VOLUME I

CONTRACT DOCUMENTS
AND
TECHNICAL SPECIFICATIONS

FOR

C-130 FLIGHT SIMULATOR TRAINING FACILITY
FINAL

PROJECT NUMBER DPEZ 089017

PART A

OWNER:

Wyoming Air National Guard
153RD Airlift Wing

JULY 2013

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PART A

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DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01000

GENERAL REQUIREMENTS

1.0 GENERAL

1.1 SCOPE

A. Project provides for furnishing all plant, labor, material, equipment and appliances to construct a new C-130 Flight Simulator Training Facility at the Wyoming Air National Guard Base in Cheyenne, Wyoming, as described herein and shown on the construction drawings.

B. The Contractor will be held responsible for all requirements described in the Contract Documents. All work, including that of subcontractors, shall be completed in accordance with the Contract Documents. Failure to be familiar with the requirements of the Contract will not relieve the Contractor of responsibility to comply.

C. The organization of the specifications into divisions, sections, and articles, and the arrangement of the Drawings shall not control the Contractor in dividing the work among subcontractor or in establishing the extent of the work to be performed by any trade.

1.2 WORK SCHEDULING

A. Normal base work hours for the Contractor will be between the hours of 7:00 a.m. through 5:00 p.m., excluding Saturdays, Sundays, and Federal Holidays. If the Contractor desires to work during periods other than above, Contractor must notify the Contracting Officer 24 hours in advance of Contractor's intention to work during other periods to allow assignment of additional inspection forces and for notification of fire, security and safety. When the Contracting Officer determines that they are reasonably available, Contracting Officer may authorize the Contractor to perform work during periods other than normal duty hours/days. However, if inspectors are required to perform in excess of their normal duty hours/days solely for the benefit of the Contractor, the actual cost of the inspection, at overtime rates, will be charged to the Contractor and will be deducted from the final payment of the Contract amount. (Note: If applicable, at time of award this paragraph will be modified to the negotiated schedule for this Project).

B. The following Federal legal Holidays are observed by this base:

New Year's Day, 1 January; Martin Luther's King's Birthday, Third Monday of January; President's Day, Third Monday of February; Memorial Day, Last Monday of May; Independence Day, 4 July; Labor Day, First Monday in September; Columbus Day, Second Monday in October; Veteran's Day, 11 November; Thanksgiving Day, Fourth Thursday in November; Christmas Day, 25 December.

C. NOTE: Any of the above holidays falling on a Saturday will be observed the preceding Friday, holidays falling on a Sunday will be observed on the following Monday.

D. Access to the Base during “Frontier Days” will be difficult. Verify with Contracting Officer.

E. Prior to commencing work on the job initially, resumption of work after prolonged interruption (7 calendar days or more) commencement of any warranty work, and upon completion of warranty work, the Contractor must notify the Contracting Officer or the Contracting Officer Representative (COR). When relocating to new sites, returning to sites for follow-up work on a phased work plan, notification to the COR is sufficient. Notification should be by personal contact; however, advance notification may be by telephone, or in writing, and should be accomplished sufficiently in advance to allow scheduling of inspection forces. The above precautions are to ensure construction inspection and recording of work proceedings.

1.3 ENTRY TO BASE/ACCESS TO SITE

A. Cheyenne ANG Base is a closed base, pursuant to Sec 21, Internal Security Act of 1950, 50 U.S.C. 797 and, as such, only those persons authorized entry may enter. It is, therefore, required that control be exercised over Contractor personnel while working on the base. To maintain this control, a listing of all Contractor personnel who will be working under the Contract, must be submitted to the Contracting Officer 5 working days prior to the start of work under the Contract. The preferred method of providing this list is via email, to the Contract administrator. The listing shall include, but not limited to: Contract number, project number, employee name, and the estimated starting and ending date of each employee. Subsequent listings of all additions or deletions will be submitted as employees are hired or released.

B. During construction, the Contractor shall permit base personnel access to the facilities within the work area. The Contractor shall provide protection to persons and property throughout the progress of the work.

