drawings, and work sheets shall be sealed and signed by designer.
- F. Proposed outline of required demonstration and training.

1.6 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Spare Parts: Extra heads and special sprinkler head wrenches enclosed in steel cabinet in accordance with NFPA 13-96. Provide minimum of 2 heads of each type and temperature rating installed.
- C. NFPA 25-95.
- D. Operation and maintenance data for review and approval as required by Section 01785.
1. Manufacturer's operation and maintenance data for the following:
 - a. Fire department connection.
 - b. Sprinklers.
 - c. Valves.
 - d. Alarm check valve.
 - e. Valve supervisor.
 - f. Backflow preventer.
 - g. Pressure gauges.
 - h. Water Motor Gong
- E. Valve schedule for all sprinkler system control and drain valves. For each valve, list valve designation number, valve type, size, location, and function.
- F. Contractor's Material and Test Certificates similar to those in NFPA 13-96.

- G. Backflow preventer state certification test.
- H. Set of final as-built sprinkler system drawings.
- I. Videotapes: As specified in Section 01815.

PART 2 PRODUCTS

2.1 UNDERGROUND PIPE AND FITTINGS

- A. Ductile Iron Pipe: AWWA C151-96, Class 50, 350 psi pressure rating, push-on or mechanical-joint type with cement mortar lining and seal coat according to AWWA C104-95.
 - 1. Fittings: AWWA C110-93 or AWWA C153-94, ductile iron or cast iron push-on or mechanical joint type. Include cement mortar lining and seal coat according to AWWA C104-95.

2.2 ABOVEGROUND PIPE AND FITTINGS

- A. General: Designed for 175 psi working pressure. Mark each length of pipe with applicable ASTM standard and manufacturer's identification.
- B. Steel Pipe: ASTM A795-96, black steel. Pipe joined with threaded or cut groove fittings shall be Schedule 40. Other pipe thicknesses are acceptable.
 - 1. Fittings:
 - a. Threaded:
 - 1) Cast Iron: ASME B16.4-92 Class 125, standard pattern with threads complying with ASME B1.20.1-83.
 - 2) Malleable Iron: ASME B16.3-92, Class 150, standard pattern with threads complying with ASME B1.20.1-83.
 - b. Cast Iron Flanged: ASME B16.1-89, Class 125, raised ground face, bolt holes spot faced.
 - c. Welded: Standard weight, black iron.
 - 1) Factory Wrought Steel Buttweld Fittings: ASME B16.9-93.
 - 2) Buttwelding Ends for Pipe, Valves, Flanges, and Fittings: ASME B16.25-97.
 - 3) Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures: ASTM A234-96.
 - 4) Steel Pipe Flanges and Flanged Fittings: ASME B16.5-96.
 - 5) Forged Steel Fittings, Socket Welded and Threaded: ASME B16.11-96.
 - d. Grooved Couplings and Mechanical Fittings: Couplings shall be UL 213-93, AWWA C606-87, ASTM A536-84 ductile iron or ASTM A47-90 malleable iron, with enamel finish and grooves or shoulders designed to accept grooved couplings.

Synthetic-rubber gasket with central-cavity, pressure-responsive design, and ASTM A183-83 carbon-steel bolts and nuts.

2.3 VALVES

- A. Valves shall be UL listed or FM approved for fire sprinkler systems.
- B. Gate Valves: Indicating type with indentation in valve stem for monitor switch.
 - 1. 2-Inch and Smaller: UL 262-94, 175-pound non-shock WWP, cast-bronze, threaded ends, solid wedge, outside screw and yoke, rising stem.
 - 2. 2-1/2-Inch and Larger: UL 262-94, 200-pound non-shock WWP, iron body, resilient wedge, epoxy coated interior and exterior, outside screw and yoke, rising stem. Provide replaceable bronze wedge facing rings and flanged ends.
- C. Ball Valves, 2-inch and Smaller: 175-pound WWP, two-piece bronze body, full port, chrome plated ball, reinforced TFE seats and stem seal, blowout-proof stem, threaded ends. UL listed and FM approved for trim and drain use.
- D. Butterfly Valves:
 - 1. Wafer/Lug: 250-pound non-shock WWP, iron body, lug or wafer body, nickel plated iron disc, resilient seat, gear operator with position indicator, accepts internal and external supervisory switches.
 - 2. Grooved: 175-pound non-shock WWP, epoxy coated iron body, resilient disc, gear operator with position indicator, grooved end connections.
- E. Check Valves:
 - 1. Swing:
 - a. 2-Inch and Smaller: 200-pound non-shock, WWP, bronze body, screwed bonnet, regrinding type, renewable disc, with threaded connections.
 - b. 2-1/2-Inch and Larger: UL 312-93, 175-pound non-shock, WWP, iron body and bolted bonnet, horizontal swing, renewable seat and disc, bronze or cast-iron disc with bronze disc ring and flanged ends.
 - 2. Wafer, 2-1/2-Inch and Larger: UL 213-93, 175-pound non-shock, WWP, iron body, double spring-loaded bronze alloy discs, resilient seal, stainless-steel spring and hinge pin.
- F. Globe Valves:
 - 1. Straight Pattern, 2-Inch and Smaller: ASTM B62-93, 175-pound non-shock, WWP, bronze body, screwed bonnet, integral seat, renewable disc, rising stem. UL listed for trim and drain use.
 - 2. Angle Pattern: 2-Inch and Smaller: ASTM B62-93, 175-pound non-shock WOG, bronze body, screwed bonnet, integral seat, renewable disc, rising stem. UL listed for trim and drain use.

- G. Automatic Ball Drip: UL 1726-93, FM approved, bronze, automatic drain valve, 3/4-inch, spring loaded, ball check device with threaded ends. Model C by Reliable Automatic Sprinkler Co., Inc., Mount Vernon, NY, or approved equal.

2.4 ALARM CHECK VALVE

- A. UL 193-93, 175 psig working pressure, divided seat ring, rubber faced clapper, check type water flow alarm valve for use in wet pipe systems, with closed alarm line drain trim arrangement, supervised alarm silence valve, retard chamber, restriction assembly, alarm test trim, and alarm vent trim. Model E with Model E3 trimmings by Reliable Automatic Sprinkler Co., Inc., Mount Vernon, NY, or approved equal

2.5 BACKFLOW PREVENTER

- A. Vertical Type: ASSE 1015-93, double-check backflow preventer, consisting of epoxy coated ductile iron body, bronze trim and working parts, stainless steel springs, replaceable bronze or EPDM seats and disc, 175 psi working pressure. OS&Y gate valves on inlet and outlet with indentation for monitoring switch, and strainer on inlet. Include 2 positive-seating check valves and test cocks. Pressure loss shall be 5 psig maximum through middle third of flow range. Model 870V by FEBCO, Fresno, CA, or approved equal.

2.6 VALVE SUPERVISION

- A. UL 753-95, electrical-supervision type, SPDT contacts, designed to signal supervised valve in other than full open position. Weatherproof switch housing and cover with tamper-resistant screws. Model PCVS or OSYSU-A2 by Potter Electric Signal Company, St. Louis, MO, or approved equal.

2.7 ALARM PRESSURE SWITCH

- A. UL753-95 and FM approved, electrical-supervision type, SPDT contacts, designed for detection of waterflow conditions. Switch shall have 1/2-inch NPT connection and field adjustable to operate between 4 psi and 20 psi. Weatherproof switch housing and cover with tamper-resistant screws. Model PS10A by Potter Electric Signal Company, St. Louis, MO, or approved equal.

2.8 WATER MOTOR GONG

- A. UL, Dependable Pelton wheel type, prompt positive operation, nylon bearings with no lubrication needed, compact lightweight, rust-free cast aluminum gong, self-setting. Model C by reliable Automatic Sprinkler Co., Inc Mount Vernon, NY or approved equal.

2.9 SPRINKLERS

- A. UL 199-97, automatic sprinklers with nominal 1/2-inch orifice for "ordinary" temperature classification, except where higher temperature heads are required or shown.
- B. Sprinklers: Manufactured by Star Sprinkler, Inc., or approved equal.
 - 1. Upright: Fusible link or glass bulb type, bronze sprinkler. Model SG-QR.
 - 2. Pendent:
 - a. Standard: Fusible link or glass bulb type, bronze sprinkler. Model SG-QR.

2.10 PIPE SUPPORTS

- A. Size in accordance with NFPA 13-96

2.11 PIPE SLEEVES

- A. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: ASTM A53-96, Schedule 40, or standard weight, zinc-coated steel.
- B. Sleeves in Partitions, Walls, Floors, and Roofs Other Than Masonry and Concrete: Zinc-coated steel sheet having a nominal weight of not less than 0.90 pound per square foot.

2.12 PRESSURE GAUGES

- A. 3-1/2-inch dial type, with maximum limit not less than twice the normal working pressure.

2.13 FIRE DEPARTMENT CONNECTION

- A. Siamese Connection: UL 405-93, exposed siamese inlet type, polished brass body, double clapper, 2-1/2-inch by 2-1/2-inch by 4-inch. Threads matching local fire district equipment, bronze escutcheon plate identified with "Auto Spkr," swivel plugs, and chain. Model S133 by Standard Fire-West, Los Angeles, California, or approved equal.

2.14 IDENTIFICATION

- A. Tags: As specified in Section 15075.
- B. Signs: Red and white signs of baked porcelain enamel. Signs shall have corner holes or slots for attachment.

2.15 INSPECTOR'S TEST CONNECTION

- A. Accessible test connection valve and orifice, equal in size to smallest sprinkler installed.

2.16 ESCUTCHEON PLATES

- A. One-piece or split-hinge metal plates for piping passing through floors, walls, and ceilings in exposed areas. Provide chromium-plated finish in finished areas and paint finish in unfinished areas.

2.17 SPLASH BLOCKS

- A. Precast concrete, 7-1/2 inches wide at upper end, 13-1/2 inches wide at lower end, 24 inches long.

2.18 SPRINKLER STORAGE CABINET

- A. Metal enclosure with hinged cover designed to provide on-site storage of extra sprinklers and sprinkler wrench.

2.19 SEALANT

- A. UL 1479-94 and ASTM E119-95, water-based, intumescent sealant, impervious to water when dry, colored red, and classified for up to 3 hours. SpecSeal Sealant by Specified Technologies Inc., Somerville, NJ, or approved equal.

2.20 PAINTING

- A. As specified in Section 09903.

2.21 ELECTRICAL WORK

- A. Provide control wiring, including connections to fire alarm systems, in accordance with NFPA 70-96 (NEC), and NFPA 72-94. Electrical metallic tubing conduit may be used in dry locations not subject to mechanical damage; provide rigid metal conduit in all other locations. All voltages shall be compatible with fire alarm system. Coordinate electrical work with Division 16.

PART 3 EXECUTION

3.1 PIPING AND SPRINKLERS, GENERAL

- A. Underground Service Entrance: Install pipe and fittings with restrained joints to water service piping in accordance with NFPA 24-95.
- B. Piping and sprinkler layouts shown on the drawings are schematic and intended to be used for bidding purposes only. Field verify exact pipe routing and quantities of sprinklers required to suit actual conditions in the building. Coordinate sprinkler piping with work of other trades. Locations for duct work, plumbing, electrical work, and lighting fixtures shall take precedence over space for sprinkler piping and heads.
- C. Install sprinklers in suspended ceilings in center of acoustical panels and tiles.
- D. Conceal piping except in mechanical areas, attics, crawl spaces, and storage spaces.
- E. Install piping straight and true to bear evenly on hangers. Pitch lines at 1/2 inch in 10 feet and cross headers and mains at 1/4 inch in 10 feet.
- F. Maintain maximum possible headroom in areas where piping is exposed.
- G. Provide sway bracing and flexible joints in accordance with NFPA 13-96.
- H. Ream cut pipe ends to the full pipe diameter.
- I. Screwed Connections: Use true taper full V-threads.

3.2 EARTHQUAKE PROTECTION

- A. Install sprinkler system to minimize or prevent pipe breakage due to earthquakes.
- B. Install flexible pipe couplings on grooved end pipe as flexure joints at the following locations:
 - 1. Within 24 inches of the top and bottom of risers 2-1/2 inches or larger.
 - 2. Within 12 inches above and below the floor in multistory buildings.
 - 3. On one side of concrete or masonry walls within 3 feet of the wall surface.

4. At or near building expansion joints.
 5. Within 24 inches of the top and bottom of drops to hose lines, rack sprinklers, and mezzanines.
 6. Within 24 inches of the top of drops exceeding 15 feet in length to sprinklers or portions of systems supplying more than one sprinkler.
- C. Install swing joints assembled with flexible fittings where sprinkler piping crosses building seismic joints.
- D. Provide clearance around all pipes extending through walls, floors, and foundations. Minimum clearance shall be 2 inches larger than the pipe for pipes 1 inch to 3-1/2 inches and 4 inches for pipes 4 inches and larger.
- E. Sway Bracing: Support system piping to resist both lateral and longitudinal horizontal loads. Determine loads in accordance with NFPA 13-96.
1. Install sway bracing at tops of risers utilizing four-way brace.
 2. Install lateral sway bracing spaced at a maximum of 40 feet on center for feed and cross mains.
 3. Install lateral brace on last length of pipe at end of a feed or cross main.

3.3 VALVE SUPERVISION

- A. Monitor all water supply shutoff valves in open position with valve supervisor. Connect alarm to fire alarm panel. Coordinate with fire alarm system installation.

3.4 PIPE SUPPORTS

- A. Install hangers in accordance with NFPA 13-96. Use rod hangers on exposed piping; wire U-hook and similar hangers will be permitted only on concealed piping. Use copper or plastic-coated hangers to support copper pipe.

3.5 PIPE SLEEVES

- A. Install where piping passes through walls, floors, roofs, and partitions. Sleeves shall pass through entire thickness of walls, floors, roofs, and partitions and be secured. Provide not less than 1/4 inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and seal at both ends of sleeve. Seal annular space with fire sealant where sleeves pass through fire rated assemblies. Extend sleeves in floor slabs 3 inches above finished floor.

3.6 ESCUTCHEON PLATES

- A. Install escutcheon plates at all exposed pipe penetrations other than attics, crawlspaces, or normally inaccessible spaces. Securely anchor plates in place with set screws or other approved means.

3.7 DRAINS

- A. Install sprinkler branches and piping to drain to main drain on supply riser. Route drain to outside, sized in accordance with NFPA 13-96. Arrange sprinkler system to require a minimum

number of low point drains. Provide auxiliary drains as required by NFPA 13-96. Provide plugged tee outlet at outer end of each branch line for flushing and draining. Install ball valves on drain lines.

3.8 INSPECTOR'S TEST CONNECTION

- A. Install test connection with 1-inch pipe and unsupervised gate valve. Locate valve within five feet of floor. Connect inspector's test to the most remote part of the sprinkler system with the discharge routed to the outside. Install concrete splash block at discharge location.

3.9 FIRE DEPARTMENT CONNECTION

- A. Mount as shown. Route drain from ball drip to floor drain.

3.10 TESTING

- A. Notify Contracting Officer at least five days before testing. Test, in the Contracting Officer's presence, in accordance with NFPA 13-96. Repeat test procedure until results listed are obtained.
- B. Hydrostatic Test: Hydrostatically test all systems, including fire department connections, to not less than 200 psi for 2 hours. Read test pressure from gauge located at low point of system.
- C. Leaks in Piping: Correct immediately.
 - 1. On threaded piping, tighten joints. If necessary, dismantle and replace section. Caulking, peening, or stop-leak compounds will not be permitted.
- D. Backflow Preventer: Test in accordance with state requirements by certified tester.

3.11 FINISHES

- A. Repair, seal, and coat exposed threads, wrench marks, and abrasions on galvanized or protected steel pipe and fittings. Clean dirt and debris from sprinklers. Replace sprinklers with paint other than factory finish with new sprinklers.

3.12 EXTRA HEADS

- A. Mount cabinet with extra heads and special sprinkler head wrenches near sprinkler riser.

3.13 INSTRUCTION CHARTS

- A. Provide permanently mounted, plastic covered charts next to wet pipe assembly. Charts shall describe operation and maintenance of entire system, including recommended frequency of maintenance and testing.

3.14 IDENTIFICATION

- A. General: As specified in Section 15075.
- B. Valves: Identify and label alarm test valve and indicating control valves. Attach caution signs to all valves controlling water to sprinkler system in accordance with NFPA 13-96.
- C. Miscellaneous Fire Lines: Label inspector's test and fire lines.

D. Nameplate for Hydraulically Designed Systems: Mount hydraulic design information sign at alarm valve and include information in accordance with NFPA 13-96.

3.15 PAINTING

A. As specified in Section 09903. Touch up factory painted valves and equipment where paint is scratched or missing.

B. Paint all pipes and accessories exposed to outdoor air.

3.16 TRAINING

A. Provide 2 hours of instruction to Government personnel. Include instruction on locating valves and drains, pipe routing, and maintenance and testing procedures.

END OF SECTION

SECTION 15010

GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section contains items of common or administrative nature that pertain to all mechanical work.

1.2 QUALITY ASSURANCE

- A. All pressure vessels, including safety devices and appurtenances, shall comply with standards of and bear stamp of ASME.

1.3 DRAWINGS

- A. Drawings are diagrammatic and show general design, arrangement, and extent of the systems. Do not scale drawings for roughing-in measurement, nor use as shop drawings. Make field measurements and prepare shop drawings as required. Coordinate work with shop drawings of other divisions. Investigate capacity and space requirements of proposed equipment before submitting shop drawings.

1.4 COORDINATION

- A. Interruption of Services: Coordinate shutdown of water, waste, fire protection, or cooling or heating systems with Contracting Officer.
- B. Schedule of Work: Coordinate work with other trades. In scheduling, anticipate such items as installing equipment through available openings in structure.
- C. Make minor changes in piping, ductwork, and equipment locations to suit actual conditions.

1.5 PROTECTION

- A. Completely cover motors and other machinery to protect from dirt and water. Cap all openings in pipe and ductwork to protect against entry of foreign matter.

PART 2 PRODUCTS

- A. Similar products shall be provided by the same manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's recommendations unless otherwise specified. Verify final equipment locations with field measurements and with the requirements of the actual equipment to be connected.

- B. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting. Extend grease fittings to an accessible location.
- C. Conceal all piping in finished areas of the building except where shown otherwise.

3.2 EQUIPMENT START-UP

- A. Before start-up, verify that piping, ductwork, and related systems have been tested, and operational and performance tests have been made. Check each piece of equipment for proper lubrication, drive rotation, belt tension, proper control sequence, and other conditions which may cause damage to equipment or endanger personnel.
- B. Ensure control systems are fully operational in automatic mode.
- C. After start-up runs have been completed and systems have been demonstrated to be satisfactory and ready for permanent operation, clean or replace permanent pipeline strainers, clean permanent filters, replace throwaway air filters with new, properly adjust valve and pump packing, adjust belt tensions, secure drive guards in place, and check lubrication and replenish if required.
- D. Equipment where specified shall be started by manufacturer's representative. Copies of start-up logs shall be provided to the Contracting Officer and included in Operation and Maintenance Manuals.

END OF SECTION

SECTION 15050

BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section describes materials and methods common to multiple sections of Division 15. Mechanical materials specified under other sections of Division 15 shall meet requirements of this section, unless part of larger factory-assembled equipment.

1.2 COORDINATION OF ELECTRICAL AND MECHANICAL WORK

- A. As specified in Section 01312.
- B. Electrical Requirements:
 - 1. Provide mechanical system controls, controllers, control transformers, disconnects, starters, control wiring, power wiring, and all other electrical work necessary for complete and operable mechanical systems. Motors, motor circuits, and controllers shall meet requirements of NEC 430-96. Air conditioning and refrigeration equipment shall meet NEC 440-96. All electrical work, including materials provided under Division 15, shall meet requirements of Division 16.
 - 2. HVAC Control Wiring: As specified in Section 15915.
 - 3. Wiring Diagrams: Provide complete and approved wiring diagrams for all electrical power and control work relating to mechanical systems.
 - 4. Install wiring for all mechanical work in conduit as specified in Section 16050.

1.3 RELATED WORK

- A. Mechanical Insulation - Section 15080.
- B. Mechanical Vibration Control - Section 15070.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's technical product data and installation instructions.
- C. Pipe hanger and support schedule showing manufacturer's model number, size, location, and features for each required pipe hanger and support.
- D. Current welder AWS certification for welding processes involved and employer signed record accepting responsibility for welder's ability.
- E. Motor literature showing nominal efficiency rating for each motor at rated load and voltage at an ambient temperature of 40 degrees C.

1.5 QUALITY ASSURANCE

- A. Mechanical Welding:
 - 1. Perform welding of pressure piping systems in accordance with provisions of ASME Boiler and Pressure Vessel Code, 1995, and ASME B31.9-96, Code for Building Services Piping.
 - 2. Contact Contracting Officer 48 hours prior to any welding operations.
- B. Hangers, supports, and components shall be UL listed and FM approved.

PART 2 PRODUCTS

2.1 MOTORS

- A. Motors shall be energy efficient with nominal efficiency equal to or greater than that stated in NEMA MG 1-97, Table 12-6C, for that type and rating of motor. Motors specifically manufactured for a particular piece of equipment with a lower efficiency shall be brought to the attention of the Contracting Officer for approval.
- B. Motors shall be ball bearing, squirrel cage, open dripproof, normal starting torque of the horsepower and current characteristics scheduled, with thermal overload protection and dustproof and leakproof bearing rings. Insulation shall be rated for continuous duty at 40 degrees C ambient.
- C. Motors shall be dynamically balanced and tested and selected for quiet operation. Motors shall operate continuously at full load with temperature rise in any part not to exceed NEMA standards.
- D. Motors shall have 1.15 service factor at project altitude and at specified voltage.