C. In the event of a declared National Emergency, the Contracting Officer may be required to stop work on this Contract for security reasons. The Contractor shall ensure the Contracting Officer has a current "Off Duty" contact name and telephone number at all times to facilitate notification.

D. The Contractor shall be responsible for compliance with all regulations and orders of the Commanding Officer of the Military Installation, respecting identification of employees, movements on installation, parking, truck entry, and all other military regulations, which may affect the work.

E. The work under this Contract will be performed at an operating Military Installation with consequent restrictions on entry and movement of nonmilitary personnel and equipment. The Military Installation may have specific requirements, which will be identified at the Preconstruction Conference.

F. The Contractor shall inform all personnel working under its jurisdiction (including subcontractor and visiting supplier personnel) that access to areas outside of the immediate work area, excluding direct haul and access routes, contracting and COR and point of supply and storage is prohibited. Circulation of said personnel will be limited to official business only. Persons in violation of the above may be apprehended and turned over to the appropriate authorities.

1.4 UNAUTHORIZED PERSONNEL

A. The Contractor shall inform all personnel (including subcontractor and visiting supplier personnel) that access to areas outside of the immediate work area excluding, direct haul and access routes, Contracting and Civil Engineering offices and point of supply and storage, is prohibited. Circulation of said personnel will be limited to official business only. Persons in violation of the above will be apprehended and appropriately disciplined.

1.5 INSPECTION OF SITE

A. The Contractor shall be responsible for the complete coordination and proper relation of the work of all trades. Reference Contract Clauses FAR 52.236-3, "Site Investigation and Conditions Affecting the Work," and FAR 52.236-8, "Other Contracts."

B. It is recommended that prospective bidders visit the premises and thoroughly familiarize themselves with the details of the work and working conditions. It is the responsibility of all offerors to have compared the premises and the site with the Specifications and Drawings, and to have satisfied themselves as to all conditions of the premises, the existing obstructions, the actual elevations, and any other conditions affecting the execution and completion of the work prior to submission of the Proposal. Reference Contract Clause FAR 52.236-3, "Site Investigation and Conditions Affecting the Work."

C. No allowances or extra construction on behalf of any Contractor will be permitted subsequently by reason of error or oversight on the part of the subcontractor, or on account of interferences by the activities of the Contracting Officer or others. Reference Contract Clause FAR 52.236-3, "Site Investigation and Conditions Affecting the Work."

D. All dimensions shown on the Drawings are based on "as-built" record drawings and, to the extent possible, accurately represent existing conditions; however, there may be some variance between existing conditions and Contract Drawings. The Contractor is responsible for verifying all dimensions and for reporting to the Contracting Officer any discrepancies that may affect performance of the work represented by Contract Drawings and specifications. Reference Contract Clause DFARS 252.236-7001 "Contract Drawings, Maps, and Specifications."

1.6 CORRELATION OF DRAWINGS, SPECIFICATIONS AND CONTRACTS

A. The Specifications, Contract and the accompanying Drawings are intended to describe and provide for a complete, new and usable facility. They are intended to be cooperative and what is called for by one shall be as binding as if called for by all. The Contractor will understand that the work herein described shall be complete in every detail, notwithstanding every item necessarily involved is not particularly mentioned, and the Contractor shall be responsible to provide all labor and material for the entire completion of the work intended. Should any error or inconsistency appear in the Drawings or Specifications, the Contractor, before proceeding with the work, shall make mention of same to the Contracting Officer for proper adjustment, and in no case shall the work proceed with uncertainty. Reference Contract Clause DFARS 252.236-7001, "Contract Drawings, Maps and Specifications."

1.7 REPORT OF ERROR AND DISCREPANCIES

A. The Contractor shall be responsible for any and all discrepancies in work due to failure to obtain dimensions and investigate conditions at the building before fabrication and installation.

B. The Contractor shall bear all costs in replacing all materials and labor due to not observing the above paragraph and such replaced materials shall meet the approval of the Contracting Officer.

C. The Contractor shall promptly notify the Contracting Officer in writing of any discrepancies.

D. Reference contract clauses FAR 52.236-21, "Specifications and Drawings for Construction." FAR 52.246-12 "Inspection of Construction," and DFARS 252.236-7001, "Contract Drawings, Maps and Specifications."

E. Any proposed changes to the specifications by the Contractor must be submitted in writing to the Contracting Officer for approval prior to implementation.

1.8 DIVISION OF WORK

A. The various divisions of the specifications shall not be considered as negotiations of the material and labor involved. The arrangement and order of these divisions have been made for convenience only, and it is not the intent, nor shall it be so construed, a particular trade or subcontractor must perform that work included in any one division.

B. Any item mentioned under any division heading must be supplied even though it is not specified under the heading for the respective work, but is shown on the Drawings. No claims for extras arising out of real or alleged error in such arrangement or order of the various divisions will be given consideration.

C. The organization of the specifications into divisions, sections, and articles, and the arrangement of the Drawings shall not control the Contractor in dividing the work among subcontractor or in establishing the extent of the work to be performed by any trade.

D. Reference Contract clause FAR 52.236-21, “Specifications and Drawings for Construction.”

E. Any proposed changes to the specifications by the Contractor must be submitted in writing to the Contracting Officer for approval prior to implementation.

1.9 METHOD OF CARRYING ON THE WORK

A. All work under the Contract shall be arranged and carried on in such a manner as to complete work in the least possible time. The Contractor shall consult with the Contracting Officer as to methods or sequence of carrying on the work. A definite program of work shall be arranged before starting. Reference AF Form 3064 “Progress Schedule.”

B. Activities in the vicinity of this Project may be kept in full or partial operation during construction. The Contractor shall coordinate with the Contracting Officer and schedule construction activities. Reference Contract Clause AF Form 3064 “Progress Schedule.”

1.10 STANDARDS OF MANUFACTURE

A. All recognized regulatory/code standards shall be the latest published edition prior to the date of release for bid/proposal of the Contract Documents.

B. For purpose of establishing the standard of construction and the requirements to be met in the work of all divisions, the Drawings and these Specifications are based on the use of products hereinafter specified, adapted to the installation as required to meet the condition.

C. Where brand names are shown, these names are intended to describe a quality of product, and in no way are intended to limit products of equal quality. Therefore, products of other manufacturers may be employed for this work provided they are equivalent materials and construction and equally adaptable to the conditions as approved by the Contracting Officer. Reference Contract Clause FAR 52.236-5, "Materials and Workmanship."

1.11 MEANING OF APPROVED, DIRECTED, ETC.

A. "Approved," "Directed," "Required," "Applicable," or words of like or similar effect, when used in the Specifications shall be interpreted to mean "Approved By," "Directed By," etc., the Contracting Officer unless otherwise specifically stipulated.

1.12 MISPLACED MATERIALS

A. Any material that is deposited elsewhere than areas designated as approved by the Contracting Officer shall be rehandled and deposited where directed. No payment will be made for rehandling such material. The Contracting Officer will notify Contractor of any noncompliance with the foregoing provisions.

1.13 COMPLIANCE WITH CODES AND REGULATIONS

A. All work shall be done in accordance with the applicable codes and/or ordinances in force at the time of construction. It is the Contractor's responsibility to ensure that where EPA, DEQ or other such regulations control the removal, handling, installation or disposal of materials, they shall be strictly adhered to whether or not specifically referenced in the construction documents.

B. Contractor shall have data sheets available at the site on any materials used to comply with MIOSHA and EPA. Reference Contract Clause FAR 52.223-3, "Hazardous Material Identification and Material Safety Data."

1.14 MATERIAL TESTING BY NATIONAL LABORATORIES

A. Electrical materials and equipment shall be new and bear the UL label or be listed in UL Electrical Construction Materials Directory or Electrical Appliance and Utilization Equipment Directory, wherever standards have been established by the agency.