2.2 DRIVES

- A. V-belt with cast iron sheaves rated not less than 1-1/2 times motor horsepower. Motors 5 horsepower and less for belt-driven equipment shall have adjustable pulleys. Provide two motor sheaves, one of the adjustable pitch type to be used for air balance, and one of the fixed pitch type to be used for final rpm.
- B. Multiple V-belts shall be matched sets.

2.3 DRIVE GUARDS

- A. Meet requirements of OSHA.
- B. All drive guards shall be removable.
- C. Belt Drives: Enclosed in a 16-gauge expanded metal or wire screen drive guard with 70 percent free area, with steel frame covering both sides of belt drive. Provide holes in belt guards for tachometer readings. Provide access door in guard to permit checking of belt tension.
- D. Rotating Shafts and Couplings: Provide a solid 16-gauge sheet metal inverted U-cover over entire length of exposed shaft. Extend cover to below bottom of shaft and couplings.

2.4 PIPE HANGERS AND SUPPORTS

- A. General: Provide adjustable pipe hangers on suspended pipe. Chain or perforated strap will not be permitted. Isolate hangers coming in contact with bare copper pipe with dielectric hanger connectors. Hanger rods shall be continuous threaded steel. Turnbuckles shall have capacity of not less than attached rod. Provide bracing to prevent lateral motion.
- B. Individual Hangers:
 - 1. Uninsulated Copper Pipe: Copper plated or coated steel, adjustable swivel ring hanger.
 - 2. Uninsulated Steel and Insulated Steel or Copper Piping and Ducts: Zinc plated adjustable swivel ring hangers for pipe sizes up through 1-1/2-inch, and wrought steel adjustable clevis hangers for pipe sizes 2-inch and over.
- C. Grouped Horizontal Piping and Piping on Walls: Cold formed, lipped channels, not less than 1-1/2-inch by 1-1/2-inch, No. 12 gauge with mounting holes. Hot-dipped galvanized clamps shall be sized for outside diameter of insulation on insulated pipes. Hangers shall support five times the weight or thrust applied without failure.
- D. Vertical Supports: Friction riser clamps, supported and braced.
- E. Piping Run in Metal Studs: One-piece plastic sleeve with integral synthetic rubber pipe insulator.
- F. Insulated Pipe Supports: As specified in Section 15081.
- G. Spring Hangers and Supports: As specified in Section 15070.

2.5 SLEEVES

- A. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: ASTM A53-96, Schedule 40, galvanized steel pipe.
- B. Sleeves in Partitions, Walls, Floors and Roofs Other than Masonry or Concrete: Minimum 24 gauge galvanized sheet steel.

2.6 ESCUTCHEONS

- A. One-piece or split-hinge adjustable metal plates with nickel-plated or paintable surface depending on finished surface.
- B. Chrome Plated Pipe: Solid pattern, smooth chrome plated cast brass.
- C. Other Types of Pipe: Heavy solid pattern steel, cast iron, or malleable iron with set screws. Escutcheons installed over sleeves which project above finished floors shall be deep cup type.

2.7 SEALANTS

- A. As specified in Section 07900.

PART 3 EXECUTION

3.1 MOTORS

- A. Mount belt driven equipment with motors on common steel base with adjustable motor mount. Align all drives. Use belts identified by the manufacturer and tension belts in accordance with manufacturer recommendations.

3.2 DRIVES

- A. Fan static pressures and rpm shown are approximate. Adjust or change drives as required to achieve air quantities shown.

3.3 PIPE HANGERS AND SUPPORTS

- A. General: Maintain uniform grading of piping system and install hangers to provide indicated pipe slopes. Install supports between piping and building structure to prevent swaying and vibration. Install hangers to provide minimum 1/2 inch clear space between finished covering and adjacent work. Do not support weight of piping from mechanical equipment, ductwork, pump flanges, coil connections, and related items. Threaded rods shall have two locknuts. Support hanger rods by coach screw rods, angle iron clips, or beam clamps. No drilling of structural members will be permitted without approval. Do not bend pipe hanger rods to provide alignment of piping offset from overhead supports. Size hangers on insulated pipe to fit outside diameter of insulation.
- B. Hanger Spacing: Install adjustable type hangers and support the piping systems without sagging. Install hangers at locations not more than 3 feet from the end of each runout and not over 1 foot from each change in direction or offset and at the following maximum spacing:

PIPE TYPE	PIPE SIZE (INCHES)	MAXIMUM SPACING	MINIMUM HANGER ROD SIZE
Steel	1/2 through 1-1/4	7 Feet	3/8 Inch
	1-1/2 through 2	10 Feet	3/8 Inch
	2-1/2 through 3	12 Feet	1/2 Inch
	4 through 5	12 Feet	5/8 Inch
	6	12 Feet	3/4 Inch
	8 through 12	12 Feet	7/8 Inch
Copper	3/8 through 3/4	5 Feet	3/8 Inch
	1 through 1-1/2	6 Feet	3/8 Inch
	2 through 2-1/2	8 Feet	1/2 Inch
	3 and above	10 Feet	1/2 Inch
Cast Iron	2	1 each joint	3/8 Inch
	3	1 each joint	1/2 Inch
	4 through 5	1 each joint	5/8 Inch
	6	1 each joint	3/4 Inch
	8 through 12	1 each joint	7/8 Inch

- C. Support horizontal soil pipe near each hub or hubless clamp with spacing of 5 feet maximum between hangers. Provide adequate support for no hub pipe to prevent sagging and to maintain straight runs of DWV pipe.
- D. Trapeze Hangers: Trapeze hangers shall be spaced for smallest pipe in group. Provide additional hanger rod at mid span where trapeze length exceeds 4 feet. Secure pipe at each trapeze with standard pipe straps. Uninsulated copper pipe shall rest on neoprene sleeves. Trapeze type hangers may be used for multiple parallel horizontal pipes.
- E. Vertical Supports:
 - 1. Cast Iron Soil Pipes: Support at not less than every story height and at pipe base.
 - 2. Screwed Pipe: Support at 8 feet on center for 1-1/2-inch and smaller pipe. Support at 10 feet on center for 2-inch and larger pipe.
 - 3. Copper Tubing: Support at 6 feet on center for 1-1/2-inch and smaller pipe. Support at 8 feet on center for 2-inch and larger pipe.
- F. Remove rust from ferrous hanger equipment and rods, and apply one coat of rust inhibitive paint before or immediately after erection.
- G. Provide additional support for heavy valves, specialties, and sway bracing where required.

3.4 SLEEVES

- A. Provide sleeves where piping passes through walls, floors, roofs, and partitions. Sleeves shall pass through entire thickness of building material and be secured. Sleeves shall be sized large enough to allow for pipe movement and for continuous insulation. Sleeves shall be installed with 1/2 inch annular space between pipe insulation or bare pipe and the interior of the sleeve. Terminate sleeves flush with walls, partitions, and ceilings. Each sleeve shall be utilized for only one pipe. Firmly pack space between sleeve and pipe with insulation and seal both ends with sealing compound.
- B. Seal annular space with fire barrier UL/FM approved foam where sleeves pass through fire rated assemblies.
- C. Sleeves used below grade and for penetration of waterproofed walls shall contain integral water stop. Pipe sleeves shall be watertight with 25-year siliconized sealant joints on both sides of wall.
- D. In floors containing floor drains, extend floor sleeves 2 inches above finished floor.

3.5 ESCUTCHEONS

- A. Install escutcheons where pipes pass through walls, floors, or ceilings in finished areas. Install nickel-plated escutcheons in finished areas after painting is completed. Paint escutcheons in unfinished areas after painting of surface is completed. Firmly secure escutcheons to uninsulated pipes with set screws.

3.6 SEALANTS

- A. As specified in Section 07900.

- B. Penetrations in floors, mechanical room walls, and other fire wall construction shall be closed and sealed with firestopping material.
- C. The annular space between exposed pipe or ductwork and walls or floors shall be filled, sealed, and painted to match adjacent surfaces.

3.7 CLEANING

- A. Remove foreign materials including dirt, grease, and splashed paint. Restore damaged finishes of equipment to original condition.

3.8 PRELIMINARY OPERATION

- A. Operate any portion of installation if requested. Such operation does not constitute acceptance of work as complete.

END OF SECTION

SECTION 15070
MECHANICAL VIBRATION AND SEISMIC CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing vibration and seismic isolating mountings and hangers for equipment having reciprocating or rotating parts and for equipment, piping, or vessels that produce or transmit objectionable vibrations, pulsations, or noises.

1.2 QUALITY ASSURANCE

- A. Seismic Controls: Tested by an independent test laboratory and analyzed by a registered engineer to ensure the stated load capacity.

1.3 PROJECT CONDITIONS

- A. Project seismic zone:
 - 1. 4 with a zone factor of 0.40.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's technical product data and installation instructions for each type of vibration control product. Submit schedule showing size, type, deflection, and location for each product furnished.
- C. Shop drawings showing dimensions, weights, required clearances, and method of assembly of components. Detail bases and show location of equipment anchoring points, coordinated with equipment manufacturer's shop drawings. Spring isolators shall include spring diameters, deflections, compressed spring height, and solid spring height.
- D. Equipment operating speed.
- E. Equipment weight.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Operation and maintenance data for each type of vibration or seismic control product.
- C. Report: Report showing measured equipment deflections and quality assurance certification from seismic controls.

PART 2 PRODUCTS

2.1 GENERAL

- A. Vibration devices shall be color coded to indicate capacity range.

2.2 MOUNTINGS

- A. Pads (ASHRAE Type 1): Rubber pad arranged in single or multiple layers with non-slip pattern.
- B. Double Deflection Mountings and Rails (ASHRAE Type 2): Neoprene type, factory drilled, metal surfaces covered by neoprene or embedded in oil-resistant elastomer to prevent corrosion. Friction pads on top and bottom. Type ND or rail type DNR as manufactured by Mason Industries, Inc., Hauppauge, NY; Series R or rail type RD by Vibration Mountings and Controls, Inc., Bloomingdale, NJ; or approved equal.

2.3 ISOLATION HANGERS

- A. General: Formed with brackets and standard isolator type indicated, designed for three times rated loading of units, fabricated to accept minimum misalignment of 30 degrees off center in any direction before contacting hanger box.
 - 1. Outside Spring Diameter: Not less than 80 percent of compressed height of spring rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
- B. Neoprene Vibration Isolator (ASHRAE Type 2): Neoprene or rubber element with minimum deflection of 0.3 inch, securely retained in hanger box. Type HD as manufactured by Mason Industries, Inc., Hauppauge, NY, or approved equal.
- C. Spring Vibration Isolator (ASHRAE Type 3): Steel spring with cap in lower part of hanger and rubber or neoprene hanger element in top. Type 30N as manufactured by Mason Industries, Inc., Hauppauge, NY; Series FSH-30A by Vibration Mountings and Controls, Inc., Bloomingdale, NJ; or approved equal.

2.4 BASES

- A. Structural Rails (ASHRAE Type B): ASTM A36-96, wide flange, angle, or channel steel, minimum depth equal to 1/10 of the longest span of equipment, but not less than 6 inches. Height saving brackets shall be integral part of the rails. For seismic applications, structurally attach rails to one another. Type ICS as manufactured by Mason Industries, Inc., Hauppauge, NY; Series WFR by Vibration Mountings and Controls, Inc., Bloomingdale, NJ; or approved equal.

2.5 SEISMIC CONTROLS

- A. Seismic Snubbers:
 - 1. General: All-directional snubber; maintain factory set clearances. Load capacity of at least four times the rated static load capacity. Snubber must have minimum of two anchor bolt holes.
 - 2. ASHRAE Type C:

- a. General: Steel spring isolator with elastomeric snubber, within cast iron or welded steel housing.
 - b. Outside Spring Diameter: Not less than 80 percent of compressed height of spring rated load.
3. Cable Restraints (ASHRAE Type E): Galvanized or stainless steel, 7 x 19, aircraft cable. Series SCR by Vibration Mountings and Controls, Inc., Bloomingdale, NJ, or approved equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Mount equipment, piping, and ducts with vibration isolation in accordance with ASHRAE HVAC Applications Handbook-95. Comply with minimum static deflections.
- B. Install vibration isolation equipment in accordance with manufacturer's recommendations.
- C. Adjust vibration isolators to ensure that units have equal deflection, do not bottom out under loading, and are not short-circuited by other contacts or bearing points.
- D. Clean each vibration control unit and verify that each is working freely.

3.2 MOUNTINGS

- A. Restrained Mountings: Mount equipment with operating weight different from installed weight, such as chillers and cooling towers and equipment exposed to wind, on restrained spring mountings.

3.3 VIBRATION HANGERS

- A. Locate vibration hangers as near to overhead support structures as possible.
- B. Piping:
 1. Install isolation hangers on all piping in equipment room and for 50 feet from vibrating equipment. First three hangers from the equipment shall provide same deflection as equipment isolators, with maximum limitation of 2-inch deflection; remaining hangers shall be spring or combination spring and rubber with 0.75-inch deflection.
 2. Install pre-compressed hangers for first two hangers from equipment to prevent load transfer to equipment flanges.
 3. Install isolation hangers on piping 2 inches to 6 inches in diameter. Hangers adjacent to noise-sensitive areas shall be spring type.
- C. Duct Hangers: Install wherever ducts are suspended below or near noise-sensitive area and for all ducts where duct static pressures are 2 inches of water gauge and greater.

3.4 BASES

- A. Coordinate base design with equipment weight and dimensions.
- B. Use structural rails with mountings for absorption chillers, reciprocating compressors, shell mounted compressors, heating and ventilating units, and other equipment where manufacturer indicates a complete steel base is not required.
- C. Pump bases to be sized to support pump and piping elbows.

3.5 ACOUSTICAL SEAL

- A. Install acoustical seals where piping passes through equipment room walls, floors, or ceilings. Seals shall project a minimum of 1 inch past either face of wall. Install in accordance with manufacturer's recommendations. If seal is not installed around pipe before construction of building member, pack concrete around seal to make it integral with building material.

3.6 SEISMIC CONTROL

- A. Install seismic controls as required for zone specified.
- B. Install seismic snubbers on each spring-mounted unit. Locate snubbers as close as possible to the vibration isolators and bolt to supporting structures.
- C. Angle brace piping and ducts hard mounted to structure.
- D. Locate concrete anchors away from edges, stress joints, or existing fractures. Follow ASTM E488-96 for edge distances and center-to-center spacing.
- E. Suspended Equipment:
 - 1. Provide flexible connections between braced equipment and piping and ductwork that need not be braced.
 - 2. Provide flexible connections between isolated equipment and braced piping and ductwork.
 - 3. Install sleeves and lateral, axial, and downward cable restraints as required by manufacturer for seismic zone specified.
 - 4. Install cables with enough slack to engage only when 1/4 inch movement occurs.
- F. Ducts: Provide seismic cable restraint on rectangular ducts with cross-sectional areas of 6 square feet and larger, and round ducts with diameters of 28 inches or larger. No bracing is required if the duct is suspended by hangers 12 inches or less in length, as measured from the top of the duct to the bottom of the support where the hanger is attached. Brace ductwork at 30-foot intervals, at each turn, and at each end of a duct run.
- G. Pipe: Provide seismic restraint on piping 2-1/2 inches nominal diameter and larger. Provide seismic restraint on piping located in boiler rooms and mechanical equipment rooms that have a nominal diameter of 1-1/4 inch and larger. Provide seismic restraint on all piping that have a nominal diameter of 1 inch and larger. No bracing or restraint is required for piping suspended by individual hangers 12 inches or less in length as measured from the top of the pipe to the bottom of the support where the hanger is attached.

END OF SECTION

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing markers, tags, and labels for mechanical piping, ducts, and equipment.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Complete list of proposed materials, including manufacturers' names, catalog numbers, and descriptive literature for the following:
 - 1. Plastic pipe markers.
 - 2. Tags.
 - 3. Labels and nameplates.
 - 4. Stencils.
 - 5. Paint.

1.3 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Furnish valve schedule for each piping system, typewritten on 8-1/2-inch x 11-inch bond paper. In tabular format, include valve identification number, piping system, system abbreviation (as shown on tag), location of valve (room or space), function, normal position, and area served. Mark valves which are intended for emergency shut-off and similar special uses by special flags in margin of schedule. Show valve tag designations on as-built drawings.
- C. Furnish project record drawings with valve locations and tag designations shown on floor and elevation plans and schematic diagrams.

PART 2 PRODUCTS

2.1 PLASTIC PIPE MARKERS

- A. Pre-formed, semi-rigid, pre-printed, snap-on, color-coded pipe markers that completely encircle the pipe and are protected by corrosive resistant plastic coating. Directional flow arrows shall be integral with the marker. Snap-on Markers by Seton Name Plate Company, Branford, Connecticut, or approved equal.

2.2 TAGS

- A. Engraved anodized aluminum or engraved plastic, 2-inch diameter tags, color coded to match piping system identification. Tag shall be pre-punched to receive chain. Style 2070 or 2961 by Seton Name Plate Company, Branford, CT, or approved equal. Provide solid brass jack chain for attaching tags.

2.3 LABELS AND NAMEPLATES

- A. Black plastic laminate, 1/16-inch thick, with white engraving, drilled for mounting with two sheet metal or brass screws. Pressure-sensitive embossed labels are not acceptable. Engraved SetonPly nameplates style 2060 by Seton Name Plate Company, Branford, CT or approved equal.

2.4 STENCILS

- A. Metal stencils of letter sizes complying with ASME A13.1-96. Exterior grade oil-based alkyd gloss stenciling spray paint. Color shall comply with NEMA Z535.1-91. Manufactured by Seton Name Plate Company, Branford, Connecticut, or approved equal.

2.5 MANUFACTURER'S NAMEPLATES

- 2.6 Metal nameplates permanently fastened to equipment with data engraved or stamped.

PART 3 EXECUTION

3.1 GENERAL

- A. Identify piping and ductwork in crawlspaces, basements, above ceilings, attics, accessible chases, storage, and mechanical rooms. Provide identifying markings at 25 feet on center but not less than once in each room for piping and at 50 feet on center on ductwork. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

3.2 PIPE MARKERS

- A. Apply pipe and flow direction arrow marking near each valve, control device, and near each branch and riser takeoff excluding takeoffs less than 10 feet in length. Locate markers near locations where pipes pass through walls, floors or ceilings.
- B. Apply marking to pipe so lettering is in most legible position. For overhead piping, apply marking on lower half of the pipe where view is unobstructed, and marking can be read from floor level.

3.3 VALVE IDENTIFICATION

- A. Identify all valves, cocks, and control devices in piping systems, including fire protection valves, in main lines and branches. Exclude check valves, valves within factory fabricated equipment, plumbing fixture supply stops, HVAC terminal devices, and similar rough-in connection of end-use units. List each tagged valve in valve schedule for each piping system.
- B. Valve tags shall have unique prefix to indicate systems, followed by valve number. Example: CW-1; CW-2; HW-1; etc. The prefix shall match the system abbreviation in pipe label color and valve tag lettering schedule.

- C. Valve Schedule: Mount valve schedule in each equipment room. Valve schedule shall be mounted in glazed display frame, screwed to the wall or plastic laminated with grommets and mounted to the wall.

3.4 EQUIPMENT IDENTIFICATION

- A. Manufacturer's Nameplates: Provide on all equipment identifying manufacturer's name, equipment model number, size, capacity, and electrical characteristics. Leave manufacturer's nameplates clean and legible.
- B. Controls: Label magnetic starters and relays to identify connecting or controlled equipment. Label manual operating switches, fused disconnect switches, and thermal overload switches. Label automatic controls, control panels, zone valves, relays, and starters.
- C. Equipment: Label each unit with equipment symbol as noted on equipment schedules on drawings.
- D. Fire Dampers: Identify fire damper access doors. Paint access door red and stencil each door "FIRE DAMPER ACCESS" with 2-inch high letters.

3.5 ADJUSTING AND CLEANING

- A. Relocate any mechanical identification or nameplate which has been visually blocked. Clean face of identification devices and valve charts.

3.6 COLOR AND IDENTIFICATION SCHEDULE

- A. Label piping and valves in accordance ASME A13.1-96 and the following table:

PIPE LABEL COLOR AND VALVE TAG LETTERING SCHEDULE		
SERVICE	FIELD COLOR/ LETTER COLOR	VALVE TAG
Domestic Cold Water	Green/White	CW
Refrigerant Liquid	Yellow/Black	RL
Refrigerant Suction	Yellow/Black	RS
Fire Protection Lines	Red/White	FIRE
Sanitary Sewer	Green/White	SAN

END OF SECTION

SECTION 15080

MECHANICAL INSULATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing insulation for mechanical piping, ductwork, and related equipment.

1.2 QUALITY ASSURANCE

- A. Composite insulation, including jackets, coverings, sealers, mastics, and wet or dry adhesives, shall have a flame-spread rating of 25 or less and smoke-developed rating of 50 or less, as tested by ASTM E84.
- B. Tubing insulation with a smoke-developed rating of 150 or less may be used, except in ducts, plenums, and concealed spaces that are part of the air distribution system.
- C. PVC fitting covers shall have a maximum flame spread of 25 or less and are excepted from the smoke spread criteria.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's technical product data, k-value, thickness, accessories, and installation instructions for the following:
 - 1. Pipe insulation.
 - 2. Fittings and valve covers.
 - 3. Adhesives.
 - 4. Vapor barrier mastic.
 - 5. Rigid inserts.
 - 6. Tubing insulation.
 - 7. Duct insulation.

PART 2 PRODUCTS

2.1 FIBER GLASS PIPE INSULATION

- A. Rigid fiber glass pipe insulation with pressure sensitive tape lap sealing system for installation in temperatures down to 15 degrees F. Pressure sensitive tape shall not separate in high heat or humidity. Factory applied jackets, Type III, Class 12, with maximum water vapor permeance of 0.02 perm. Maximum thermal conductivity (k), 0.23 Btu-in/hr-ft²-°F at 75 degrees F.