B. The Contractor shall submit proof that the material or equipment, which the Contractor proposes to furnish under this Specification, conforms to the standards of Underwriters' Laboratories. The label of Underwriters Laboratories (UL) shall be accepted as conforming to this requirement.

C. In lieu of the label, the Contractor may submit a written certification from any recognized testing agency, adequately equipped and competent to perform such services, that the material or equipment has been tested and conforms to the standards, including the methods of testing used.

1.15 SUBMITTALS

A. Shop Drawings and Product Data: The Contractor shall furnish submittals in the form of manufacturer's brochures, pamphlets, or written specifications on all items to be installed unless specifically directed otherwise by these Specifications or by the Contracting Officer. Reference Contract Clause FAR 52.236-5, "Material and Workmanship," FAR 52.225-5, "Buy American Act-Construction Materials," FAR 52.223-3, "Hazardous Material Identification and Material Safety Data," and DFAR 252.227-7033, "Rights in Shop Drawings."

B. Approval of Materials: Prior to the purchase of material, the Contractor shall submit to the Contracting Officer, for material approval/disapproval, brochures and technical literature covering, in detail, the materials the Contractor proposes to supply. This shall include the specific catalog and model specification number designations. Submittals shall demonstrate that the item conforms to all of the requirements. No unapproved or disapproved materials shall be used. Submittals shall be made for the items listed on AF Form 66, Schedule of Material Submittals, or equivalent. Reference Contract Clause FAR 52.236-5, "Material and Workmanship."

1.16 CONSTRUCTION SCHEDULING, WORK PROGRESS AND PREPARATION OF PROGRESS SCHEDULES AND REPORTS

A. The Contractor shall prepare a work progress schedule on AF Form 3064 "Contract Progress Schedule," or acceptable substitute form. For construction projects in excess of $1 million, Microsoft Project, latest version, or acceptable substitute form is also required. These schedules are to be submitted to the Contracting Officer for approval, in the number of copies as directed, prior to start of construction. The schedule will show the order in which the contractor proposes to perform the work, the dates on which the Contractor contemplates starting and completing the various divisions and salient features of the work. Reference Contract Clause FAR 52.236-15, "Schedules for Construction Contracts." The work shall be scheduled so that upon the start of construction, work progresses in a continuous and diligent manner. A schedule that does not reflect steady and reasonable progress throughout the construction period will be rejected. The schedule shall include

a line item for rough inspections by Government personnel as outlined in the various sections of the Specifications or on the Drawings. A rough inspection is required on all installed systems prior to sealing off or closing in a wall, pipe chase, suspended ceiling system etc. These systems include by not limited to: domestic and heating water lines, communication and electric runs, all insulation material to be covered by other material (GWB, wood panel etc), duct runs, ceiling suspension systems, raised flooring, fire detection/protection/suppression systems etc. A second or finish inspection will be conducted after these systems are "hidden" to ensure the quality of the finished product. The finish inspection does not constitute the final Project inspection accomplished at Project completion. The Contractor shall request these inspections, through the Contracting Officer at least 5 workdays prior to the desired inspection date.

B. A weekly meeting may be held between the Contractor, COR and Contracting Officer, to discuss work progress, problems and potential change orders. The Contractor shall attend these meetings at no additional cost to the Government. Prior to specific work elements of a project, the Contractor shall confer with the COR and agree on a sequence of procedures and means of access to premise and buildings; space for storage of materials and equipment; delivery of materials and use of approaches, use of corridors, stairways and similar means of passage. Weekly progress reports are to be submitted on AF Form 3065 "Contract Progress Report," or acceptable substitute form, are required for both the Contractor and the Contracting Officer's Representative (COR) covering the period from notice to proceed through final inspection. If there are possible deviations from the original plan, those are to be noted and approved by the Contracting Officer before work changes are implemented. Reference Contract Clause FAR 52.236-15, "Schedules for Construction Contracts."