- B. Insulation Thickness: Provide insulation of thickness specified for all piping listed in the following table:

PIPE INSULATION THICKNESS				
PIPING APPLICATION	PIPE DIAMETERS			
	1/4" to 1"	1-1/4" to 2"	2-1/2" to 4"	6" to 8"
Domestic Cold, Cold Condensate, Domestic Hot	1	1	1-1/2	1-1/2

- C. Covers: High-impact, UV-resistant, 20-mil thick PVC covering, designed for use outside or to protect insulation from damage. Zeston 2000 PVC jacketing, by Johns Manville Insulations, Denver, CO, or approved equal.
- D. Insulation Coatings and Adhesives: Washable, abrasion-resistant indoor coating/adhesive for lagging thermal insulation. Coating material shall not discolor with age. Foster Sealfas coating 30-36 or Foster Drion 85-75 adhesive, by H. B. Fuller Company, Foster Products Corp., Vadnais Heights, MN, or approved equal.
- E. Insulation Vapor Barrier Mastic: Water based mastic for protection of thermal insulation. Water vapor permeance shall be 3.0 perms at 1/16th dry thickness. Foster SealPas G-P-M 35-00 vapor barrier mastic, by H. B. Fuller Company, Foster Products Corp., Vadnais Heights, MN, or approved equal.

2.2 TUBING INSULATION

- A. Pipe Insulation: Flexible, elastomeric foamed plastic closed-cell insulation complying with ASTM C534, Type I. Thermal conductivity (k), 0.27 Btu-in/hr-ft²-°F at 75 degrees F. Insulation shall be AP Armaflex, by Armstrong World Industries, Inc., Lancaster, PA, or approved equal.
- B. Insulation Thickness: Provide insulation of thickness specified for piping listed in the following table:

PIPE INSULATION				
PIPING APPLICATION	PIPE DIAMETER			
	1/4" to 1"	1-1/4" to 2"	2-1/2" to 4"	6" to 8"
Refrigerant	1	1	1-1/2	1-1/2

- C. Adhesive: Contact adhesive for joining seams and butt joints of closed-cell insulation. Armstrong 520 Adhesive by Armstrong World Industries, Inc., Lancaster, PA, or approved equal.
- D. Insulation Tape: Elastomeric thermal insulation tape with closed-cell structure. Armaflex Insulation Tape, by Armstrong World Industries, Inc., Lancaster, PA, or approved equal.
- E. Protective Finish: Water-based latex enamel paint. WB Armaflex Finish, by Armstrong World Industries, Inc., Lancaster, PA, or approved equal.

2.3 PIPE FITTING AND VALVE COVERS

- A. Compressed fiber glass blanket insert and premolded 20-mil thick, high-impact, UV-resistant PVC cover; thickness equal to adjoining pipe insulation. Zeston 2000 PVC fitting and valve covers by Johns Manville Insulations, Denver, CO, or approved equal.

2.4 ACCESSORIES

- A. Galvanized Metal Shields: Shield length and minimum gauge shall be in accordance with the following table:

METAL SHIELD SIZE		
PIPE SIZE	SHIELD LENGTH	THICKNESS
1/4" to 3-1/2"	12"	0.048"
4"	12"	0.060"
5" to 6"	18"	0.060"
8" to 14"	24"	0.075"

2.5 DUCT INSULATION

- A. Mineral Fiber Blanket: Glass fiber bonded with a thermosetting resin, light weight, blanket-type thermal and acoustical insulation. Thickness shall be 2 inches with a density of 1.0 pcf. Thermal conductivity (k), 0.25 Btu-in/hr-ft²-°F at 75 degrees F. Ducts carrying cooled air or outside air shall have a fire resistant vapor barrier jacket. Install duct insulation with vinyl facing when used for interior concealed surfaces and FSK aluminum facing when used in mechanical rooms and locations subject to physical damage or abuse. Microlite brand fiber glass duct wrap insulation as manufactured by Johns Manville Insulations, Denver, CO, or approved equal.
- B. Adhesive and Mechanical Fasteners: As recommended by duct wrap manufacturer.
- C. Tape: Pressure-sensitive tape matching the facing and designed for use with duct wrap.

PART 3 EXECUTION

3.1 GENERAL

- A. Apply insulation, adhesives, sealants, and mastics as recommended by manufacturer.
- B. Apply insulation on clean, dry surfaces after items to be insulated have been tested and approved.
- C. Install insulation materials with smooth and even surfaces. Tightly butt longitudinal seams and end joints. Bond with adhesive. Finish insulation neatly at terminations.
- D. Taper insulation for terminations where vapor retarders are required. Seal tapered ends with vapor retarder.
- E. Fill and seal voids with vapor retarder mastic at penetrations in jackets for thermometers and pressure gauges.
- F. Penetrations:
 1. Exterior Walls: Terminate insulation flush with mechanical sleeve seal for penetrations of below grade walls. Seal terminations with vapor retarder mastic.
 2. Interior Walls: Extend piping insulation continuously through walls.

3. Fire Rated Walls: Terminate insulation at penetrations through fire rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire resistant joint sealer.
 4. Floor Penetrations: Extend pipe insulation continuously through floor assembly. For insulation with vapor retarders, seal insulation with vapor retarder mastic where floor supports penetrate vapor retarder.
- G. Apply insulation on all cold surfaces with continuous unbroken vapor seal. Extend sealants to protect all surfaces, ends, and raw edges of insulation especially at valves, fittings, and flanges. Insulate and vapor seal hangers, supports, and anchors that are secured directly to cold surfaces to prevent condensation, extending insulation at least 6 inches from cold surface where possible.
 - H. Insulate concealed piping, fittings, valves, and flanges same as exposed work.
 - I. Install insulation on components that require periodic inspecting, cleaning, and repairing in a manner that facilitates easy removal and replacement without damage to adjacent insulation.

3.2 FIBER GLASS PIPE INSULATION

- A. Jackets: Install jackets tight. Provide jackets with not less than 1-1/2-inch laps at longitudinal joints and not less than 3 inches wide on butt strips. Secure laps and butt strips with adhesive or vapor barrier mastic. Seal all openings, punctures, and breaks in vapor barrier jackets with vapor barrier mastic.
- B. Pipe Exposed to Weather: Cover insulated pipe, valves, and fittings located outside with weather resistant jacketing installed in accordance with manufacturer's recommendations. Seal all seams and joints.
- C. Pipe Exposed to Abuse or Damage: Cover insulated pipe, valves, and fittings located within 7 feet of finished floor with covering.

3.3 TUBING INSULATION

- A. Insulate only refrigerant suction lines inside buildings for air conditioning systems. Insulate both refrigerant vapor and liquid lines inside building for heat pump systems.
- B. Slip insulation on pipe before installation when possible. When slip-on technique is not possible, slit insulation and apply to pipe. Insulate line fittings with miter-cut pieces of insulation same size as adjacent insulation. Seal all joints, seams, and miter-cut pieces with adhesive.
- C. Use insulation tape to insulate short lengths of pipe and fittings in congested or hard to reach areas. Apply tape with a spiral wrap to obtain a 50 percent overlap. Build up insulation with multiple wraps as recommended by manufacturer.
- D. Exterior Insulation: Wrap glass mesh securely around tubing insulation and adhere overlapping seams. Apply two coats of protective finish over glass mesh.

3.4 FITTING INSULATION FOR USE ON PIPE FITTINGS

- A. Insulate all fittings, flanges, unions, and valve bodies in cold lines. Coat pipe insulation ends with vapor barrier mastic. Apply premolded, precut insulation. Make joints tight and bond with adhesive.

- B. Encase pipe fitting insulation and valve covers with one-piece premolded 25/50 rated PVC insulated fitting covers. Tuck ends of insulation snugly into throat of fitting and edges adjacent to pipe fitting. Secure PVC fitting cover by stapling and taping ends to adjacent pipe covering. Seal cold water system seam cover edges with vapor barrier adhesive.
- C. Identify insulated valves as specified in Section 15075.
- D. Refrigerant Fittings: Seal edges of cover with vapor barrier adhesive. Wrap edges of cover with vapor barrier pressure sensitive color matching tape. Extend tape over adjacent pipe insulation and overlap tape at least 2 inches.

3.5 PIPE ACCESSORIES

- A. Install 360-degree rigid insulation inserts, protected by 180-degree galvanized metal shields, between pipe and hanger. Insulation insert shall be same thickness as adjoining pipe insulation, divided into longitudinal half sections and covered with fire resistant vapor barrier jacket. Insulation inserts shall be same length as metal shield with thickness equal to adjoining insulation. Install double layer shield when pipe hanger spacing exceeds 10 feet. Install wood inserts on pipes 8 inches and larger. Insert shall be as long as the protective shield.

3.6 DUCT INSULATION

- A. Insulate the outside of all supply, return, and outside air ducts and plenums.
- B. Wrap around duct in accordance with manufacturer's recommendations. Install insulation tight and smooth. Secure to ducts having long sides or diameters as follows:
 - 1. Smaller than 24 Inches: Bonding adhesive in 6-inch wide transverse strips on 12 inch centers.
 - 2. 24 Inches and Larger: Mechanical fasteners spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of insulation.
- C. Overlap joints 3 inches. Seal joints by stapling 9/16-inch outward clinched staples through the overlapping facing of flange at 6 inches on center and by taping with minimum 3-inch wide foil reinforced kraft tape. Tape pin penetrations and punctures in facing.
- D. Seal joints, breaks, and punctures with vapor barrier mastic.

END OF SECTION

SECTION 15130

PUMPS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing a sewage lift station.

1.2 RELATED WORK

- A. Plumbing - Section 15400.
- B. Utility Trenching and Backfill – Section 02320.
- C. Pressure Sewer Piping and Appurtenances – Section 02532.

1.3 CODES AND STANDARDS

- A. Hydraulic Institute, HI 1.1-1.5 and HI 1.6.
- B. UL 778.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
- C. Submit certified pump curves with selection points clearly indicated, installation and start-up instructions, and physical data for approval.
- D. Submit wiring diagrams detailing wiring for power, signal, and control systems.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Operation and maintenance data for each type of pump, including spare parts lists for each pump.
- C. Spare Parts: One mechanical seal for each pump. Label seal with pump designation number.
- D. Videotapes: As specified in Section 01815.

PART 2 PRODUCTS

2.1 GENERAL

- A. Provide factory tested pumps, thoroughly cleaned and painted with machinery enamel prior to shipment. Type, size, capacity, and model number of each pump is listed in the pump schedule. Provide pumps of same type by same manufacturer.
- B. Select pumps so that ratio of impeller diameter used to maximum impeller diameter indicated for the casing on the pump curve does not exceed 0.85.
- C. Pump construction shall be rated for minimum 175 psig working pressure and continuous water temperature of 225 degree F. Pumps shall be factory tested at 1.5 times working pressure.
- D. Pump bearings shall be ball type, grease lubricated, including grease fitting, unless otherwise specified.
- E. Motor sizes shown on drawings have been selected for non-overloading conditions. Motor brake horsepower shall not be exceeded at any point of the pump characteristic curve and shall not exceed 100 percent of nominal motor horsepower under any condition of pump load. Motor efficiency shall be as specified in Section 15050.

2.2 SUBMERSIBLE PUMP LIFT STATION

- A. General: Furnish and install a ABS Piranha series "S" duplex pumping system and a disconnect system which permits installation and removal of each pump without the need for personnel to enter the wet well. All components of the pumping system must be listed labeled by Underwriter's Laboratory for operation in Class 1, Group D, Division 1 location as defined in Section 501-8 of the National Electric Code. Pump capacity and motor characteristics as listed on drawing.
- B. Pump Construction: The volute casing, impeller and motor enclosure shall be cast iron. The motor shaft on which the impeller is mounted shall be stainless steel. The impeller shall be slip-fit to the shaft, key driven, and attached with stainless steel fasteners.

All electrical parts shall be housed in an air-filled water-tight enclosure. Tandem lapped-face seals shall be provided on the rotating motor shaft. The inner seal shall operate in a sealed, oil filled chamber containing two moisture sensing probes, capable of detecting any influx of conductive liquid past the outer seal. The probes shall be connected to a relay and signal device in the pump control panel, providing the operator with an indication of impending seal failure.

Automatic reset, normally closed thermostats shall be provided in two adjacent phases of the motor winding. The thermal protection system shall limit motor skin temperatures to 80% of Group D gas ignition temperatures under all electrical conditions, including single phasing or locked rotor. The motor enclosure shall be listed and labeled by Underwriter's Laboratory as suitable for use in Class 1, Group D, Division 1 hazardous location.

The pump and motor assembly shall be listed by Underwriter's Laboratory as "Portable Utilization Equipment," permitting the use of flexible power and control cable in wet well. The

cable entry point at the top of the pump motor shall be epoxy-sealed to prevent entrance of moisture into the motor enclosure.

- C. Fiberglass Basin: Unless otherwise indicated the plastic terminology used in this standard shall be in accordance with the definitions given in American Society for Testing and Materials (ASTM) Designations D3753-99.

The resin used shall be of a commercial grade and shall either be evaluated as a laminate by test or determined by previous service to be acceptable for the environment.

The reinforcing material shall be a commercial grade of glass fiber having a coupling agent which will provide a suitable bond between the glass reinforcement and the resin.

The laminate shall consist of an inner surface, an interior layer, and an exterior layer of laminate body.

The inner surface shall be free of cracks and crazing with a smooth finish. This may be a gelcoat surface or reinforced with glass surface veil.

A minimum of 0.100 inch of the laminate next to the inner surface shall be reinforced with not less than 20 percent nor more than 30 percent by weight of noncontinuous glass strands having fiber lengths from 0.5 to 2.0 inches.

The exterior layer of body of laminate shall be of construction suitable for the service intended and contain sufficient glass by weight to provide the aggregate strength necessary to meet the tensile and flexural requirements. The exterior surface shall be relatively smooth with no exposed fibers or sharp projections. Enough resin shall be present to prevent fiber show.

The tank wall must be designed to withstand wall collapse based on the assumption that saturated soil exerts hydrostatic pressure of 120 pounds per cu. Ft. The tank wall laminate must be constructed to withstand or exceed two times the actual imposed loading on any depth of basin.

Under totally water submerged conditions, the center deflection of any empty tank bottom must be less than 3/8 inch as not to interfere with bottom pump mounting requirements and rail systems.

- D. Disconnect System and Guide Rail Construction: The design of the disconnect system shall permit the easy removal of each pumping unit for inspection or service. The pumps, when lowered into place, shall be automatically connected to the discharge piping. There shall be no need for personnel to enter the wet well to inspect or service the pumps.

Each pump shall be securely attached to a sliding guide bracket designed for use with at least two guide rails. Minimum schedule 40 standard galvanized steel pipe guide rails shall be furnished and installed by the Contractor. Each sliding guide bracket shall have nonsparking material at the point of contact with the guide rails to prevent spark ignition of explosive wet well gases during pump installation and removal.

A cast iron discharge elbow, located on the floor of the wet well, will receive the pump discharge when the pump is lowered into place. The receiving edge of the discharge elbow shall be fitted

with no-sparking material to prevent spark ignition of explosive wet well gases during pump installation and removal. The pump discharge shall be fitted with a resilient seal which provides a positive hydraulic seal for maximum pump system efficiency.

The lower guide rail brackets for each pump shall be mounted by the pump manufacturer on a steel base plate, in alignment for proper operation of the disconnect system. The base assembly shall provide stable, three-point support of the pumping unit during pump operation.

The entire quick disconnect pumping system must be listed and labeled by Underwriter's Laboratory (UL) as suitable for operation in a Class 1, Group D, Division 1 location as defined in Section 501-8 of the National Electric Code.

- E. Electric Controls - Duplex System: All controls shall be mounted in a NEMA 1 metal enclosure. The control panel and all electrical components shall bear the Underwriter's Laboratory (UL) label. All circuit breakers shall have operators extending through the door of the enclosure. All motor starters overload resets, selector switches, push buttons and pilot lights shall be mounted on the door of the enclosure.

The control for each pump shall include a thermal magnetic circuit breaker, rotary hand off automatic switch, and magnetic motor starter with ambient compensated overload relays and quick trip heaters.

The pump control circuit shall include a door interlock switch to de-energize the control circuit when the enclosure door is open, a control circuit transformer with fused 115 volt secondary, and a door mounted control circuit disconnect switch. Pump operation shall be controlled by three (3) bulb type liquid level sensors. An intrinsically safe pilot circuit shall be provided for each level sensor to a level incapable of releasing sufficient electrical or thermal energy to ignite explosives gases.

The controls shall provide for lead/lag sequencing of the pumps. The pumps shall operate singly or in parallel. An automatic alternator shall alternate the lead-standby duty on each succeeding pump cycle. An outer pump seal leakage detection system shall be included in the control enclosure. When the motor probes sense the presence of moisture in the oil seal chamber, a relay coil will illuminate a panel mounting indicating lamp to indicate possible outer motor seal failure.

A fourth level sensor, with intrinsically safe circuit, shall be furnished for indication of high water alarm condition. High water alarm shall be indicated by a panel mounted pilot light and an external audible alarm with silence button.

- F. Control panel shall have following features:

1. UL listed
2. NEMA 4x enclosure
3. Motor circuit breakers

4. Fused control circuit and door interlock switch
 5. Hand off automatic switches
 6. Magnetic starters with ambient compensated overload protection, quick trip heaters and reset push buttons
 7. Terminal strip for ease of installation
 8. Electric alternator (duplex units)
 9. Running lights
 10. Elapsed time meters
 11. 115 V receptacle with ground fault circuit interrupter
 12. Standard level controls
 13. Ground level access doors 2
 14. 60 day event recorder - Rustrack 288R
- G. An aluminum cover shall be furnished and shall be 3/8" thick. The cover shall have a pump access opening and an opening in the valve chamber. Vent fittings shall be provided on the cover.

PART 3 EXECUTION

3.1 GENERAL

- A. Discharge increasers shall be concentric and located at pump discharge nozzle.
- B. Install lift station in accordance with manufacturer's written installation instructions.

3.2 IDENTIFICATION

- A. As specified in Section 15075.

3.3 TRAINING

- A. As specified in Section 01815.
- B. Provide 2 hours of instruction to Government personnel.

3.4 ADJUSTING AND CLEANING

- A. Alignment: Check alignment and, where necessary, realign shafts of motors and pumps within recommended tolerances of manufacturer.

- B. Verify pumps are free to rotate by hand. Do not operate pump if it is bound or drags until cause of trouble is determined and corrected.
- C. Start-Up: Lubricate pumps before starting in accordance with manufacturer's written recommendations.
- D. Ensure pumps are wired properly, with rotation in correct direction, and that pump and motor grounding have been provided.

3.5 TESTING, ADJUSTING AND BALANCING

- A. As specified in Section 15952.

END OF SECTION

SECTION 15183

REFRIGERANT PIPING SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing refrigerant piping.

1.2 RELATED WORK

- A. General mechanical provisions - Section 15010.
- B. Basic materials and methods - Section 15050.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's literature for hangers, silver solder, valves, and flux.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING

- A. Tubing: Air-conditioning and refrigeration (ACR) copper tube, manufactured in accordance with ASTM B280-83 and ANSI/ASHRAE 15-78, 20-foot lengths, hard drawn, cleaned and capped, color coded, and marked ACR.
- B. Fittings: Wrought copper solder joint.
- C. Solder: Silver solder and applicable flux.
- D. Supports: Hangers and anchors as required.

2.2 INSULATION

- A. Section 15080.

2.3 VALVES

- A. As approved.

PART 3 EXECUTION

3.1 GENERAL

- A. Install refrigerant piping and accessories in accordance with the recommendations of the manufacturer and as shown.

- B. Support and anchor piping to adequately prevent sagging and vibration.

3.2 INSTALLATION

- A. Install piping clean of scale, sand, dirt, moisture, oil, and oxide. Cut tube ends square; ream, burr, and size. Polish both tube and solder cup to bright metal with steel brush or sand cloth. Steel wool is prohibited. Apply flux sparingly to outside of tube and inside of solder cup. Avoid flux on areas not cleaned. Assemble parts immediately after flux is applied. Heat tube until flux becomes clear. Apply silver solder to fill socket. Keep flame away from solder as it is fed into socket.

3.3 TESTING AND EVACUATION

- A. Accomplish after condensers and compressors are installed and all refrigerant piping is complete. Test before insulation is applied. Testing and evacuation will be observed by the Contracting Officer.
- B. Evacuation and Testing Equipment: Two-stage high vacuum pump with clean oil, capable of pumping down to 0.50 millimeter of mercury (500 microns), and a closed end mercury manometer, or thermocouple or thermistor vacuum gauges.
- C. Connect pump to system with as large a diameter copper connecting line as is feasible to monitor the vacuum evacuation range. Vacuum shall be brought to the range of dehydration at normal temperatures, 0.50 millimeter of mercury (500 microns), equivalent to 29.62 inches mercury vacuum.
- D. Evacuate refrigerant piping, condenser, and evaporator coil. Do not evacuate compressor. Evacuate system to 500 microns absolute pressure. Pressurize with refrigerant to 20 psi gauge. Check for leaks. Reevacuate system to 500 microns and hold vacuum for a minimum of 6 hours. Pressurize to 30 psi gauge and check all joints for leaks with soap solution or electronic leak detector. Remake all leaking joints and repeat system evacuation procedure, including leak testing.

3.4 FINAL TESTING, ADJUSTING, AND BALANCING

- A. Section 15952.

3.5 INSULATION

- A. Section 15081.