C. The Contract Schedule will include the final 5 percent of the contract for closeout. Closeout retainage will include O&M Data, manufacturer's services (i.e., training for equipment use), and warranties.

1.17 SAFETY ASSURANCE

A. Compliance with Regulations: All work including the handling of hazardous materials or the disturbance or dismantling of structures containing hazardous materials shall comply with the applicable requirements of 29 CFR 1910/1926. Work involving the disturbance or dismantling of asbestos or asbestos-containing materials; the demolition of structures containing asbestos; and/or disposal and removal of asbestos, shall also comply with the requirement of 40 CFR, Part 61, Subparts A and B. ETL 1110-1-118 and DA Circular 40-83-4. All work shall comply with applicable state and municipal safety and health requirements. Where there is a conflict between applicable regulations, the most stringent shall apply.

B. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable regulations pertaining to the health and safety of personnel during the execution of work. The Government shall not be held liable for any action on the part of the Contractor, the Contractor's employees or subcontractor, which result in illness, injury or death.

C. Crawl spaces and attics are to be treated as confined space entry. Contractor must follow 29 CFR 1910.146 and use Air Force Form 1024 when making an entry. NOTE: A confined space does not include areas above suspended acoustical tile ceiling.

D. Where an employee can fall more than 6 feet, a fall protection system must be used; 29 CFR 1926.500 stipulates where this occurs and the different types of fall arrest systems.

E. When the Contractor is working in buildings that are occupied by Government personnel, the Contractor must provide Material Safety Data Sheets (MSDS) to the Contracting Officer before starting work.

F. All references to protection of the site and adjacent buildings when trenching, shall include protection of all employees also.

G. Inspections, Tests and Reports: The required inspections, tests and reports made by the Contractor, subcontractor, specially trained technicians, equipment manufacturers and other as required, shall be at the Contractor's expense.

H. Materials and Equipment: Special facilities, devices, equipment, clothing and similar items used by the Contractor in the execution of work shall comply with applicable regulations.

I. Traffic Control Devices: The Contractor shall comply with the recommendations contained in Part 6 of the U.S. Department of Transportation, Federal Highway Administrations "Manual on Uniform Traffic Control Devices (D6. 1978) to ensure proper warnings to motorists and adequate traffic control. The Contractor shall provide all warning lights, barricades and other traffic control devices and signs.

1.18 INSPECTIONS AND TESTS

A. Inspections and tests are for the sole benefit of the Government and shall not relieve the Contractor of the responsibility of providing quality control measures to ensure that the work strictly complies with the Contract requirements. No inspection or test by the Government shall be construed as constituting or implying acceptance. Reference Contract Clause FAR 52.246-12, "Inspection of Construction".

1.19 QUALITY CONTROL/TESTS

A. Where work is specified to be in conformity with Standard Specifications of ASTM International (ASTM), or with Federal Specifications or with specifications of well-known recognized technical and trade organizations, but no tests are specifically stipulated in connection herewith, the Contractor shall furnish and pay for any tests or certifications required by the Contracting Officer to show that the proposed materials meet with the applicable requirements.

B. The Contractor shall submit a written certification from any recognized testing agency, adequately equipped and competent to perform such services, that the material or equipment has been tested and conforms to the standards, including the methods of testing used.

C. Wherever testing or analysis of material is required, such testing unless otherwise noted will be made at the Contractor's expense.

D. Subsequent testing of those materials which fail to meet specifications will be accomplished by the Contractor at no cost to the Government.

E. Contractor Quality Control (CQC) Program: The Contractor shall provide and maintain an effective quality control program in accordance with the Contract. Within 10 days of the Award of the Contract, the Contractor shall provide three copies of the Project CQC plan to the Contracting Officer. This document, as a minimum, shall include name and address of the independent testing agency and the responsible principal with the firm; a summary of QC tests required by the specification and to be provided by the testing agency; and typical daily reports forms to be used for this Project. The plan shall also indicate organizational procedures to immediately notify the Contracting Officer or COR of test results in noncompliance with the specification and recommendations on correction. The testing agency must be an independent company and not owned or partially owned by the Contractor or any relation or employee of the Contractor.