END OF SECTION

SECTION 15400
PLUMBING SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing waste, vent, and sanitary sewer system; storm drains; and domestic cold and hot water supply systems.

1.2 RELATED WORK

- A. Mechanical identification - Section 15075.
- B. Mechanical insulation - Section 15080.
- C. Plumbing fixtures - Section 15410.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's data for the following:
 - 1. Pipe.
 - 2. Fittings.
 - 3. Joining material.
 - 4. Valves.
 - 5. Backflow preventers.
 - 6. Pressure reducing valve.
 - 7. Water meter with remote meter reader.
 - 8. Pressure gauge.
 - 9. Thermometer.
 - 10. Hose bibbs.
 - 11. Cleanouts.
 - 12. Floor sinks.
 - 13. Instantaneous water heater.

1.4 QUALITY ASSURANCE

- A. Meet requirements of Uniform Plumbing Code and ASME B31.9.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Spare Parts: One T-handle for wall hydrants.
- C. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Furnish manufacturer's operation and maintenance data for the following:
 - a. Valves.
 - b. Backflow preventers.
 - c. Water pressure reducing valve.
 - d. Water meter.
 - e. Shock absorbers.
 - f. Hose bibbs.
 - g. Instantaneous water heater.
- D. Valve schedule for all plumbing valves. For each valve, list valve designation number, valve type, size, location, and function.
- E. Backflow preventer state certification test.

PART 2 PRODUCTS

2.1 SOIL, WASTE, AND VENT PIPE AND FITTINGS, ABOVEGROUND

- A. Hubless Cast Iron Pipe: ASTM A888 or CISPI 301, service weight (SV), with hubless joints using stainless steel bands.
 - 1. Fittings: CISPI 301, hubless cast iron, long sweep bends.
 - 2. Joining Material: ASTM C1277, assembly of metal housing, corrosion-resistant fasteners, and ASTM C564 rubber sleeve or gasket with integral, center pipe stop.
 - a. Heavy-Duty Couplings: ASTM A666, type 301 stainless steel shield, and stainless steel bands. Include sealing sleeve.
 - 1) Clamp width shall be 3 inches wide with four clamps for pipe 1-1/2 inches to 4 inches.
 - 2) Clamp width shall be 4 inches wide with six clamps for pipe 5 inches to 10 inches.
- B. PVC Plastic Pipe: ASTM D2665, Schedule 40 PVC.

1. Socket Fittings: ASTM D2665, made to ASTM D3311 drain, waste, and vent pipe patterns.
 2. Joining Material: ASTM D2564, solvent cement approved by pipe manufacturer.
- C. Exposed Pipe and Fittings: Polished chrome over nickel-plated brass.
- 2.2 SOIL, WASTE, STORM, AND DRAINAGE PIPE AND FITTINGS, BELOWGROUND
- A. Hub-and-Spigot Cast Iron Pipe: ASTM A74, service class. Include ASTM C564 rubber gasket, with dimensions required for pipe class, for each hub.
1. Fittings: ASTM A74, cast iron service class, hub and spigot compression joint, long sweep bends.
 2. Joining Material: Compression gasket joints.
- B. PVC Plastic Pipe: ASTM D2665, Schedule 40 PVC.
1. Socket Fittings: ASTM D2665, made to ASTM D3311 drain, waste, and vent pipe patterns.
 2. Joining Material: ASTM D2564, solvent cement approved by pipe manufacturer.
- 2.3 DOMESTIC WATER PIPING, UNDERGROUND
- A. Copper Piping: ASTM B88, copper tubing, hard drawn temper, Type K.
1. Fittings: ASME B16.18, cast copper alloy, or ASME B16.22, wrought copper.
 2. Joining Material:
 - a. Brazing: AWS A5.8, BCuP, copper phosphorus alloy, or BAg1, silver alloy.
- 2.4 DOMESTIC WATER PIPING AND FITTINGS, ABOVEGROUND
- A. Copper Pipe: ASTM B88, copper tubing, hard drawn, Type L.
1. Fittings: ASTM B16.18, cast copper alloy, or ASTM B16.22, wrought copper.
 2. Joining Material: ASTM B32, Alloy SN95, or SN94 lead free solder.
- 2.5 VALVES
- A. Gate Valves:
1. 2-inch and Smaller: Class 150, 300 psi, ASTM B62 cast-bronze body and union bonnet, solid bronze wedge, rising stem, integral seat, threaded or soldered ends, and aluminum or malleable-iron handwheel.
 2. 2-1/2-inch and Larger: Class 125, 200 psi, ASTM A126 cast iron body and bonnet, solid cast iron wedge, brass-alloy stem, outside screw and yoke, flanged end connections, and cast iron handwheel.

- B. Ball Valves, 4-inch and Smaller: Class 150, 600 psi, ASTM B584 bronze body and bonnet, two-piece construction, chrome-plated brass ball, conventional port, bronze or brass stem; Teflon seats and seals; threaded or soldered end connections, vinyl-covered steel lever handle and handle memory stop.

2.6 BACKFLOW PREVENTERS

- A. Vacuum Breaker: ASSE 1012, suitable for continuous pressure. Include inlet screen and intermediate atmospheric vent.
- B. Double-Check Valve: As specified in Section 13930.
- C. Reduced Pressure: ASSE 1013, reduced pressure type backflow preventer suitable for continuous pressure applications. Include outside screw and yoke gate valves or ball valves on inlet and outlet, and strainer on inlet, test cocks and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

2.7 PRESSURE REDUCING VALVE

- A. ASSE 1003, water regulator, rated for initial working pressure of 150 psig minimum, bronze body with threaded ends, integral factory-installed Y-pattern strainer, with adjustable reduced pressure range.

2.8 WATER METER WITH REMOTE METER READER

- A. AWWA C700 with type "B" pulser and remote display, consisting of cast bronze meter housing, thermoplastic measuring chamber, permanently sealed register, thermoplastic nutating disc, and built-in strainer. 80 degrees F. maximum operating temperature and 150 psi maximum operating pressure. Typical operating range 80, 3psi pressure loss at 12 flow. Model C700, by AMCO, or approved equal.

2.9 DOMESTIC WATER ACCESSORIES

- A. Pressure Gauge: 4-1/2-inch dial, water service, bronze bourdon tube movement, cast aluminum case, white face, black numbers, with gauge cock. Range at two times working pressure. Ametek, U.S. Gauge Division, Sellersville, PA, or approved equal.
- B. Unions: ASME B16.22, wrought copper solder joint, ground seat.
- C. Flanges: Class 125, cast iron or cast bronze flanges.
 - 1. Bolts and Nuts: ASME B18.2.1, carbon steel square head machine bolts with galvanized heavy hex nuts.
 - 2. Gaskets: ASME B16.21, nonmetallic, flat, 1/16-inch, full faced, for potable water service.
- D. Dielectric Connections: Fitting having insulating material isolating joined dissimilar metals. Epco Sales, Inc., Cleveland, OH, or approved equal.
 - 1. Unions: Rated for 250 psig minimum working pressure at 180 degrees F. temperature.
 - 2. Flanges: 150 psig minimum working pressure, with bolt insulators, dielectric gasket, bolts, and nuts.

2.10 HOSE BIBS

- A. Bronze body, rough brass finish, with renewable composition disc, 1/2 inch or 3/4 inch threaded or solder joint inlet. ASME B1.20.7 garden hose threads on outlet and field-installed hose connection vacuum breaker.

2.11 CLEANOUTS

- A. Exposed Piping: Cast iron cleanout tee with bronze plug or cleanout ferrule and bronze plug. Series 58510 or 58900, by Josam Manufacturing Company, Michigan City, IN, or approved equal.
- B. Exterior: Adjustable cast iron floor cleanout with cast iron ferrule, outside caulk connection, bronze internal cleanout plug, and adjustable head with cast iron heavy duty, vandalproof, secured cover.
 - 1. Unpaved Areas: Series 58850, Josam Manufacturing Company, Michigan City, IN, or approved equal, set in minimum 18-inch-square by 6-inch poured concrete, with top at finished grade.

2.12 FLOOR SINKS

- A. FLOOR SINK (10" x 10" x 6" DEEP) TYPICAL: Smith 3100Y-14 or approved equal. Cast iron flanged receptor with acid resistant coated interior, nickel bronze rim and grate. Aluminum dome strainer, flashing clamp. Grate shall be three-fourth, one half or no grate as indicated on drawings. Floor sink without grate shall be provided with nickel bronze rim. Outlet size shall be as indicated on drawings.

2.13 VENT FLASHING

- A. Lead Sheet: ASTM B749, 4 pounds per square foot or 0.0625 inch thickness.
- B. Flashing Membrane: EPDM or neoprene flashing 60 mil thick, resistant to ozone and ultraviolet. Service temperature range shall be -60 to 270 degrees F. Hardware shall be stainless steel.

2.14 SHOCK ABSORBERS

- A. ASSE 1010, bellows or piston type with pressurized cushioning chamber. Absorbotron, by Josam Manufacturing Company, Michigan City, IN, or approved equal.

2.15 PIPE SLEEVES

- A. As specified in Section 15050.

2.16 ESCUTCHEONS

- A. As specified in Section 15050.

2.17 HANGERS, ANCHORS, AND GUIDES

- A. As specified in Section 15050.

2.18 IDENTIFICATION

- A. As specified in Section 15075.

2.19 INSULATION

- A. As specified in Section 15080.

2.20 INSTANTANEOUS ELECTRIC WATER HEATER

- A. Tankless Type:

1. Description: UL listed for residential use. Meets ASHRAE 90.1 standard for energy conservation. 1.0 GPM flow rate, 31 degree F temperature rise. Model S46IL, as manufactured by Chronomite, or approved equal.
2. Casing: Steel or cast aluminum.
3. Heating Element: 4.6 KW, 208 volts, 22 amps.
4. Temperature Control: Power/flow switch activates when water flows through heater. Adjustable thermostat for each element.
5. Pressure Required: 45 psig minimum.
6. Warranty: 1 year.

PART 3 EXECUTION

3.1 GENERAL

- A. Install materials and equipment as shown and specified in accordance with governing codes and standards.
- B. Rough in work as construction progresses to minimize cutting, eliminating interferences.
- C. Locate equipment requiring service and maintenance in fully accessible positions. Install access doors for this purpose if required.
- D. Runs and arrangement of piping shall be as shown, subject only to such changes and modifications as may be necessary to suit actual conditions at building, to avoid interference or conflict with work of other trades. Install piping concealed in floor or in wall construction or excavations to prevent delay to other work and to allow ample time for necessary tests and approvals.
- E. Carefully check installations against structural, architectural, and mechanical drawings and note where walls, ceilings, beams, and pipe shafts are furred or enclosed. Piping shall not be furred in or covered before approval by the Contracting Officer.
- F. Support horizontal piping runs from ceilings or construction above. Locate as closely as possible to structural members or bottom of slabs or beams to obtain maximum head room. If piping interferes with finished ceiling or wall surfaces, notify Contracting Officer and correct unsatisfactory conditions.
- G. Waste, soil, water, and other services shall be fully connected to each individual piece of apparatus with required piping, unions, flanges, valves, check valves, and other needed appurtenances.

- H. Each branch pipe shall be controlled by gate valve where it connects to supply main or riser. Each toilet room, group of fixtures, or isolated fixture shall be separately controlled by valves in accessible location and provided with access doors where necessary.
- I. Install swing joints or expansion loops to allow for pipe expansion. Securely anchor pipes so expansion can occur at these joints.
- J. Make joints between dissimilar piping by dielectric unions or flanges.
- K. Use reducing fittings wherever a change in pipe size occurs. The use of bushings will not be permitted.
- L. Provide piping with unions to permit alterations and repairs.
- M. Exposed piping at plumbing fixtures shall be chrome-plated brass pipe.

3.2 VALVES

- A. Where soldered end connections are used, use solder having a melting point below 840 degrees F for gate, globe, and check valves; below 421 degrees F for ball valves.
- B. Provide extended stems where insulation is specified.
- C. Valves shall be same size as upstream piping, unless otherwise shown.
- D. Drain valves shall be 1/2-inch globe type valves with capped male hose nipples. Install low point drains in cold and hot water systems.

3.3 INSTALLATION OF SANITARY SYSTEM

- A. Make connection to the public sewer system as required by local codes. Do not backfill trench until the complete sewer line has been installed, tested, and approved.
- B. Pitch underground sanitary pipe within building minimum of 2 percent downward for piping 3 inches and smaller and 1 percent downward for piping 4 inches and larger. Make changes in direction of drainage lines with 45-degree wyes, long turn wyes, or sweep bends. Use long turn fittings wherever space conditions permit. Provide waterproofing around all lines penetrating through foundation walls and floor slabs.
- C. Check and verify all inverts of lines within and outside the building.
- D. Install traps on fixtures and equipment requiring connection to sanitary system. Traps shall be same size as pipe on which they occur. Provide cleanouts for all traps. Vent traps as shown and as required by local codes.
- E. Cleanouts:
 1. Size same as drainage piping. Install cleanouts at each change in direction of piping greater than 45 degrees. Install cleanouts at base of each stack and each change in direction. Install cleanouts on minimum of 50-foot centers at horizontal runs.
 2. Install cleanout deck plates with top flush with finished floor.
 3. Install cleanout wall access covers with frame and cover flush with finished wall.

4. Cleaning screws, deckplates, and other plugs shall be made up with graphite and oil only; use of grease or cement is not allowed.
5. Install ground cleanouts within an access box set in 24-inch square by 6-inch thick concrete pad. Access cover shall be flush to finished grade.

F. Vents:

1. Pitch vent 1 percent down toward vertical fixture vent or stack.
2. Where vent piping is run concealed in partitions, obtain exact dimensions and locations of partitions and use special care to ensure that lines are maintained in their proper locations.

G. Flashing:

1. Cast Iron Vent: Flash vents penetrating roof structure with sheet lead. Extend flashing riser beyond top of vent and turn over and roll down inside of pipe vent minimum of 1/2 inch with skirt extending on all sides of vent minimum of 8 inches.
2. Plastic Vent: Install vent flashing membrane according to manufacturer's instructions. Protect plastic plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.4 INSTALLATION OF WATER SYSTEM

- A. Install piping with 0.25 percent slope toward drain.
- B. Conceal water piping in finished areas.
- C. Cold Water: Locate underground service minimum of 4 feet below grade. Fit pipe connections to mechanical equipment with unions for ease of dismantling.
- D. Hot Water: Begin installation of hot water piping system at water heater and traverse building. Fit piping around heater and equipment with sufficient number of unions to ensure easy dismantling for maintenance.

3.5 SHOCK ABSORBERS

- A. Sizes based on water-supply fixture units as shown. Install ball valve between shock absorber and water line for servicing.

3.6 HANGERS, ANCHORS, GUIDES

- A. As specified in Section 15050.

3.7 PIPE IDENTIFICATION

- A. As specified in Section 15075.

3.8 INSULATION

- A. As specified in Section 15080.

3.9 WATER HEATERS

- A. Install water heater on concrete base. Install units plumb, level, and firmly anchored.
- B. Set and connect units according to manufacturer's written instructions. Maintain manufacturer's recommended clearances.
- C. Connect hot and cold water piping to water heaters with shutoff valves and dielectric unions.

3.10 FLUSHING AND CLEANING

- A. Flush and clean sanitary lines and remove water and debris before final connection into existing waste lines.

3.11 DISINFECTION OF WATER SYSTEM

- A. As specified in Section 02519. Disinfect all water piping and equipment upon completion of piping installation. Following disinfection, flush water from system through its extremities. Continue flushing until samples show quality is comparable with public water supply and complies with requirements of public health authority having jurisdiction.

3.12 FIELD QUALITY CONTROL

- A. Notify Contracting Officer at least 48 hours before testing. Perform tests in presence of Contracting Officer.
- B. Rough-In Inspection: Piping shall be inspected before concealing or closing-in after rough-in and before setting fixtures.
- C. Final Inspection:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - 2. Submit test report for each test.
 - 3. Test drain, waste, and vent piping on completion of rough-in. Close openings in piping system and fill with water to point of overflow but not less than 10 feet of head. Water level must not drop from 15 minutes before inspection starts through completion of inspection. Correct leaks and retest system.
 - 4. Cap domestic water piping and subject piping to static water pressure of 50 psig above operating pressures or 150 psig maximum without exceeding pressure rating of piping system materials. Allow to stand for 4 hours. Correct leaks and loss in pressure and retest system.

END OF SECTION

SECTION 15410

PLUMBING FIXTURES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing plumbing fixtures and trim.

1.2 RELATED WORK

- A. Plumbing systems - Section 15400.

1.3 QUALITY ASSURANCE

- A. Meet requirements of the International Plumbing Code.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's data and installation instructions. Include fixture, trim, faucets, fittings, accessories, and supports. Indicate materials, finishes, dimensions, and flow rates. Include rough-in requirements, clearances, and anchorages.
 - 1. Water closet.
 - 2. Lavatory.
 - 3. Service sink.
 - 4. Sink.
 - 5. Supply/drain insulation.
 - 6. Garbage disposal.
 - 7. Fire extinguisher cabinet & extinguisher

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Manufacturer's operation and maintenance data for all plumbing fixtures and faucets.
 - 2. Replacement parts lists for all fixtures.

PART 2 PRODUCTS

2.1 PLUMBING FIXTURES

- A. Low-flow, from one manufacturer when possible. Include required specialties, trim, supports, and related items. Furnish screwdriver-operated stops, chrome-plated adjustable cast brass P-trap with tubing drain to wall, and chrome-plated escutcheon sized to match tailpiece. Handicap fixtures shall comply with Uniform Federal Accessibility Standards (UFAS).

2.2 WATER CLOSET

- A. ASME A112.19.2M and A112.19.6, limited to 1.6 gallons per flush.
- B. Gravity Tank Type: White, vitreous china, siphon jet, close coupled bowl, tank, fill valve, tank cover and chrome trip lever. Model 2998.012 “Cadet 16-1/2”H Elongated, manufactured by American Standard, or approved equal.
 - 1. Seat: White, elongated, open front, solid plastic seat with cover.

2.3 LAVATORY

- A. Wall Hung Lavatory: ASME A112.19.2M, white, vitreous china, 20-1/2- inches by 18-1/4- inches single faucet hole with back splash. Model 0356.421 “Lucerne”, manufactured by American Standard, or approved equal.
 - 1. Drain:
 - a. Integral grid drain and tailpiece.
 - b. Indirect lift waste and tailpiece.
 - 2. Faucet: Polished chrome-plated cast brass, 3-1/2-inch spout, water economy aerator, flow limited to 0.5 gpm. Model 23TI053, manufactured by Delta, or approved equal.
 - 3. Carrier: Floor mounted concealed arm carrier.

2.4 SERVICE SINK

- A. Sink: White, acid resisting, porcelain enameled inside only, 24 inches by 20 inches by 12 inches deep, cast iron service sink, 10-inch back, concealed hangers, 3-inch cast iron P trap, chrome plated strainer, U-shaped sheet brass rim guard. Model K-6716 “Bannon”, manufactured by Kohler, or approved equal.
 - 1. Faucet: Chrome plated brass faucet with vacuum breaker, integral stops, pail hook, and 3/4-inch hose thread spout.

2.5 SINK

- A. Single Compartment Sink: Type 302, minimum 18-gauge stainless steel, self-rimmed, 3 each 1-1/2-inch faucet holes on 4-inch centers. Compartment shall be 21 inches wide, 15-3/4 inches front to back, 5-3/8 inches deep; overall size, 25 inches by 21 inches. Model ADAR-2521-L, manufactured by Elkay, or approved equal.
 - 1. Drains: Cast brass, basket strainer with stopper and 1-1/2-inch tailpiece.
 - 2. Faucet: Single lever swing faucet, 1/2-inch male IP connectors, chrome finish, aerator, hose, and spray. Model 173-WF, manufactured by Delta, or approved equal.

2.6 GARBAGE DISPOSERS

- A. Continuous feed, rubber cushion mounted, stainless steel stopper flange, shredder ring and grind chamber, sound baffles, dishwasher drain connection, permanently lubricated bearings, manual reset overload protection, 1/2 HP, 115 volt, single phase motor. 2 year warranty. Model Badger 5, manufactured by In-Sink-Erator or approved equal.

2.12 FIRE EXTINGUISHER CABINET & EXTINGUISHER

- A. Fire Extinguisher Cabinet: Potter Roemer, Croker, J.L., or approved equal, unit consisting of 20-gauge aluminum box with anodized aluminum door, style "E" break glass (25 square inch), decal Figure No. 1970, cylinder lock. Finish shall be baked enamel inside, rust resistant prime coat outside except for aluminum door and trim. 10lb. Dry chemical fire extinguisher, UL rating of 4A:60B:C. See architectural drawings for mounting heights.

		<u>Overall</u>	<u>Recess</u>
F.E.C.-SR	Semi Recessed 1724-E	13"x28"x6"	10"x25"x4"
F.E.C.-S	Surface Mount 1754-E	11"x26"x6"	

PART 3 EXECUTION

3.1 PROTECTION

- A. Protect fixtures and equipment during construction. Cover metal trim with noncorrosive grease or protective tape.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set fixtures level and plumb. Install at spacing and heights above finished floor as shown, square in relation to interior floor and wall lines.
- C. Install traps that are easily removable for service and cleaning.
- D. Install individual stop valves in each water supply to fixture. Omit stop valves on supplies to emergency equipment.
- E. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork.
- F. Insulate lavatory hot water supplies, stops and handles, drain, trap, and waste to wall.

3.3 ADJUSTING

- A. Adjust stops and valves to operate at intended water flow rate without splashing, noise, or overflow.

3.4 CLEANING

- A. Remove protection and labels. Clean and polish fixtures and trim.

END OF SECTION

SECTION 15731

SPLIT SYSTEM AIR-CONDITIONER

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing an air-cooled condensing unit and direct expansion evaporator section.

1.2 RELATED WORK

- A. General mechanical provisions - Section 15010
- B. Basic materials and methods - Section 15050.

1.3 QUALITY ASSURANCE

- A. ASME Code for Unfired Pressure Vessels, ANSI/ASHRAE 15-78, NEC 440. System components shall meet efficiency ratings in ASHRAE 90-75.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's literature and installation instructions for air-cooled condenser, evaporator, expansion device, and controls.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Spare Parts: Minimum one (1) years supply of spare air filters for evaporator section of each evaporator section shall be provided.
- C. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Manufacturer's operation and maintenance data for condenser, evaporator, expansion device, and controls.
 - 2. Where more than one unit is installed, provide an equipment schedule listing, for each unit, its designation, location, and areas served.

PART 2 PRODUCTS

2.1 CONDENSING UNIT

- A. General: Provide factory assembled and tested air-cooled condensing units as shown, consisting of compressor, condenser coil, fan, motor, refrigerant reservoir, and factory built and wired electrical control panel in rainproof enclosure. Capacity and electrical characteristics as shown.
- B. Casing: 18-gauge galvanized steel casing finished with baked enamel. Provide removable panels for access to controls and weep holes for water drainage. Provide base with mounting holes. Provide brass service valves, fittings, and gauge ports on exterior of casing.
- C. Compressor: Hermetically sealed reciprocating or rotary type with overload and overheat protection, oil failure switch, and crankcase oil heater. Provide compressor spring mounts with suction and discharge vibration eliminators. Provide switch and timer to prevent compressor rapid cycle.
- D. Condenser: Coil shall be high heat transfer aluminum fins bonded to copper or aluminum tube. Coil shall be cleaned, sealed, leak tested at 150 psig, and pressure tested to 400 psig. The propeller fans shall be operated by a direct drive, single-speed fan motor with vertical discharge. An ambient sensing thermostat shall control the fan speed as required. The fan shall be protected by a closely spaced, corrosion resistant grille. Flooding of the condenser with liquid refrigerant will not be permitted to replace the required liquid receiver storage requirement of 1-1/2 times the system capacity.
- E. Accessories: Filter dryer and sight glass.
- F. Corrosion Protection: Special protection for cabinets is not required for equipment that has a zinc coating conforming to ASTM A 386 of a duplex coating of zinc and paint. Equipment items shall be protected by the manufacturer with a corrosion inhibiting coating or paint system that have been proven capable of satisfactorily withstanding the following test: Test method shall be ASTM B117. Period of test shall be 125 hours for equipment intended for installation outdoors or which will be otherwise subjected to marine atmosphere. Each specimen shall have a standard scratch as defined in ASTM 1654.
 - 1. Finned Tube Coils: Finned tube coils shall be protected with “Blygold Polual”, or “Thermoguard Fin Guard Silver” a polyurethane based metal impregnated coating.
 - a. Coating thickness and application shall be applied in strict accordance with the coating manufacturer’s recommendation.
 - b. The coating shall be performed by a qualified and experienced factory certified applicator such as International A/C Coatings, Honolulu, Hawaii, Thermoguard Pacific., or an approved applicator
 - 2. Cabinet and Exterior Surfaces: Unit cabinet shall be coated with Ameron PSX 700 Engineered Siloxane or “Thermoguard Casing Guard”. Metal preparation shall provide a surface profile that shall include degreasing and etching.
 - a. The coating shall be applied to all interior and exterior surfaces. Coating thickness and application shall be applied in strict accordance with coating manufacturer’s recommendations.

- b. After the coating has totally cured, the equipment shall be assembled using care not to damage the coating during assembly. Fasteners shall be stainless steel with bonderized rubber washer attached. Any touch up required shall be performed in accordance with the manufacturers's recommendations.
3. The coating shall be performed by a qualified and experienced factory certified applicator such as International A/C Coatings, hononlulu, Hawaii, Thermoguard Pacific, Inc. or an approved applicator.

2.2 EVAPORATOR SECTION

- A. Capacities and electrical characteristics as shown. Coils, air filters and coil cabinet shall allow attachment to duct and to furnace without modification and shall be standard manufactured products.
 1. Coil Cabinet: Galvanized steel. Coils shall be accessible for service and removable from the cabinet through panels.
 2. Coils: Aluminum plate fin and copper tube type. Fins shall have collars drawn, belled, and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall have galvanized steel casing and a condensate pan and drain.
 3. Filter Section: Filter section shall be supplied by the air handling unit manufacturer, with the same casing construction as before specified for other unit sections. The type of filters to be housed within the filter section shall be of the type and efficiency indicated on the equipment schedule

2.3 EXPANSION DEVICE

- A. Evaporator manufacturer's standard expansion valve, capillary, or other device.

2.4 REFRIGERANT PIPING

- A. Section 15183.

2.5 REFRIGERANT PIPING

- A. Provide precharged and insulated suction and liquid tubing of length shown or piping recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

- A. Install equipment as shown, in accordance with recommendations of manufacturer.

3.2 REFRIGERANT PIPING

- A. Section 15183.

3.3 REFRIGERANT PIPING

- A. Install as recommended by manufacturer.

3.4 COORDINATION

- A. Coordinate control components and operation with the automatic temperature controls to ensure non-duplication of components and correct and safe operation of air conditioning units.

3.5 TESTING

- A. Section 15952.

3.6 DEMONSTRATION

- A. As specified in Section 01815.
- B. Provide one hour of operating instructions.

END OF SECTION

SECTION 15750

HUMIDITY CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing a humidity control system.

1.2 RELATED WORK

- A. General mechanical provisions - Section 15010.

1.3 QUALITY ASSURANCE

- A. System and components shall be UL listed.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Detailed shop drawings for humidity control system.
- C. Manufacturer's literature and installation instructions for the humidity control system.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Manufacturer's operation and maintenance data for humidity control system.

PART 2 PRODUCTS

2.1 ELECTRIC REHEAT COIL

- A. General: Furnish and install electric open coil duct heaters. Voltage size, wattage, number of steps and voltage shall be as shown on drawings.

Heaters shall be UL listed for zero clearance and shall meet all applicable requirements of the 1990 National Electric Code.

- B. Heaters shall be slip-in type for duct mounting
- C. Elements shall be constructed of 80% nickel and 20% chromium; steps shall be arranged to prevent stratification when operating at less than full capacity. The maximum watts per square inch of wire surface shall be as follows: duct installation up to 150 KW=standard watts density, draw-through air handling units and duct coils over 150 KW-35, blow-through air handling units and variable volume reheat boxes = 25.

- D. Coil terminals shall be stainless steel, terminal insulators and bracket bushings shall be constructed of ceramic and securely positioned. Terminals shall be machine crimped to coil.
- E. Frame shall be constructed of sufficiently heavy gauge galvanized steel to assure structural rigidity and have vertical galvanized steel supports with stiffening ribs and gussets spaced no more than 4" apart, spot welded to the casing.
- F. Terminal box shall be provided with solid cover in order to minimize dust infiltration and shall be hinged if built-in fuses or interlocking disconnect switches are provided. Heater terminal box must be totally enclosed and must be without perforated or expanded sheet metal covers, louvers or grilles in order to meet Paragraph 5.6 of UL Standard 1096 which prohibits venting into false ceiling space, hollow spaces in the wall or other concealed spaces of a building structure. Terminal box shall be insulated to prevent condensation.
- G. Direction of Airflow: Heaters shall be interchangeable for mounting in a horizontal or vertical duct and airflow may be through the heater in either direction except when position sensitive mercury contactors or SCRs are built-in. In these cases, airflow direction shall be as scheduled.
- H. Safety Devices: A manual reset thermal cutout shall be furnished for primary over temperature protection. For secondary protection, a sufficient number of heat limiters in the power lines shall de-energize elements if the primary cutout fails. All safety devices shall be serviceable through the terminal box without removing the heating coil from the duct.
- I. Wiring Diagrams: A separate, complete wiring diagram shall be furnished for each heater. Diagram shall include recommended supply wire gauges per NEC, and fuse sizes. Typical wiring diagrams are not acceptable. Each heater shall be complete with clearly marked power and control terminals.
- J. Built in component shall include contactors to break all ungrounded conductors, transformer with primer fusing, pressure-type airflow switch set at .07" WC, all as required by UL, branch circuit fuses per NEC, interlocking disconnect switch and a single terminal block to accept the number, type and size of conductors as shown on the electrical plan.
- K. Special Features: The following additional features shall be an integral part of each heater.
 - 1. Mercury contacts shall be used for quiet operation.
 - 2. Terminal box shall be insulated to prevent condensate.
 - 3. Time delay for delay between steps.
 - 4. Pilot lights:
 - a. One per step.
 - b. Airflow switch.
 - c. Manual reset thermal cutout On.
 - d. Control voltage On.
 - e. Power On.

- f. Normal operation.
- 5. Humidistats: Natural hair or nylon element, setpoint adjustable from 50 to 55 percent relative humidity.
- 6. Air Flow Switch: Shall operate with horizontal air flow velocity of 480 fpm or upward vertical flow of 910 fpm.

PART 3 EXECUTION

3.1 GENERAL

- A. Install unit, steam distributor, steam hose, and condensate return line as shown.
- B. Pipe water supply and drainage system to each humidifier unit as specified in Section 15400 .
- C. Locate humidistats and air flow switch in ducts and rooms as shown. When no air is moving through ducts, humidifier shall be automatically de-energized.

END OF SECTION

SECTION 15810

DUCTWORK

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing ductwork, duct accessories, and appurtenances for heating, ventilating, and air conditioning systems.

1.2 RELATED WORK

- A. Duct insulation - Section 15080.
- B. Air outlets and intakes - Section 15850.

1.3 QUALITY ASSURANCE

- A. Comply with SMACNA HVAC Duct Construction Standards, second edition, 1995, SMACNA 1985 HVAC Air Duct Leakage Test Manual, ASHRAE 1997 Fundamentals, ASHRAE 1996 Systems and Equipment Handbook, and NFPA 90A-93.
- B. Maintain one copy of SMACNA, HVAC Duct Construction Standards, second edition, 1995, and SMACNA 1985 HVAC Air Duct Leakage Test Manual on site for reference.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Detailed duct layout drawings.
- C. Manufacturer's product literature and catalog cuts for the following items:
 - 1. Flexible ducts.
 - 2. Joint sealer.
 - 3. Dampers.
 - 4. Duct joint types.
 - 5. Duct gauge.
 - 6. Duct reinforcing.
 - 7. Duct liner.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.

PART 2 PRODUCTS

2.1 DUCTWORK

- A. Galvanized Ductwork: Lock-forming quality, ASTM A527-85, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.
- B. Joint Sealer: UL listed, Class 1, flame spread 0, fuel contributed 0, smoke developed 0, water-based sealer. Nontoxic, noncombustible, and nonflammable. IG 601 as manufactured by Hardcast, Inc., Wylie, TX, or approved equal.

2.2 DUCT LINER

- A. Liner: ASTM C1071-91, Type II, combination thermal and acoustical glass fiber having minimum 1-1/2 pcf density and 1-inch thickness. Thermal conductivity at 75 degrees F shall be 0.27 Btu-in/hr-ft²-degree F or better. Insulation shall have a coating on the air stream side that imparts no odor to the air and will not erode. Coating shall be anti-mold/mildew. Friction factor, as installed, not to exceed 1.2 times that of bare duct.
- B. Fasteners: Galvanized pins with fastener heads or washers with minimum area of 0.75 square inch and minimum thickness of 0.010 inch. Fasteners capable of indefinitely sustaining 50-pound tensile dead load test perpendicular to duct wall.
- C. Adhesives: ASTM C916-85, Type I adhesive.

2.3 HANGERS AND SUPPORTS

- A. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod. Straps and rod sizes shall conform to SMACNA HVAC Duct Construction Standards, 1995.
- B. Vibration Hangers and Seismic Support: As specified in Section 15070.

2.4 SCREENS

- A. Bird Screens: Stainless steel, 2x2 mesh, 0.063-inch diameter, set in galvanized steel frame.

2.5 DAMPERS

- A. Low Pressure Manual Dampers: Single or multi-blade type with position-indicating device and lock.
- B. Motor Operated Damper

2.6 TURNING VANES

- A. Fabricated at site or manufactured. Manufactured turning vanes constructed of 1-1/2 inch wide curved single thickness blades set at 3/4-inch on center. Support with bars on 2-inch centers perpendicular to blades. Set bars into side strips suitable for mounting in ductwork.

2.7 DUCT HARDWARE

- A. Test Holes: Screw cap and gasket and flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide length to suit duct insulation thickness.

- B. Quadrant Locks: For each manual damper, provide quadrant lock device on one end of shaft and end bearing plate on other end for damper lengths over 12 inches. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.8 FLEXIBLE DUCT CONNECTIONS

- A. UL 181-96, flexible duct connection, flame retarded or noncombustible fabric suitable for 1-1/2 times duct pressure at connection.
 - 1. Conventional Indoor System Connectors: Glass fabric double coated with polychloroprene, minimum weight of 24 ounces per square yard.

PART 3 EXECUTION

3.1 DUCTWORK

- A. Supply, return, outside, and exhaust air duct systems shall be constructed from galvanized sheet metal in accordance with SMACNA Standards to meet pressure class shown.
- B. Design and fabricate ductwork to prevent buckling, breathing, vibration, and noise. Provide reinforcing in accordance with SMACNA and as required to meet actual job conditions.
- C. Design and fabricate ductwork to keep resistance losses to a minimum. Alter duct sizes on basis of equal friction where required to facilitate installation.
- D. Locate ductwork runs vertically and horizontally and avoid diagonal runs wherever possible. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- E. Ductwork shall be adequately supported by hangers. Diagonally or transversely cross break all panels on ducts.
- F. Duct dimensions shown are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.
- G. Fabricate plenums with 16-gauge galvanized sheet metal reinforced with galvanized steel angle frames at 30 inches on center. Provide access doors and reinforce around doors with galvanized sheet angle.
- H. Low pressure, rectangular duct joints flush, driven slip, for exposed ducts and where otherwise required for reasons of space limitations; use standing seams for all other applications.
- I. Elbows:
 - 1. Construct radius elbows with inside radius not less than duct width.
 - 2. Use miter elbows at exposed elbows, immediately upstream from supply air outlets and where required to facilitate installation.
 - 3. Construct round duct elbows with radius /diameter ratio of 1.5.
- J. Paint visible portions of duct interior flat black at air outlets.

- K. Provide sheet metal angle type escutcheons at exposed duct penetrations of walls, floors, and ceilings.
- L. Ducts through roof shall be 16-gauge, galvanized steel, flashed and counter flashed, and provided with storm collars to ensure watertight construction.
- M. Seam and Joint Sealing:
 - 1. Seal externally insulated ducts prior to insulation installation.
 - 2. Seal ducts where audible leaks occur. Make corrections of minor leakage as approved.
 - 3. Pressure Classification Less than 2 Inches Water Gauge: SMACNA seal class C, seal transverse joints only.

3.2 DUCT LINER

- A. Install in accordance with SMACNA Standards and NAIMA Fibrous Glass Duct Liner Standard, 1994. Longitudinal joints in duct liner are not permitted, except at corners of ducts, unless size of duct and standard liner product dimensions necessitate their use. Brush or spray adhesive on 90 percent of duct surface. Apply adhesive to inside corner joints of all lining. Apply adhesive to both surfaces of butt joints in duct lining. Coat all leading edges of insulation with adhesive. Attach pins and washers to all lined duct surfaces (washer on the air side), spacing in accordance with SMACNA for design air velocity.
- B. Line supply, return, and outside air ducts and plenums. Insulate access doors and panels in the same manner as ducts and plenums.
- C. Metal Nosing: Install metal nosings over transverse liner edges facing airstream at fan discharge and at any interval of lined duct preceded by unlined duct. In addition, cover exposed end of duct lining with metal nosing where velocities exceed 4000 fpm.
- D. Terminate lining at each diffuser, register, and grille with adhesive sealer.

3.3 HANGERS

- A. Hanger spacing shall conform with SMACNA HVAC Duct Construction Standards, Second Edition, 1995. Additionally, support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection. Support vertical ducts at a maximum interval of 16 feet and at each floor.

3.4 DAMPERS

- A. Install manual splitter dampers in duct divisions and splits.

3.5 TURNING VANES

- A. Install in square or rectangular 90-degree elbows in supply, return, exhaust, and outside air systems. Where turning vanes are installed at an angle other than 45 degrees, vanes shall be fabricated with side parallel to adjacent ducts to ensure parallel air flow.

3.6 FLEXIBLE CONNECTIONS

- A. Install wherever ductwork connects to vibration isolated equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and to absorb vibration of connected equipment. Flexible separation shall be not less than 3 inches between separated metals.

3.7 FIELD QUALITY CONTROL

- A. Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories to obtain proper operation and leak-proof performance.

3.8 CLEANING AND PROTECTION

- A. Thoroughly clean interior of ductwork of dust and debris before installing air inlets and outlets. Clean external surfaces of foreign substances and dust.
- B. Strip protective paper from stainless steel ductwork surfaces and repair finish where it has been damaged.

3.9 TESTING, ADJUSTING AND BALANCING

- A. As specified in Section 15950.
- B. Locate duct test openings at fan inlet and outlet and wherever air measurements are required for balancing air systems. Coordinate location with Balancing Agency.
- C. Dampers:
 - 1. Verify automatic dampers and damper frames are installed level in both directions. Blades shall not touch any adjacent materials throughout full travel by blades. Verify damper and damper frames are installed so there is no torsion or twist in frame to prevent smooth operation of damper.

END OF SECTION

SECTION 15830
FANS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing fans and related appurtenances.

1.2 QUALITY ASSURANCE

- A. Design, fabricate, and install components in compliance with NFPA 90A and NFPA 70.
- B. Test fans in accordance with procedures of AMCA 210 and meet the requirements of AMCA standards where applicable standards exist.
- C. Fans shall bear the UL label and the AMCA Certified Rating Seal when the fan is covered by the standard. When no standard is applicable, the manufacturer shall submit data to verify the fan capacity at the specified conditions. Where some ratings are shown, the manufacturer shall certify that the fan has been tested in accordance with AMCA 330 and that the some level does not exceed that shown.

1.3 PERFORMANCE REQUIREMENTS

- A. Air ratings are based on sea level conditions.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Detailed shop drawings showing physical dimensions, shaft sizes, drives, drive arrangement, and motor data.
- C. Manufacturer's literature, including performance curves, installation instructions, and AMCA certified air delivery and sound level (sones) at the conditions shown.
- D. Submit wiring diagrams detailing wiring for power and control systems differentiating clearly between factory and field installed wiring.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Submit operation and maintenance data for each type of fan.
- C. Spare Parts: One set of spare belts for each belt-driven fan that matches products installed. Label belts clearly identifying to which fan unit the belt belongs.

PART 2 PRODUCTS

2.1 ROOF AND WALL VENTILATORS

- A. General: Capacities and electrical characteristics as scheduled on the drawings. Model G, as manufactured by Greenheck, or approved equal.
- B. Housing: Weatherproof, heavy-gauge spun aluminum with rigid steel internal support structure.
- C. Fan Wheel: Aluminum, non-overloading, backward inclined, centrifugal type. Dynamically balanced.
- D. Motor: Open drip proof, high-efficiency motor, mounted out of the air stream.
- E. Shafts: Solid steel, precision ground, polished, and treated for rust resistance.
- F. Drive:
 - 1. Direct drive.
- G. Vibration Isolators: Multidirectional, rubber-in-shear.
- H. Screen: Aluminum birdscreen.
- I. Roof Curb:
 - 1. Prefabricated, aluminum curb with welded seams and fastening flange for "self-flashing". Closed cell neoprene rubber gasketing around the top of the curb and 1-1/2-inch thick, 3-pound density rigid insulation along the sides.
- J. Accessories:
 - 1. Disconnect Switch: On/off type switch, factory wired to the motor and installed under the motor dome.

2.2 CEILING FAN

- A. General: Capacities and electrical characteristics as scheduled on the drawings. Model CSI, as manufactured by Greenheck, or approved equal.
- B. Housing: Acoustically insulated, galvanized steel housing with chatter proof damper.
- C. Fan Wheel: Centrifugal type, dynamically balanced.
- D. Motor: Permanently lubricated, direct drive motor with built-in overload protection and plug in disconnects. Motor mounted on rubber mountings.
- E. Grille:
 - 1. White plastic, egg crate, face grille with 85 percent free area.

F. Accessories:

1. Wall Cap: 8 inch diameter inlet with weather cap, aluminum construction, birdscreen, and backdraft damper. Model WC, as manufactured by Greenheck, or approved equal.

2.3 CABINET FAN

A. General: Capacities and electrical characteristics as scheduled on the drawings. Model SP, as manufactured by Greenheck, or approved equal.

B. Housing: Acoustically isolated, galvanized steel housing with chatter proof damper.

C. Fan: Centrifugal type, forward curve, dynamically balanced.

D. Shafts: Solid, ground, and polished steel.

E. Drive:

1. Direct drive.

F. Accessories

1. Wall cap. 8 inch diameter inlet with weather cap, aluminum construction, birdscreen, and backdraft damper. Model WC, as manufactured by Greenheck, or approved equal.

2.4 VIBRATION ISOLATION

A. As specified in Section 15070.

PART 3 EXECUTION

3.1 GENERAL

A. Install fans in accordance with manufacturer's recommendations. Install fans level and plumb.

B. Arrange installation of units to provide access space for service and maintenance of motors, bearings, and belts.

C. Provide flexible connections at inlet and outlet of units connected to ductwork.

3.2 VIBRATION CONTROL

A. As specified in Section 15070.

B. Suspend units from structural steel support frame using threaded steel rods and neoprene grommets.

3.3 IDENTIFICATION

A. Label fans as specified in Section 15075.

3.4 CLEANING

- A. Inspect exposed finish after completing installation. Remove burrs, dirt, and construction debris and repair damaged finishes including chips, scratches, and abrasions. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.
- B. Do not operate fans until ductwork is clean.