F. Samples used for testing shall be selected as specified for the various tests elsewhere in the specifications but in every case the method of selecting samples and the location for selection shall be as approved by the Contracting Officer.

G. Tests shall be made in accordance with the specified testing procedures and/or methods and otherwise as required to provide compliance with all Contract requirements. Tests shall be made by independent, commercial testing laboratories approved in writing by the Contracting Officer.

H. Results of all tests shall be recorded on certified test reports of the commercial testing laboratories. Reports shall include a statement that the materials tested do or do not meet the requirements of the Contract specifications. Six copies of all reports shall be forwarded directly to the Contracting Officer for approval within 5 days of the actual performance of the test. The testing agency shall immediately notify (verbally) the Contracting Officer of any tests, which indicate failure to meet the Contract requirements.

I. Any item, for which test reports show failure to meet all Contract requirements shall be retested as often as required to show full compliance with Contract requirements, at the Contractor's expense.

J. Contractor will provide an emergencies plan, with names of personnel to accomplish the repairs in the event of utility and/or communications emergencies.

1.20 KEYS

A. The Contractor shall be responsible for any Government-owned keys that have been issued to the Contractor for access to facilities or areas pertinent to this Contract.

B. Upon completion of the work in an area, or upon request of the Contracting Officer, the key or keys relevant to the area shall be returned immediately. Keys shall be returned prior to final task order payments.

C. Should the Contractor Lose a Key: The Contractor shall notify the Contracting Officer, immediately and in writing, but not later than 1 working day after the Contractor is aware of the loss. Should the key not be found before final acceptance, the final Contract payment shall be reduced by the replacement cost for each key not returned and, if required by the Contracting Officer, any re-keying costs and cost of any other damages suffered by the Government.

1.21 WARRANTY

A. In addition to the specific guarantees required by the specifications for certain portions of the work to be performed under this Contract, the Contractor shall furnish a written warranty for all of the work to be performed under this Contract, against defects in materials or workmanship for a period of 1 year from the date of final acceptance of the completed work by the Government.

B. All work including workmanship, material, and equipment (other than Government furnished equipment) shall be warranted for the full period of standard manufacturer's warranty, but in no case shall be warranted for a period of less than 1 year upon notice from the Contracting Officer of any failure during this warranty period, the part or parts shall be replaced promptly with new parts by and at the expense of the Contractor. Whenever the manufacturer of a piece of equipment supplied by the Contractor customarily

provides a warranty covering the equipment, the Contractor shall promptly turn over such to the Contracting Officer.

C. Upon completion, the Contractor shall provide the Contracting Officer with five bound sets containing maintenance, repair and operating instructions and parts lists for each piece of installed equipment.

D. Reference Contract Clause FAR 52.246-12, "Inspection of Construction" and FAR 52.246-21, "Warranty of Construction."

1.22 CUTTING AND REPAIRING

A. Unless otherwise specified hereinafter, the Contractor shall do all necessary cutting, drilling, fitting and patching of work and corresponding work that may be required to make several parts come together and fit it to receive, or be received, by work of other trades shown upon, or reasonably implied, by the Drawings and Specifications for the completed Project. Reference Contract Clause FAR 52.246-12, "Inspection of Construction."

B. The Contractor shall be held responsible for all cutting, replacement, and repairing of work that is due to faulty workmanship and which is not specifically covered by Specifications for trades which are affected. The Contractor will also be held responsible for providing, without extra cost to the Government, any small incidental items which are not specifically mentioned in trade specifications, but which are necessary to complete the work in accordance with the Drawings, and under the general understanding that the work when completed, shall be a finished and workmanlike job. Reference Contract Clause FAR 52.236-5, "Material and Workmanship" and FAR 52.246-12, "Inspection of Construction."