3.5 TESTING, ADJUSTING, AND BALANCING

- A. As specified in Section 15952.

3.6 DEMONSTRATION AND TRAINING

- A. Provide four hours of operating instructions. Include procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

END OF SECTION

SECTION 15850

AIR OUTLETS AND INTAKES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing diffusers, registers, and grilles in connection with heating, ventilating, and air conditioning systems.

1.2 RELATED WORK

- A. Ductwork - Section 15810.

1.3 QUALITY ASSURANCE

- A. Air outlets and inlets shall be tested and rated in accordance with ARI 880-94 and ASHRAE 70-91.
- B. Install air outlets and inlets in accordance with NFPA 90A-93.

1.4 SUBMITTALS

- A. As specified in Section 01330.
- B. Manufacturer's specifications for the items listed below. Include materials, construction, installation instructions, performance data, CFM ratings, pressure drops, NC level, throw patterns, and parts lists.
 - 1. Diffusers.
 - 2. Registers.
 - 3. Grilles.
- C. Submit louver color samples for selection and approval.

1.5 CLOSEOUT SUBMITTALS

- A. As specified in 01770.
- B. Spare Parts: Opposed blade damper keys.

PART 2 PRODUCTS

2.1 GENERAL

- A. Air flow capacity and throw patterns as shown. Pressure drops of diffusers and supply registers shall not exceed 0.1 inch W.G. and pressure drops for return and exhaust grilles shall not exceed 0.05 inch W.G., unless otherwise shown.
- B. Coordinate borders and mounting frames with ceiling finish.
- C. Dampers shall be opposed blade type, key, or standard blade screwdriver operated from the face of the unit. Provide keys for each unit installed.

2.2 DIFFUSERS

- A. Louvered Face: Square, louvered face steel diffuser with movable blades accessible from face for adjustable discharge and volume damper. Border style compatible with ceiling system. Finish shall be white. Face size shall equal ceiling module size when mounted in ceiling grid; i.e., a diffuser with 24 x 24 face would be provided for a 24 x 48 ceiling grid. Model TDCA by Titus Division, Tomkins Industries, Inc., Richardson, TX, or approved equal.

2.3 REGISTERS

- A. Return Register: Double deflection, 3/4-inch blade spacing, 1-1/4-inch steel border with extruded aluminum airfoil blades and steel opposed blade damper. Front blades parallel to long dimension. Blades fixed at 45 degrees and securely held in place. Provide gasket between the frame and surface. Register finish shall be white. Model 3FL by Titus Division, Tomkins Industries, Inc., Richardson, TX, or approved equal.

2.4 GRILLES

- A. Grilles: 45 degree deflection, 3/4-inch blade spacing, steel grille with front blades parallel to long dimension. Grille finish shall be white. Model 3FL by Titus Division, Tomkins Industries, Inc., Richardson, TX, or approved equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Install diffusers, registers, and grilles as shown, coordinating exact locations with Contracting Officer.
- B. Attach diffusers, registers, and grilles to ducts and secure frame to surfaces as recommended by manufacturer.

3.2 TESTING, ADJUSTING AND BALANCING

- A. As specified in Section 15952.

END OF SECTION

SECTION 15915

ELECTRIC AND ELECTRONIC CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing a complete electrical/electronic system of automatic temperature control for the heating, ventilating, and air-conditioning system.

1.2 QUALITY ASSURANCE

- A. The system shall be calibrated and completely checked by mechanics regularly employed by the manufacturer of the temperature control equipment.
- B. All control items installed must be the product of one manufacturer, as much as possible.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's literature and installation instructions for each type of control, panel, and instrument.
- C. Shop Drawings:
 - 1. Provide a complete written sequence of operation for each system and the entire system. Include settings or adjustable range of control for devices.
 - 2. Provide schematic flow diagrams showing the entire building system including equipment and control devices. Label each device and include setting or adjustable range of control.
 - 3. Show all electrical wiring. Clearly differential between factory-installed and field installed wiring.
 - 4. Show details of control panel faces, including controls, instruments, and labeling

1.4 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Manufacturer's operation and maintenance data for each type control and instrument.
 - 2. Complete materials lists and schedules of all control devices. Schedules shall list, for each type of device, designation, location, function, set-point range, and set-point at start-up, as applicable.
 - 3. Vendor furnished and field modified as-built control drawings and sequence of operation descriptions. Drawing size approximately 12 inches by 18 inches.

4. Interconnection wiring diagrams with all terminals and wires identified and numbered and equipment terminal numbers shown.
- C. Vendor furnished and field modified as-built control drawings and sequence of operation descriptions. Drawing size approximately 12 inches by 18 inches, laminated in heavy clear plastic and mounted near applicable control panel.
- D. Calibration records and completion report.
- E. Warranty.

PART 2 PRODUCTS

2.1 GENERAL

- A. System shall be manufactured by Honeywell, Inc., Minneapolis, Minnesota, Johnson Controls, Inc., Milwaukee, Wisconsin, or approved equal.

2.2 ELECTRIC WIRING

- A. As specified in Section 01312.
- B. Design control wiring for less than 100 volts. Conceal conduit and wiring between the various components of the control system. Perform any cutting and patching necessary for the installation of the temperature control system.

2.3 CONTROL PANELS

- A. Central Control Panels: Fully enclosed, steel cabinet with locking doors or locking removable backs.
- B. Local Control Panels: Unitized cabinet with brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.
 1. Fabricate panels of 0.06 inch thick steel or extruded aluminum alloy, totally enclosed, with paint finish hinged doors.
 2. Panel Mounted Equipment: Mount temperature and humidity controllers, relays, and automatic switches; except safety devices, with adjustments accessible from front of panel.
 3. Door Mounted Equipment: Flush mounted on hinged door, with manual switches, including damper positioning switches, changeover switches, thermometers, and gauges.
 4. Mount electrical relays, transformers, terminal strips, and other electrical accessories within the panel and pre-wired to factory terminal strips.
 5. Provide laminated engraved nameplates beneath each control device.

2.4 THERMOSTATS

- A. Programmable Commercial Thermostat: Automatic control of single stage, cooling systems. 7-day programming with battery backup. Subbase for manual system and fan switching. Thermostat shall have the option to close outdoor air damper and energize fan only on call for cooling during unoccupied periods.

2.5 HUMIDISTAT/THERMOSTAT

- A. The Thermidistat Control Shall provide single-stage or multiple-stage equipment operation, 7-day programmable heat/cool temperature control for 24-vac system with dehumidification control for single zone air conditioning systems with electric reheat applications. Temperature display can be selectable to read degree F or degree C. The thermidistat can also be capable of being field configured to be non-programmable if desired. The thermidistat has humidity outputs that can be connected directly to 24-c humidifiers and dehumidify outputs that can be connected directly to fan coil units that have dehumidification capabilities. The thermidistat can be set for humidity settings form 50%-90% relative humidity. Provide Carrier TSTATCCPRHø1-B or approved equal.

2.6 CO2 SENSOR

- A. Sensor shall provide a 0-10VDC or 4-20mA output to have the ability to provide demand ventilation control through a motorized damper. Sensor shall be accurate from 0-2000 ppm +/- 50ppm or +/-3% of reading, whichever is greater. The IAQ sensor shall be wall mounted as indicated with an LCD display in parts per million (PPM). The set point shall be adjustable. Provide Carrier 33ZCSENCO2 or approved equal.

2.7 ACTUATORS

- A. Electric Motors: Size to operate with sufficient power to provide smooth modulating action or two-position action.
 - 1. Permanent Split Capacitor or Shaded Pole Type: Gear trains completely oil immersed and sealed. Equip spring return motors with integral spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 - 2. Motors for Valves Larger than 2-1/2 Inches and Dampers Larger than 25 Square Feet: Size for running torque of 150 inch-pounds.
- B. Damper Operator: Heavy duty oil submerged type, with sufficient power to overcome friction of damper linkage and mounting arrangement for location outside of the air stream wherever possible.
- C. Electronic Operators: Operator selected for full shutoff at maximum pump differential pressure.

2.8 CONTROL DAMPERS

- A. AMCA rated, parallel or opposed blade design. Form frames from not less than 16 gauge galvanized steel with mounting holes for flange and enclosed duct mounting. Form damper blades from not less than 16 gauge galvanized steel, with maximum blade width of 6 inches.
 - 1. Blades secured to 1/2-inch diameter, zinc plated steel shaft, with nylon or oilite bearings. Blade linkage hardware to be zinc-plated steel and accessible for maintenance. Ends sealed against spring loaded stainless steel blade bearings.
 - 2. Inflatable seal blade edging or replaceable butyl rubber or neoprene seals at all blade edges and top, bottom, and sides of the frame. Seals to provide leakage at less than 10 CFM/square foot of damper area, at differential pressure of 4 inches wg in accordance with AMCA 500.
 - 3. Size damper linkage to provide linear flow of equal percentage.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Locate thermostats and humidistats 42 inches above finished floor.

3.2 CONTROL DAMPERS

- A. Install control dampers as specified in Section 15810. Damper motors shall have metal stops to limit actuator travel.
- B. Install parallel bladed damper for two-position control and opposed bladed dampers for modulating control.

3.3 SEQUENCE OF OPERATION AHU-2

- A. Provide sequence of operation for systems as shown.

3.4 DIAGRAMS

- A. Install laminated schematic control diagram in each equipment room adjacent to the temperature control panel. Furnish one spare laminated diagram.

3.5 ADJUSTMENT

- A. On completion of the work, the Contractor shall completely adjust, ready for use, all thermostats, damper motors, and relays.
- B. Prepare project completion report stating the system is complete, has been adjusted and calibrated, and all hardware and software functions have been verified. Specifically note any deviations from specified settings or operations.

3.6 TESTING, ADJUSTING, AND BALANCING

- A. As specified in Section 15952.

3.7 DEMONSTRATION

- A. As specified in Section 01815.
- B. Demonstrate complete system operation to the Contracting Officer.
- C. Provide Government operating personnel 2 hours of instructions on the controls system.

END OF SECTION

SECTION 15952

TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of testing, adjusting, and balancing air, fluid, mechanical, control, and electrical systems associated with HVAC systems to optimum performance.

1.2 CODES AND STANDARDS

- A. Test, adjust, and balance systems in accordance with ASHRAE Applications Handbook. For NEBB certification, comply with "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems". For AABC certification, comply with "National Standards For Testing and Balancing Heating, Ventilating, and Air Conditioning Systems".

1.3 RELATED WORK

- A. Ductwork - Section 15810.
- B. Controls - Section 15915.

1.4 TESTING AGENCY

- A. An independent testing, adjusting, and balancing agency shall be responsible to test, adjust, and balance building mechanical systems to produce design objectives.
- B. Qualifications: Testing, adjusting, and balancing agency certified by NEBB or AABC in testing and balancing disciplines required for this project, and with at least one Professional Engineer, registered in State in which project is located, certified by NEBB or AABC as Test and Balance Engineer.

1.5 SUBMITTALS

- A. As specified in Section 01330.
- B. Agency and Engineer Data: Name of balancing and testing agency with resume of the agency, including qualifications of personnel to be used and authority and responsibilities of personnel.
- C. Balancing and Testing Plan: Not less than two weeks before balancing and testing is scheduled to begin, submit balancing and testing plan which includes procedures, instructions, and reports to be used. Include proposed procedure for simulation of dirty filters.
- D. Calibration Reports: Submit proof that instrumentation has been calibrated, to tolerances specified in referenced standards, within a period of six months before starting project.

1.6 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.

- B. Report: Six copies of testing, adjusting, and balancing reports bearing seal and signature of the Test and Balance Engineer. Reports shall be certification that systems have been tested, adjusted, and balanced in accordance with referenced standards; accurate representation of how systems have been installed; true representation of how systems are operating at completion of testing, adjusting, and balancing procedures; and accurate record of all final quantities measured, to establish normal operating values of systems.
 - 1. Draft Reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on NEBB or AABC standard forms. Draft reports may be handwritten, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports.
 - 2. Final Report: Upon verification and approval of draft reports, prepare final reports, typewritten, and organized and formatted as specified.

PART 2 PRODUCTS

2.1 TEST INSTRUMENTS AND EQUIPMENT

- A. Provide all test instruments, meters, gauges, thermometers, power measuring instruments, pumping equipment, temporary piping, fittings, wiring, wiring devices, and miscellaneous items necessary to perform required testing procedures.

2.2 ACCESSORY DEVICES

- A. Provide necessary dampers, thermometer wells, gauge cocks, balancing valves, and other appurtenances as required. Coordinate locations of these items as construction progresses, to avoid disturbance of finished complete systems. Provide new sheaves and belts for air moving equipment, if required, to attain desired air quantities.

PART 3 EXECUTION

3.1 GENERAL

- A. Pre-Balancing Conference: Before beginning testing, adjusting, and balancing procedures, schedule and conduct a conference with Contracting Officer and representatives of installers of mechanical and control systems. Conference objective is final coordination and verification of system operation and readiness for testing, adjusting, and balancing, and assigning testing responsibilities of each installer.
- B. Systems shall be complete and fully operational prior to beginning procedures. Insure all items such as thermometer wells, pressure test cocks, access doors, etc., are installed to facilitate tests and adjustments.
- C. Put all heating, ventilating, and air conditioning systems and equipment into full operation and continue operation during testing and balancing.
- D. Before air balance work is started, check system for duct leakage, install a complete set of clean filters, check for correct fan rotation and equipment vibration, and check automatic dampers for proper operation. Set volume control dampers and outlets in wide open position. Ensure fire dampers are open and that return air paths are not obstructed.

- E. Before hydronic balance work is started, check system for plugged strainers, proper pump rotation, and proper control valve installation and operation; check air vents at high points of systems and ensure all are installed and operating freely (automatic type) or bleed air completely (manual type); and verify proper flow meter and check valve installation and proper system pressure.
- F. All throttling devices and control valves shall be set open.

3.2 PERFORMING TESTING, ADJUSTING, AND BALANCING

- A. Cut insulation, ductwork, and piping for installation of test probes to minimum extent necessary to allow adequate performance of procedures.
- B. Patch insulation, ductwork, and housings, using materials identical to those removed.
- C. Seal ducts and piping, and test for and repair leaks.
- D. Seal insulation to re-establish integrity of the vapor barrier.
- E. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other permanent identification materials.
- F. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.3 SEQUENCING AND SCHEDULING

- A. Systems shall be fully operational before beginning procedures.
- B. Conduct tests in the presence of the Contracting Officer after providing 96-hour notice before any test is to be conducted. Provide water and electricity required for tests. Determine that all dampers, registers, and valves are in a set or full open position.

3.4 BALANCING

- A. Air Balance:
 - 1. Balance duct system to produce air quantities within 10 percent of indicated value.
 - 2. Dampers: Adjust automatic damper linkages to provide air flow quantities shown. Check all automatic dampers in normal operation to verify proper operation. Verify return, relief air, and fresh air intake dampers operate as designed to produce desired room comfort.
 - 3. Place all fans (supply, return, and exhaust) in operation and check following:
 - a. Motor amperage and voltage to guard against overload.
 - b. Fan rotation.
 - c. Operability of static pressure limit switch.
 - d. Automatic dampers for proper position.

- e. Air and water resets operating to deliver required temperatures.
 - f. Air leaks in casing and in safing around coils and filter frames.
4. Adjust system with mixing dampers positioned for minimum outside air.
 5. Balance terminal outlets in each control zone in proportion to each other. Use branch dampers for major adjusting and terminal dampers for trim or minor adjustment only.
 6. Once total design air has been balanced in branches and at outlets, verify and record the following:
 - a. Fan motor amperage.
 - b. Fan speed.
 - c. Fan cfm.
 - d. Fan outlet velocity.
 - e. External and total static pressure.
 - f. Supply, return, mixed, and outside air temperatures.
 - g. Percent outside air under minimum damper position.
 - h. Static pressure across each component (intake, filters, coils, and mixing dampers).
 - i. Take a final duct traverse.
 7. Final adjustments shall include, but not be limited to, the following:
 - a. Adjust RPM on belt drive fans. Include sheave and belt exchange to deliver air flow within limits of installed motor horsepower and mechanical stress limits of the fan. Determine limiting fan tip speed before increasing RPM. Final fan speed setting shall allow for filter loading and shall establish proper duct pressures for operation of zone CFM regulators.
 - b. Adjust RPM on Direct Drive Fans:
 - 1) For motors with speed taps, set fan speed on tap which most closely approaches design CFM. Report tap setting on equipment data sheet as high, medium, or low.
 - 2) For motors with speed control, set output of fan at design CFM by adjusting control. Ensure the fans restart after shut down. Increase setting as required for proper setting. Mark control to indicate final setting position.
- B. Equipment Motors: Record the following information for every motor and include information with the appropriate equipment.
1. Motor horsepower and rpm.
 2. Nameplate and measured voltage and amperage, each phase.

3. Motor Starters and Thermal Heaters: Check for correct sizing for proper motor protection on magnetic and manual starters.
- C. Electric Heating Coils:
1. Airflow.
 2. Entering and exiting air temperatures at full load.
 3. Voltage and amperage input of each phase at full load and at each stage.
 4. Calculated kW at full load.
 5. Fuse or circuit breaker rating for overload protection.
- D. Temperature Control System: Coordinate with Section 15915. Inspect temperature control systems for proper sequence of operation and approximate calibration. Report any deficiencies. Include written certificate in balance report that temperature controls function properly.
1. Verify proper operation of devices. Verify that all controllers are calibrated and operational.
 2. Check location of transmitters and controllers. Note adverse conditions that would affect control and suggest relocation as necessary to Contracting Officer.
 3. Note settings on controllers. Note discrepancies between set point for controller and actual measured variable.
 4. Verify operation of all limiting controllers, positioners, and relays (e.g., high and low temperature thermostats, high and low differential pressure switches, etc.).
 5. Activate controlled devices, checking for free travel and proper operation of stroke for dampers and valves. Verify and note normally open (NO) or normally closed (NC) operation.
 6. Verify sequence of operation of controlled devices. Note line pressures and controlled device positions. Correlate to air or water flow measurements. Note speed of response to step change.
 7. Confirm interaction of electrically operated switch transducers.
 8. Confirm interaction of interlock and lockout systems.
 9. Electronic Systems:
 - a. Monitor voltages of power supply and controller output.
 - b. Note operation of electric actuators using spring return.
- E. Sound and Vibration Levels: Test and adjust mechanical systems for sound and vibration in accordance with instructions of referenced standards.
- F. After deficiencies are corrected, retest the temperature control system.

3.5 REPORT

- A. Report Format: Standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Include information indicated on standard report forms prepared by AABC or NEBB for each respective item and system, and schematic diagrams for each system or piece of equipment to accompany each respective report form. Bind report forms complete with schematic systems diagrams and other data in reinforced vinyl three-ring binders. Provide binding edge labels with project identification and a title descriptive of contents. Divide contents of binder into following divisions, separated by divider tabs:
1. General Information and Summary
 2. Air Systems
 3. Temperature Control Systems
 4. Sound and Vibration Systems
 5. Recommendations
- B. Report Contents: Provide following minimum information, forms, and data:
1. General Information and Summary:
 - a. Inside cover sheet to identify testing, adjusting, and balancing agency, contractor, and project name. Include contact names, addresses, and telephone numbers.
 - b. Certification sheet containing seal, address, telephone number, and signature of Certified Test and Balance Engineer.
 - c. Listing of instrumentation used for procedures along with proof of calibration.
- C. Test Data: Report shall include the following data, in addition to certified field report readings taken during the balancing and testing operations. Include required or specified reading, first reading taken, and final balanced reading.
1. Air Handling Units and Fans: Air handling unit, fan and motor nameplate information, type, drive sheave information (as installed and changed), and final belt number and size.
 2. Air Balance for Supply, Return, Relief, and Exhaust Systems:
 - a. Outlets and Inlets: Size, reading orifice size, velocity in fpm, and design and final balanced air quantity in CFM.
 - b. Ducts: Size, velocity in fpm, and air quantity in cfm.
 3. Record thermal protection for all motors. Starter brand, model, enclosure type, installed thermal heaters and rating of heaters, required thermal heaters and rating of heaters if different from installed shall be recorded.
 4. Report shall include sheet which shall report method of balance, project altitude, and any correction factors used in calculations.

5. Report shall include a reduced set of contract drawings with all outlets, inlets, coils, fans, etc. clearly marked and all equipment designated.
6. Prepare list of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.6 PERFORMANCE TESTS

- A. After cleaning, pressure tests, adjusting, and balancing are complete, each system shall be performance tested as a whole to verify that all items perform as integral parts of system, and temperatures and conditions are evenly controlled throughout building. Make corrections and adjustments as required to produce conditions indicated.

END OF SECTION

SECTION 16010

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section includes basic requirements of a common or administrative nature that pertain to all electrical work.

1.2 WORK INCLUDED

- A. As specified and as shown, furnish, install, test, and place in satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete and operable electrical system. Electrical work also includes wiring and connections required for electrical equipment furnished under other divisions, and fire and intrusion alarm systems, audio-visual systems, telephone systems or other communications systems.

1.3 RELATED REQUIREMENTS

- A. Temporary electrical work - Section 01510. For additional basic requirements that may affect electrical work, see Division 1.

1.4 QUALITY ASSURANCE

- A. Worker's Qualifications: All electrical work shall be performed by licensed electricians or under the direct supervision of a licensed electrician.

- B. Codes and Regulations:

1. All work shall meet requirements of governing codes and regulations, NFPA 70-1996 (NEC), and NESC.
2. Advise the Contracting Officer of conflicting codes or conflicts between codes and drawings and specifications.
3. When the requirements of specifications or drawings are more stringent than the codes, regulations, or standards, the specifications or drawings shall prevail.
4. The electrical installation shall meet the requirements of NECA Standard of Installation, except where otherwise specified.

- C. UL Listing:

1. All electrical materials and equipment shall meet requirements of the applicable standards of UL if UL standards exist for such materials and equipment.
2. The UL authorized listing mark is acceptable as evidence that the materials meet this requirement.
3. In lieu of UL authorized listing mark, the Contractor may submit independent proof satisfactory to the Contracting Officer that the materials meet the standards.

4. Materials and equipment shall be installed only for their intended operational purpose.
- D. Standard Products: Provide only new electrical equipment of current standard design.
- E. Finished Surfaces:
1. Finished surfaces of existing facilities that are marred, scratched, or damaged shall be refinished to match original condition.
 2. Building surfaces that have been altered for the proper installation of electrical equipment shall be restored by skilled personnel of the trades involved at no additional expense to the Government.
- F. Polychlorinated Biphenyl (PCB): Equipment containing PCB is not acceptable.

1.5 INTENT OF CONSTRUCTION DRAWINGS

- A. Electrical drawings do not attempt to show complete details of building construction that affect installation. Diagrams are schematic only and do not necessarily show physical arrangement of equipment. Refer to drawings of other trades for additional details which affect work.
- B. Conduit, conductor and ground connections are shown diagrammatically only. Layout does not necessarily show total number of conduits or conductors for circuits required and should not be used for obtaining quantities for linear runs of conduits or wires. Locations of indicated runs are not intended to show actual routing of conduits. Provide additional conduits and wire wherever needed to complete installation of specific equipment furnished.
- C. Locations of outlets on drawings are approximate and may be distorted for clarity in representation.
- D. Install electrical outlets and other equipment clear of and in proper relation to radiators, ducts, grilles, pipes, and other equipment, and items such as cabinets and counters.
- E. Changes such as offsetting conduit runs, moving outlets, or other minor changes necessary to facilitate installation shall be made at no additional expense to the Government.

1.6 COORDINATION OF WORK

- A. Coordinate electrical work with the work of the various trades on the project.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION

3.1 INSPECTION

- A. Demonstrate that electrical work operates satisfactorily and in accordance with the requirements of the drawings and specifications. Before final inspection, remove the front covers on all panelboards, and wire gutters. Replace covers after the final inspection is completed.

3.2 TESTING

- A. General:
 - 1. Make all specified tests in the presence of the Contracting Officer.
 - 2. Furnish all instruments and provide qualified personnel to perform all tests in accordance with the drawings and specifications.
 - 3. Perform all tests at no additional expense to the Government.
 - 4. Operate all electrical equipment within the ranges specified by manufacturer.
 - 5. Correct defects revealed by the tests.
- B. Balance Test: Test for proper load balance on the system, and make adjustments as required.
- C. Conductors: Prior to energization of circuitry, test installed wires and cables to ensure that insulation resistance levels are adequate, test wires and cables for electrical continuity and for short-circuits.
- D. Wiring devices: Ensure proper polarity of connections. Prior to system energization, test wiring devices in accordance with manufacturer's recommendations.
- E. Grounding:
 - 1. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester.
 - 2. Where test shows resistance-to-ground is over 25 ohms, reduce resistance to 25 ohms or less by driving additional ground rods; then retest to demonstrate compliance.
- F. Panelboards:
 - 1. Prior to energization of circuitry, check all accessible connections to manufacturer's torque tightening specifications.
 - 2. Prior to energization of panelboards, check phase-to-phase and phase-to-ground insulation resistance with ground resistance tester.
- G. Lighting Fixtures and Lighting System: Upon completion of installation and testing of lighting fixtures replace any defective ballasts, contactors, control devices or burned out lamps.

3.3 DEMONSTRATION

- A. As specified in individual sections of Division 16.

PART 4 MEASUREMENT AND PAYMENT

4.1 GENERAL ELECTRICAL PROVISIONS

- A. Payment will be included in the bid item to which this work relates.

END OF SECTION

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of general electrical materials and methods. Electrical materials that are a part of equipment specified under other sections shall meet the requirements of this section, unless part of larger factory-assembled equipment.

1.2 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit manufacturer's literature for items listed below.
 - 1. Panelboards, circuit breakers.
 - 2. Time clocks.
 - 3. Disconnect/fused safety switches.
 - 4. Wire and cable.
 - 5. Conduit, raceway and fittings.
 - 6. Wiring devices.
- C. Submit schematic (ladder, elementary) diagrams for pump controls, and connection (wiring) diagram for wastewater pump station.

1.3 QUALITY ASSURANCE

- A. NFPA 70-96 for components and installation.
- B. Provide products that are UL listed and labeled.

1.4 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.

PART 2 PRODUCTS

2.1 RACEWAYS AND FITTINGS

- A. Raceway Systems:
 - 1. Rigid galvanized steel conduit, UL 6-93.
 - 2. Electrical metallic tubing (EMT), UL 797-93.

3. Flexible nonmetallic tubing (ENT), UL 3-94.
4. Flexible metal conduit, UL 1-93.
5. Liquidtight flexible steel conduit, UL 360-94.
6. Wireways, auxiliary gutters, and associated fittings, UL 870-91.
7. Schedule 40 and Schedule 80 rigid PVC conduit, UL 651-93.

B. Aboveground Conduit:

1. Raceway embedded in concrete or in masonry walls shall be Schedule 40 PVC.
2. Raceway concealed in hollow nonmasonry walls or above dropped ceilings shall be EMT.
3. Exposed raceway shall be rigid galvanized steel conduit.
4. Raceway between vibrating equipment and outlet boxes shall be liquidtight flexible metallic conduit.

C. Conduit Within or Under Buildings in Contact with Bare Earth: Schedule 40 pvc conduit suitable for direct burial.

D. Risers into buildings shall be rigid steel suitable for direct burial. Provide conduit bushings.

E. Underground Conduit Outside Buildings: As specified in Section 16401.

2.2 WIRE AND CABLE

A. Color Coding:

1. Color code secondary service conductors for the entire electrical system. For three phase delta secondary voltages where the midpoint of one phase is grounded, the conductor having the higher voltage to ground shall be orange. For single phase voltages, black and red for phases, white for neutral; and green for ground. Neutral and equipment grounding conductors sized No. 6 AWG and larger may be marked with colored plastic marking tape at each end and at every point where wire is accessible; conductors sized smaller than No. 6 AWG shall be color coded.

a. Color code for three phase 208/120 volts ac:

- 1) PHASE A: Black
- 2) PHASE B: Red
- 3) PHASE C: Blue
- 4) Neutral: White
- 5) Ground: Green

B. Branch and Feeder Circuits:

1. Conductor insulation shall be rated for 600 volts.
 2. Conductor size shall meet requirements of NFPA 70-96, or the sizes shown on the drawings if larger, and for feeder and branch circuits shall be No. 12 AWG minimum.
 3. Wire sizes are for copper.
 4. Copper clad and aluminum conductors are not acceptable.
 5. Feeder and Branch Circuit Equipment Grounding Conductor: As specified in Section 16060.
- C. Control Wire: No. 12 AWG copper conductor; 600-volt rated insulation.
- D. Building Wiring:
1. Feeder and Branch Circuits: Conductors shall be Type THWN.
 2. 600-Volt Control Wire: Stranded, Type MTW insulation.
 3. Low Voltage Control Cable: Cable shall have stranded copper conductors. Insulation shall be polyethylene, and rated for 150 volts minimum. Conductors shall be twisted and have thermoplastic jacket.
- E. Underground Wiring: As specified in Section 16401.

2.3 OUTLET, PULL, AND JUNCTION BOXES

- A. General: Provide one for each outlet, switch, receptacle, or combination, and each junction point. Boxes shall be as follows:
1. Metal Raceway Systems in Interior Dry Locations: Galvanized sheet metal.
 2. Outdoor and Wet Locations: Weatherproof, cast metal, threaded hub.
 3. Subject to Constant Moisture: Watertight.

2.4 WIRING DEVICES

- A. Receptacles: UL 498-91 and NEMA WD-1-83. Terminals shall be suitable for copper conductors.
1. Duplex Receptacles: Thermosetting ivory plastic, NEMA heavy duty 5-15R and 5-20R configurations, Specification grade with U-shaped grounding pole and a green-colored terminal for connection of a bonding jumper.
 2. Ground Fault Circuit Interrupter Receptacle (GFCI): Duplex 20-ampere with NEMA 5-20R configuration, UL 943-95, Class A, Specification grade. Receptacle shall have built-in surge and load noise suppression, with feed-through capability to protect branch circuit beyond GFCI receptacle against ground fault, and test and reset buttons. Indicator light shall glow only when tripped. Color shall be ivory.

3. Clock Receptacles: Single, NEMA 5-15R configuration, recessed steel plate with clock hanger. Special Purpose Receptacles: Ratings, number of poles, and configuration as shown.
- B. Snap Switches: Specification grade, 20-ampere, 120/277 volts, ac rated, general use, quiet type, NEMA heavy duty, with ivory handle, key operated where shown. Screw terminals sized for No. 10 AWG copper.
- C. Floor Boxes: Fully adjustable with 1-1/4-inch external adjustment and 3/8-inch internal adjustment, watertight after installation. Provide polycarbonate carpet ring in carpeted areas.
- D. Device Plates and Covers: One-piece, with matching countersunk screws, as follows:
 1. Indoor Finished Areas: Stainless steel.
 2. Indoor Exposed Raceway Systems: Stamped sheet metal, sized to match box without overlapping sharp edges.
 3. Wet Locations: Gasketed and weatherproof, with spring covers for receptacles, lever operators for switches, and cast aluminum cover plates for junction boxes.

2.5 PANELBOARDS

- A. Enclosures and Bus: As shown on the panelboard schedule. Complete with protective devices and enclosures, copper buses, ground and neutral bars as required, front covers with door and built-in lock. Protective devices shall be removable without disturbing adjacent units. Flush mounted panelboards shall have adjustable fronts with concealed trim clamps. Subpanel neutrals shall be insulated from their enclosures and grounds. Panelboards used as service entrance shall be UL listed as suitable for service entrance equipment.
- B. Circuit Breakers: Thermal-magnetic, multi-pole breakers shall automatically open all poles when an overload occurs in any pole. External tie-handle construction where adjacent poles are on the same phase or leg will not be accepted. Tandem breakers are not acceptable. Branch circuit breakers used for switching duty shall be UL listed as SWD type. Ground fault circuit interrupter protection as required by NEC shall be provided by ground fault circuit interrupting breakers.

2.6 SAFETY SWITCHES

- A. Quick-make, quick-break, NEMA type HD heavy duty switches. Switches shall be nonfusible type, 2 or 3-pole, with solid neutral. Switches shall have interrupting rating equal to or greater than interrupting rating of its fuses and the system short circuit capacity at the point of each application. Voltage ratings shall be that of the system voltage at point of application.

2.7 MANUAL TRANSFER SWITCHES

- A. UL listed, 600 volt, 100 ampere, 3 pole, nonfusible double throw safety switch, with solid neutral. Switches used as service equipment shall be UL listed for use as service equipment and shall have service grounding provisions.

2.8 INDIVIDUALLY ENCLOSED CIRCUIT BREAKERS

- A. Size, rating, and number of poles shown, thermal-magnetic, ambient-compensated, common trip, rated 600 volts, 22,000 AIR symmetrical, solid neutrals where required. Provide means for padlocking the handle in the OFF position.

2.9 SECONDARY LIGHTNING PROTECTOR

- A. Thyrite, disc type, rated for use at system voltage. Enclosure shall be weatherproof sealed and suitable for use in outdoor locations. Protector shall be suitable for mounting in 1/2-inch or 3/4-inch conduit knockout opening and shall have 1/2-inch or 3/4-inch male conduit threads for mounting.
- B. 240-Volt Surge Protector: Line-to-line maximum voltage rating of 240 volts; line-to-neutral maximum voltage rating of 175 volts. Impulse sparkover voltage of 10 kv/microsecond pulse, 2,300 volts. IR discharge voltage of 8x20 microsecond current wave at 1,500 amperes, 940 volts; at 5,000 amperes, 1,600 volts; at 10,000 amperes, 2,200 volts. Provide mounting bracket and ground strap. For three phase, provide three units.

2.10 TIME CLOCKS

- A. NEMA 1 enclosure. Rated for load controlled, 30 ampere contacts. Minimum of 16 hours reserve power, provision for skipping up to 6 days, astronomic dial, capability to set minimum time period of 5 minutes.

2.11 MISCELLANEOUS METAL AND METAL FRAMING

- A. Metal Framing:
 - 1. Mounting channels shall be cold rolled from mild strip steel, 12-gauge, 1-5/8 inches by 1-5/8 inches, stainless steel.
 - 2. Screws, bolts, washers, and nuts shall be stainless steel. Parts and brackets for assembly of channels shall be stainless steel.
- B. Miscellaneous Metal: Galvanized steel.

2.12 NAMEPLATES, LEGEND PLATES AND WIRE MARKERS.

- A. Nameplates: Laminated sheet plastic, approximately 1/16-inch-thick, with engraved white letters on a black background, with adhesive backing and mounting-screw holes. Minimum height of letters, 5/16 inch. Card holders are not acceptable.
- B. Legend Plates: NEMA Type KN-3 standard legend plates.
- C. Wire Markers: Pressure-sensitive or heat shrink sleeve types.

PART 3 EXECUTION

3.1 RACEWAY AND FITTINGS:

- A. Replace crushed, deformed, or clogged raceway.
- B. Make cuts square, removing sharp edges.
- C. Run raceway plumb, level, and in a direct line, with long sweeping bends and offsets. Make changes in direction of raceway with symmetrical bends or metal fittings. Bends shall not kink or reduce the internal diameter. Follow manufacturer's recommendations for handling, bending, coupling, and installing nonmetallic conduit.
- D. Make joints tight. Do not use nonconductive material at joint locations before joints are made. Provide expansion joints as necessary for PVC.
- E. Install raceway a minimum of 6 inches from uninsulated steam and hot water lines.
- F. Securely mount raceway using manufactured supports, connectors, and securing devices. Support nonmetallic conduit with straps and clamps.
- G. Make transitions between nonmetallic conduits and metallic boxes with manufacturer's standard adapters designed for such purpose.
- H. Seal wall and roof penetrations weathertight.
- I. Clean raceway before pulling in conductors. In raceway without wiring, install nylon pull string of minimum 100-pound strength, allowing 12 inches excess at each end.
- J. Underground conduit shall have watertight joints.
- K. Install conduit following manufacturer's recommendations. Backfill from tie-in point toward end of conduit run.
- L. Grout around conduit tie-ins entering manhole, vault, handhole, or building walls. Where conduit enters buildings, seal openings with approved duct seal to prevent circulation of air or moisture.
- M. Minimum depth to top of underground conduit shall be in accordance with NEC Tables 300-5 and 710-4(b).
- N. Install nylon pull cords of 100-pound test in all spare conduit.

3.2 WIRE AND CABLE

- A. Install all single conductor THHN/THWN interior wire and cable in raceways.
- B. Feeder and Branch Circuit Equipment Grounding Conductor: Section 16060.
- C. Taps and Splices: Permitted only in junction or outlet boxes. Use only copper insulated-wire connectors, bolted and taped connectors, or crimp connectors.

3.3 WIRING DEVICES, OUTLET AND JUNCTION BOXES

- A. Mounting Heights to Centerline of outlet box or receptacle:
 - 1. Receptacles: 18 inches above floor or ground, except as specified below.

- a. Above Counters: 4 inches above countertops or backsplashes, or 46 inches above floor, whichever is higher.
 - b. Mechanical Rooms: 46 inches above floor.
 - c. Clocks: 7 feet above floor.
 - d. Special Purpose Receptacles: As shown.
2. Switches and Combination Switch/Receptacles: 48 inches above floor.
- B. Install light switches on strike side of doors.
- C. Install single receptacles and switches with a minimum of 6 inches separation. Through-the-wall type handy boxes are not permitted.
- D. Install floor outlets with cover plates flush with top of finished floor adjust for carpeted areas.
- E. Remove fiber washers on mounting screws before installing device. Ground receptacles to metal boxes with green grounding jumpers. Mounting and terminal screws shall be tight.
- F. Firmly attach plates, plumb and level.
- 3.4 TIME CLOCKS
- A. Locate time clocks and contactors in area reachable from floor. Unless time clocks are located in an area where only authorized personnel may enter, provide lock.
- 3.5 METAL FRAMING
- A. Install where electrical equipment is to be surface mounted to walls and where shown. Where two or more safety switches, starters, conduits, or similar items are to be installed side by side, support on metal framing, bolt together, and brace as required to form a rigid structure.
- B. Clean cuts and welds. Coat unpainted surfaces with cold application zinc galvanizing. Coat cuts and welds on painted surfaces with zinc chromate primer and finish to match existing paint.
- 3.6 PANELBOARDS
- A. Flush or surface mount as shown, with top not more than 78 inches above the floor. On flush mounted panels, paint the front cover including the door to match the adjacent surface, as specified in Division 9. Provide typed circuit directory for each panelboard.
- 3.7 INDIVIDUALLY ENCLOSED CIRCUIT BREAKERS AND SWITCHES
- A. Install with top of enclosure between 54 inches and 78 inches off ground or floor.
- 3.8 SECONDARY LIGHTNING PROTECTOR
- A. Install on line side of main disconnects on main disconnect enclosures. Bond grounding wire to main grounding electrode conductor. Install according to manufacturer's recommendations.
- 3.9 NAMEPLATES, LEGEND PLATES AND WIRE MARKERS

- A. Nameplates: Identify all panels, motors, motor starters, control points, control centers, disconnect switches, fire alarm junction boxes and time switches. Fasten nameplates with finish screws or rivets.
 - 1. Remotely Mounted Controls: Identify the equipment controlled.
 - 2. Panels: Identify panel number, feeder number, and voltage of panel bus.
 - 3. Safety Switches, Relays, and Motor Starters: Identify equipment controlled and circuits from which they are fed.
 - 4. Motors: Identify motors as shown on drawings.
 - 5. Fire Alarm Junction Boxes: Identify boxes as "FIRE ALARM JUNCTION BOX"
- B. Legend Plates: Install for all push-buttons, pilot lights, selector switches, and selector push-buttons.
- C. Wire Markers: Install at each end of each wire interconnecting between such items as control panels, sensors, and control devices, and each end of control wires within control panels, motor control centers, and other such controllers. Wiring markers shall correspond to control wire numbers on schematic diagrams.

PART 4 MEASUREMENT AND PAYMENT

4.1 BASIC MATERIALS AND METHODS

- A. Payment will be included in the contract lump-sum price.

END OF SECTION

SECTION 16060

GROUNDING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of grounding and bonding electrical systems and noncurrent-carrying metallic parts of electrical equipment and raceways.

PART 2 PRODUCTS

2.1 GROUNDING ELECTRODE CONDUCTORS

- A. Copper, without splice throughout its length, sized according to NEC 250-94; bare or green insulated wire is acceptable.

2.2 GROUNDING ELECTRODES

- A. One-piece copper clad steel rods, minimum of 3/4-inch diameter by 10 feet long. Do not use metallic rods coated with lacquer or other nonconducting material.

2.3 BONDING JUMPERS

- A. Bare copper. Main bonding jumpers for service entrance equipment shall be the size of grounding electrode conductor which shall be sized according to NEC 250-94. Jumpers for interior wiring raceways and enclosures shall be sized according to NEC 250-95.

2.4 EQUIPMENT GROUNDING CONDUCTORS

- A. Copper, sized according to NEC 250-95. If insulated wire is used, it shall be the same type as other wires in the circuit. See Section 16050 for color coding.

2.5 CONNECTORS

- A. Bronze, copper, or stainless steel according to UL 467-93.

PART 3 EXECUTION

3.1 GROUNDING CONDUCTORS

- A. Protect ground conductors exposed to damage in accordance with NEC 250-92. Bond metal raceway at both ends to the ground wire. Protect ground conductors routed down a pole by using a half-round wood, plastic, or fiber molding from ground line to a point at least 8 feet above ground line. Staple molding to pole at intervals not exceeding 2 feet. Where conductor is not covered by molding, staple conductor to pole at intervals not exceeding 2 feet.

3.2 MADE ELECTRODES

- A. For service grounding, provide two rods spaced minimum of 6 feet apart. Embed rods vertically into permanent moisture level or in accordance with NEC 250-83(c).

3.3 SERVICE GROUNDING AND BONDING

- A. Connect grounding electrode conductor to neutral of electrical systems on supply side only of service entrance equipment within service equipment enclosure, except as otherwise permitted by NEC 250-60. Bond meter sockets to service neutral. Bond service equipment enclosures and service raceways to grounding electrode conductor within service equipment enclosures. Provide service conduits with grounding locknuts or grounding bushings; provide service enclosures with grounding connectors, lugs, or clamps. Connect grounding electrode conductor to the grounding electrode system. Bond the interior metallic water piping system to the grounding system at the service entrance per NEC 250-80. Point of attachment shall be accessible. Attach bonding conductor to piping with UL listed and bolted brass or bronze clamps. Connect conductor to clamp by lugs or pressure connectors. Sheet metal clamps are not acceptable. Where grounding electrode includes an underground water piping system, ensure continuity by providing bonding jumpers across water meters, nonconducting sections, and fittings that can be disconnected.

3.4 EQUIPMENT GROUNDS AND BONDS

- A. Ground metallic raceway systems, enclosures and noncurrent-carrying metallic parts of electrical equipment. Enclosures and noncurrent-carrying metal parts are not considered grounded by contact with grounded metallic raceway system. Install a separate ground wire in all feeder and branch circuit raceway systems, both metallic and nonmetallic, to serve as the equipment grounding conductor. Ensure electrical continuity of raceway systems. Remove nonconducting coatings where raceways connect to enclosures. Make raceway connections at enclosures tight to ensure continuity. Supplement with jumpers, as needed. Provide bonding jumpers across expansion joints and telescoping sections of metallic raceway. Establish continuity between outlet boxes and receptacles using a bonding jumper except where surface mounted boxes or approved ground yokes are used. Do not use red lead, Teflon tape, or other nonconducting material at metallic conduit joints before assembly.

3.5 GROUNDING ELECTRODE SYSTEM

- A. Grounding electrodes, including ground rings, metal underground water pipe, effectively grounded metal building frame, and concrete-encased electrodes, shall be bonded together to form the grounding electrode system at each building or structure served.

3.6 OTHER GROUNDING SYSTEMS

- A. If other grounding systems, such as for a lightning protection system, are present at or within 50 feet of the building or structure served, bond the systems together with bare copper ground wire, sized to the larger of the two grounding electrode conductor sizes.

PART 4 MEASUREMENT AND PAYMENT

4.1 GROUNDING

- A. Payment will be included in the contract lump-sum price.

END OF SECTION

SECTION 16210

ELECTRIC SERVICE

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing service entrance equipment, raceways, and conductors.

1.2 RELATED WORK

- A. Basic materials and methods - Section 16050
- B. Underground secondary - Section 16401.

1.3 QUALITY ASSURANCE

- A. Requirements of the power company.

1.4 COORDINATION

- A. Permanent electric power of the phasing, voltage, and characteristics shown will be supplied by the power company.
- B. Coordinate the work of this section with the Contracting Officer and the power company.
- C. Where work by the power company is required in conjunction with construction, such as installation of cable in common trench with other utilities, the Contractor is responsible for coordinating the work and ensuring that all required work is completed.
- D. Payment to Power Company:
 - 1. Where work is to be performed by the power company that requires payment to the power company, payment will be made by the Government.
 - 2. Where the Contractor identifies the need for work by the power company that requires payment and no known contractual arrangement by the Government has been made, the Contractor shall immediately notify the Contracting Officer.

PART 2 PRODUCTS

2.1 SERVICE RACEWAY

- A. Underground Beyond Building Limits: Section 16440.
- B. Underground Within or Under Building: Section 16050.

2.2 SERVICE CONDUCTORS

- A. Stranded, with 600-volt insulation, NEC Type THWN.
- B. All conductors shall be copper; aluminum is not acceptable.
 - 1. All terminations and connections shall be suitable for service entrance equipment.

2.3 SERVICE DISCONNECT

- A. UL listed as "Service Entrance Equipment", externally operable with open or closed position plainly marked, padlockable and capable of interrupting the maximum symmetrical short circuit current available. Provide pressure connectors for attaching service conductors. See Section 16050 for panelboards, switches, and individually enclosed circuit breakers.

2.4 WIREWAY

- A. As shown. Formed from galvanized 14-gauge minimum sheet steel, complete with all fittings, plates, and closures; hinged latched covers. Raintight wireway shall be provided with gasketed conduit hubs for top mounted equipment.

2.5 METER SOCKET

- A. Type approved by power company, weatherproof. Provide temporary blank cover.

2.6 METERS AND CURRENT TRANSFORMERS

- A. Power company furnished.

2.7 TRANSFORMERS

- A. Power company furnished.

2.8 SECONDARY LIGHTNING PROTECTOR

- A. Section 16050.

PART 3 EXECUTION

3.1 SERVICE RACEWAY

- A. Use lag screws on wood and bolts on steel or masonry. On thin skin buildings, use interior blocking as required. Conduit shall be raintight with arrangement to drain. Provide bushings at conduit ends.

3.2 SERVICE CONDUCTORS

- A. Install service conductors without splices.

3.3 SERVICE DISCONNECT

- A. Install and ground in accordance with NEC and as shown.

3.4 WIREWAY

- A. Install the wireway in accordance with NEC and as shown. Service and feeder conductors may not be in same cross section of the wireway.

3.5 METER SOCKET

- A. Install where shown.

3.6 METER

- A. Power company installed.

3.7 SECONDARY LIGHTNING PROTECTOR

- A. Install as specified in Section 16050 at each service installed.

PART 4 MEASUREMENT AND PAYMENT

4.1 ELECTRIC SERVICE

- A. Payment will be included in the contract lump-sum price.

END OF SECTION

SECTION 16401

UNDERGROUND SECONDARY

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing electrical wire and cable, not exceeding 600 volts.

1.2 RELATED WORK

- A. Basic materials and methods - Section 16050.
- B. Electric service - Section 16210.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Catalog cuts for each type of wire, cable, and conduit.

1.4 QUALITY ASSURANCE

- A. Meet requirements of local power company.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials and equipment in manufacturer's original, unopened, protective packaging. Cable ends shall be sealed to prevent contamination and moisture infiltration.
- B. Storage: Store materials and equipment as directed, complying with manufacturer's recommendations. Provide protection from the elements.
- C. Cable Handling: Handle cable, cable insulation, and conductors carefully to prevent damage by cutting, abrasion, and excessive bending.

1.6 COORDINATION

- A. Before starting construction, field verify drawings and routing of distribution system with Contracting Officer.
- B. Notify Contracting Officer two weeks before installing direct burial cable. Install direct burial cable in presence of Contracting Officer unless otherwise authorized in advance.
- C. Contractor shall be responsible for coordination with utility companies and for ensuring that all utilities for use in common trench are installed.

1.7 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.

- B. Project record drawings showing exact locations of all cable repairs and splices.

PART 2 PRODUCTS

- A. Schedule 40 PVC, unless otherwise shown.

2.2 UNDERGROUND CONDUCTORS IN CONDUIT

- A. Type THWN.

2.3 UNDERGROUND CONTROL WIRE IN CONDUIT

- A. Type THWN.

2.4 BEDDING AND BACKFILL FOR DIRECT BURIAL CABLE

- A. Section 02320.

1. Paved Areas: BD-1, SB-2, and BF-1.
2. Pedestrian and Lawn Areas: BD-1, SB-2, and BF-2.
3. Nontraffic Areas: BD-1, SB-2, and BF-2.

2.5 BEDDING AND BACKFILL FOR CONDUIT

- A. Section 02320.

1. Paved Areas: BD-2, SB-3, and BF-1.
2. Pedestrian and Lawn Areas: BD-2, SB-3, and BF-2.
3. Nontraffic Areas: BD-2, SB-3, and BF-2.

2.6 SPLICE CONNECTORS

- A. Crimp type connector approved for use on type of cable installed. Splice connectors shall be waterproof and capable of withstanding immersion in manholes for indefinite periods without failure. Taped splices are not acceptable.

2.7 UTILITY LINE MARKING

- A. Section 02502.

2.8 GROUNDS

- A. Section 16060.

PART 3 EXECUTION

3.1 EXTENSIONS INTO BUILDINGS

- A. Extend conduit wires and cables into buildings and other structures at locations shown. Provide all connections required.

3.2 CONDUIT

- A. Section 16050.

3.3 UTILITY LINE MARKING

- A. Section 02502.

3.4 CABLE INSPECTION

- A. Carefully inspect cable during handling to verify that the cable is free from visible defects. Report all cable damage to Contracting Officer, whether prior to installation, during installation, or discovered by test. Repair cable promptly, as recommended by manufacturer and as approved by Contracting Officer.

3.5 CABLE SLACK AND BENDS

- A. Leave minimum 24 inches of excess cable at all risers, transformer pads, pedestals, and termination points.
- B. The minimum acceptable bending radius, measured to the surface of the cable on the inside of the bend, is 12 times the overall diameter of the cable. No cable bends shall be made within 12 inches of a splice or termination.

3.6 CABLE SPLICES

- A. Make splices in accordance with the splice connector manufacturer's instructions.
- B. Not more than one splice will be permitted for each 2,000 feet of cable installed unless authorized by Contracting Officer.
- C. Show exact location of all splices on project record drawings.

3.7 TRENCHING AND BACKFILLING

- A. Section 02320.

PART 4 MEASUREMENT AND PAYMENT

4.1 UNDERGROUND SECONDARY (DIRECT BURIAL)

- A. Payment will be made at the contract lump-sum price.

END OF SECTION

SECTION 16500

LIGHTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing a lighting system.

1.2 QUALITY ASSURANCE

- A. Section 16010.

1.3 SUBMITTALS

- A. As specified in Section 01330.
- B. Provide manufacturer's data, including gauges of metal, diffuser material, performance curves, coefficient of utilization and maintenance factors, and ballast data. NEMA method ballast test temperature shall be provided. Submit data for fixtures, dimmers, and low voltage lighting systems.

1.4 CLOSEOUT SUBMITTALS

- A. As specified in Section 01770.
- B. Operation and maintenance data for review and approval as required by Section 01785.
 - 1. Manufacturer's operation and maintenance data for light fixtures.
 - 2. Lighting fixture schedule for each type of lighting fixture listing designation, manufacturer, product name, catalog or model number, type of lamps installed, and number of lamps installed.

PART 2 PRODUCTS

2.1 GENERAL - LIGHTING FIXTURES

- A. Provide all accessories required for a complete and operable system. For recessed fixtures, provide plaster frames and flanges suitable for ceiling. Provide plates, barriers, or rings to cover any exposed ceiling material between fixture canopy or pan and outlet box. Fixtures installed in damp and wet locations shall be UL listed and marked "Suitable for Wet Locations."

2.2 EXIT LIGHTING UNITS

- A. Exide Directa, manufactured by Exide Electronics, Philadelphia, Pennsylvania, or approved equal. Fixtures shall have a luminous face with red letters on a white field and built-in arrows to allow any directional combination. Provide bottom panel downlight. Two 120-volt ac lamps shall be provided with a rated life of 50,000 hours minimum. Power supply for ac lamps shall be as shown. When emergency lighting units are specified, include dc circuit and lamp rated for voltage of emergency unit, and connect to emergency light dc supply as shown.

2.3 EMERGENCY LIGHTING UNITS

- A. Exide Model B-200 Lightguard, manufactured by Exide Electronics, Philadelphia, Pennsylvania, or approved equal. Self-contained unit, rated 115 volts, 60 hertz, single phase, ac input with 12-volt dc output, rated for total emergency lighting load. System shall automatically energize emergency and dc exit lights upon failure of normal power and de-energize lights upon restoration of normal power. The unit shall automatically be maintained in a charged condition.
- B. Case: Acid-resistant, containing battery, charger and controls, relays, indicating lights, switches, and all necessary components. Case shall contain compartments to separate battery from other controls, and shall have a battery level inspection port and hinged front access door to battery and wiring.
- C. Battery: Two 3-cell, 6-volt, sealed lead-acid, calcium alloy, grid type. 32-ampere-hour minimum capacity at the 8-hour rate, at 25 degrees C to a final voltage of 1.75 volts per cell in a 1.200 to 1.220 specific gravity. Battery shall operate unattended requiring no additional water for minimum of 10 years under normal operating conditions. Container shall be high impact translucent plastic with permanently sealed cover.
- D. Load Relays: Hermetically sealed, mercury plunger type, automatically connecting and disconnecting lamp load to and from battery.
- E. Charger: Completely automatic, solid state, two-rate, with capacity to restore batteries to full charge within 12 hours after a full load discharge for 1-1/4 hours. Charger shall monitor battery voltage and automatically return to high rate as required. Solid state components shall be rated minimum 200 percent of operating duty.
- F. Controls: On-off switch, front-mounted push-to-test switch, ready state light, high rate charge light, and front-mounted battery voltmeter.
- G. Lamps: Top mounting for three adjustable, removable lampheads. Lamps shall be 12-watt Model H Halogen lamps.
- H. Remote Lamps: Unit shall be capable of operating number of remote lamps shown. Lamps shall be in accordance with fixture schedule.

2.4 EXTERIOR LIGHTING FIXTURES

- A. Complete with poles and bases, as shown.

2.5 BALLASTS

- A. 120-volt, 60-hertz, high power factor type.
 - 1. Fluorescent Lamp Ballasts: Rapid start, CBM certified by ETL, Class P, sound rating A., solid-state electronic.
 - 2. High Intensity Discharge Lamp Ballasts: Constant wattage, starting temperature of minus 20 degrees F minimum.

2.6 LAMPS

- A. Provide for each fixture a lamp of the type, size, color, wattage, and voltage shown.

2.7 LENS AND ENCLOSURES

- A. Acrylic fixture lens. Where shown, provide vandalproof lens, injection molded, ultraviolet stabilized, polycarbonate capable of withstanding blows from stones, baseball bats, and .22 caliber bullets; secured by tamperproof screws. Provide fluorescent safety sleeves where shown or required, meeting OSHA requirements and having 96 percent light transmission with no coloration.

2.8 DIMMERS

- A. SCR type, rated watts, as indicated, 120 volts, overload protected. Control as shown. Filtered to prevent interference with other systems.

2.9 CONTROLS

- A. Photoelectric: Rated for inductive loads controlled.
- B. Time Clocks: Section 16050.

PART 3 EXECUTION

3.1 INTERIOR LIGHTING FIXTURES

- A. Mount at heights shown, adjusting fixture locations to avoid space conflicts. Securely support fixtures, attaching to outlet box if box is adequately supported. Support suspended fixtures by metal stems that hang level in same horizontal plane. Do not use fixtures as a raceway for circuit conductors except for single branch circuit supplying the fixtures. Branch circuit wiring shall not pass through an outlet box that is an integral part of an incandescent fixture unless fixture is identified for the purpose. Flush and recessed fixtures without integral outlet box shall have tap connection conductor, with insulation rated for 90 degrees C, run from fixture terminal connection to an outlet box at least 1 foot from fixture. Tap shall be between 4 and 6 feet long in metallic raceway. Wiring within fixtures shall be neatly arranged and protected from damage. Protect conductor insulation from abrasion where it passes through metal using chase nipples or equivalent.

3.2 EXTERIOR LIGHTING FIXTURES

- A. Install on concrete base with anchor bolts and cable entry as shown. Adjust fixtures as required for even distribution. Ground each fixture to equipment grounding system. Adjust poles vertically with respect to each other such that the human eye cannot detect an out of vertical condition.

3.3 EXIT LIGHTING FIXTURES

- A. Consistent with design and esthetics, install to provide best visual indication of exits.

3.4 EMERGENCY LIGHTING UNITS

- A. Install in unobtrusive and accessible location to provide illumination of exits, stairways, and obstacles. Avoid glaring eye level or shadow-casting light. Consider voltage drop in remotely locating heads and wiring and increase ampacity as needed. Emergency lighting circuits shall not share conduits with other circuits.

3.5 BALLASTS

- A. Preinstalled in fixtures, unless otherwise shown. Remote ballasts shall be in accessible and noncombustible locations.

3.6 LAMPS

- A. Just before final inspection, install new lamps in fixtures.

3.7 LENS AND ENCLOSURES

- A. Clean and install just before final inspection.

3.8 DIMMERS

- A. Install as shown. Test for interference with other systems.

3.9 CONTROLS

- A. Install as shown.
- B. Locate photoelectric controls where sunlight will operate controls unimpeded by obstructions or artificial light.
- C. Time Clocks.
- D. Section 16050.

3.10 TESTS

- A. After fixture installation, test lighting circuits. Replace noisy or defective fixtures.

PART 4 MEASUREMENT AND PAYMENT

4.1 LIGHTING FIXTURES

- A. Payment will be made at the contract lump-sum price.

END OF SECTION

SECTION 16740

TELEPHONE FACILITIES

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing a complete telephone raceway system, including provisions for termination facilities and other work in conjunction with the telephone company.

1.2 COORDINATION

- A. Coordinate all work with Contracting Officer and telephone company. Where work by the telephone company is required in conjunction with construction, such as prewiring of buildings or installation of cable in common trench with other facilities, Contractor shall be responsible for coordinating work and ensuring that all required work is completed.
- B. Where work by the telephone company requires payment to the telephone company, payment will be made by the Government. Where Contractor identifies the need for work by the telephone company that requires payment and no known contractual arrangement by the Government has been made, Contractor shall immediately notify Contracting Officer.

1.3 RELATED WORK

- A. Basic materials and methods - Section 16050.

1.4 QUALITY ASSURANCE

- A. Section 16010. The telephone raceway system and other facilities shall meet the requirements of the local telephone company.

1.5 SUBMITTALS

- A. As specified in Section 01330.
- B. Submit shop drawings and catalog cuts for cabinets, outlet boxes, nozzles, and all covers.

1.6 DEFINITION

- A. Bedding and backfill material types (BD, SB, BF) are defined in Section 02320.

PART 2 PRODUCTS

2.1 UNDERGROUND CONDUIT

- A. PVC, sized as shown. Use only couplings and fittings designed specifically for type of conduit shown.

2.2 CABLE BEDDING AND BACKFILL

- A. Provide bedding and backfill for direct burial telephone cable in accordance with Section 02320 as follows:
 - 1. Paved Areas: BD-1, SB-2, and BF-1.
 - 2. Pedestrian and Lawn Areas: BD-1, SB-2, and BF-2.
 - 3. Nontraffic Areas: BD-1, SB-2, and BF-2.

2.3 CONDUIT BEDDING AND BACKFILL

- A. Provide bedding and backfill for underground conduit and backfill in accordance with Section 02320 as follows:
- B. Pvc (ABS as Applicable):
 - 1. Paved Areas: BD-2, SB-3, and BF-1.
 - 2. Pedestrian and Lawn Areas: BD-2, SB-3, and BF-2.
 - 3. Nontraffic Areas: BD-2, SB-3, and BF-2.

2.4 ABOVE GRADE RACEWAY

- A. Sized as shown; rigid galvanized steel, unless otherwise shown. Minimum size of conduit shall be 3/4-inch. Use only couplings and fittings designed specifically for type of conduit or raceway shown.

2.5 EMBEDDED RACEWAY

- A. Sized as shown; PVC, unless otherwise shown. Minimum size of conduit shall be 3/4 inch. Use only couplings and fittings designed specifically for type of conduit or raceway shown.

2.6 BOXES

- A. Outlet, pull, and junction boxes shall have sufficient free volume to accommodate wiring and devices.
- B. Wall Boxes: In dry locations, wall boxes shall be 4-inch by 4-inch by 2-1/2-inch minimum galvanized sheet metal. In outdoor and wet locations, boxes shall be weatherproof, threaded hub, 4-inch by 4-inch by 2-1/2-inch minimum cast metal with weatherproof covers and watertight cable connectors for 1/8-inch diameter cable.
- C. Floor Boxes: Type B-2536 with S-2530 covers, manufactured by Hubbell, New York, New York, or approved equal, with flush 2-1/8-inch and 3/4-inch threaded brass caps for use when telephone nozzles or floor service fittings are removed. Boxes shall be fully adjustable type with 1-1/4-inch external adjustment and 3/8-inch internal adjustment and shall be watertight after installation. All floor boxes shall include nozzles with side conductor outlets.

2.7 PLATES AND COVERS

- A. One-piece metallic. Surface mounted installations shall have stainless steel covers of type designed for the box. Plates shall be stainless steel for flush boxes. In wet locations, plates shall

be gasketed and weatherproof. Junction boxes shall have blank covers. Metal plates for outlet boxes shall have a center bushed hole. Screws shall have countersunk heads of finish to match plates.

2.8 CABINETS

- A. Galvanized sheet metal of the size shown, NEMA Type 3R, surface mounted with hinged door.

2.9 GROUND CONDUCTOR

- A. Bare or green insulated No. 6 AWG conductor.

2.10 TELEPHONE TERMINAL BOARD

- A. 3/4-inch-thick A-C interior plywood, sized as shown.

2.11 PULL CORD

- A. 100-pound test nylon or equal material.

PART 3 EXECUTION

3.1 RACEWAY

- A. Underground Raceway:
 - 1. Trenching and Bedding and Backfill: Section 02320.
 - 2. Utility Line Marking: Section 02502.
- B. Install interior raceway with maximum of 270 degrees of total bends between outlets or junction boxes; such runs shall not exceed 90 feet. Raceways for telephone will not be shared with raceways for power.
- C. Install service conduit at the location shown on the drawings. Where plywood backboard is shown, stub service conduit up to a level 2 inches above bottom of backboard and secure to backboard. Where telephone cabinet is required, extend service conduit to cabinet.
- D. Extend 1-inch raceway from each telephone wall outlet directly to the terminal cabinet or, where plywood is required, to the plywood backboard. Extend each raceway to overlap the backboard by 2 inches and secure to backboard.

3.2 BOXES

- A. Install one box for each telephone outlet and junction point. Mount indoor outlets 18 inches above finished floor level unless otherwise shown. Cap floor boxes with a flush brass cap. Furnish nozzles or floor service fittings for floor boxes for future installation. Mount wall-mounted telephones at height as directed by Contracting Officer.

3.3 TELEPHONE CABINETS

- A. Install as shown.

3.4 PULL CORD

- A. Install pull cord in each empty raceway.

3.5 TELEPHONE TERMINAL BOARD

- A. Securely bolt to wall with top of board no more than 6 feet 6 inches above finished floor, and as shown.

3.6 GROUNDING

- A. Install one ground conductor in 1/2-inch conduit from the telephone cabinet to the electrical service ground source. Provide grounding bushings and ground conduit to grounding conductor at each end of conduit. Provide a 48-inch loop of conductor at cabinet end.

PART 4 MEASUREMENT AND PAYMENT

4.1 TELEPHONE FACILITIES

- A. Payment will be included in the contract lump-sum price.

END OF SECTION