1.23 SITE CLEANUP

A. The Contractor shall maintain the construction site in as clean and orderly condition as possible. All refuse and/or salvage material shall be gathered and disposed of periodically to maintain the site in this condition. All roadways, taxiways and ramp areas within the work area, or used by the Contractor, shall be swept and vacuumed daily to assure safe operation of aircraft. The cleaning operation shall be accomplished with self-propelled sweepers equipped with pick-up devices. The method of cleaning and equipment employed shall be subject to the approval of the Contracting Officer. Reference Contract Clause FAR 52.235-12, "Cleaning Up."

B. During and after periods of rain, this construction site may have a very high water table and/or areas of standing surface water. Dewatering techniques are a Contractor's option; however, the Contracting Officer shall approve the method prior to start of work.

C. Following completion of the work, the Contractor shall clean the entire area from any debris and/or excess of misplaced material due to the Contractor's operation and obtain Contracting Officer's approval of this finished work. (Reference Contract Clause FAR 52.246-12, entitled "Inspection of Construction" and FAR 52.236-12, "Cleaning Up.")

1.24 LAYOUT AND GRADES

A. All lines and grade work not presently established at the site shall be laid out by the Contractor in accordance with the Drawings and Specifications. The Contractor shall maintain all established boundaries and benchmarks and replace as directed any which are destroyed or disturbed. Reference Contract Clause FAR 52.236-17, "Layout of Work."

B. The Contractor shall engage a Professional Engineer or Registered Land Surveyor, licensed to practice in the State of Wyoming, to properly establish all locations, grades, elevations, dimensions, joints, etc., necessary to the proper location of all items of work included in this Contract. All such items shall be established in relation to the benchmark and control points noted on the Drawings.

C. Prior to acceptance of the facility and at such times as directed by the Contracting Officer, the Contractor shall thoroughly clean all exposed surfaces of the building where work under this Contract was completed.

D. All protective coatings, except lacquers, shall be removed from finish surfaces and the finish surfaces shall be washed and cleaned. Contractor shall be held responsible for all damaged materials, and at completion, shall replace, at the Contractor's own expense, all such damaged materials.

E. Reference Contract Clause FAR 52.236-21, "Cleaning Up," and FAR 52.246-12, "Inspection of Construction."

1.25 REFUSE AND SALVAGE MATERIALS

A. All refuse, debris, and construction waste shall be legally disposed of off base at the Contractor's expense. (Reference FAR 52.236-12 "Cleaning Up.") Accumulations of refuse on the site will not be permitted.

B. All salvage property removed and not reinstalled under this Contract shall be returned to the Government at a place on base designated by the Contracting Officer, or properly disposed of when directed by the Government.

C. Nonhazardous solid waste must be diverted to recycling, through appropriate means available to the Contractor, if such diversion is less than or equal to the equivalent cost of landfill or incineration.

D. Prior to Contract closeout the Contractor must supply a report, including the following:

1. Amount (in tons) of non-hazardous solid waste, including construction and demolition debris, that is composted, mulched, recycled, reused, donated or otherwise diverted from a disposal facility.

2. Amount (in tons) of solid waste (including construction and demolition debris) transferred to a disposal facility (landfill).

1.26 STORAGE

A. No secure storage space will be provided by the Government. The Government will not be responsible for property belonging to, or under the present control of the Contractor. The Contracting Officer, or COR, will designate an unsecured, open area for storage of construction equipment and materials during the period covered by this Contract. Reference Contract Clause FAR 52.236-10, "Operations and Storage Areas."

B. The Contractor shall construct such temporary sheds, as may be required, for the use of workmen and as required for tool cribs and storage of all work under this Contract. Temporary sheds shall be confined to the space assigned by the Contracting Officer, or COR. Sheds shall be of approved construction and wood floors, lighting and heat shall be provided in all parts used by workmen. Exterior of sheds shall be painted, all parts maintained in good condition throughout the life of the Contract, and at completion, all parts shall be removed and the premises cleaned up. Reference Contract Clauses FAR 52.236-10, "Operations and Storage Areas" and FAR 52.236-12, "Cleaning Up."

1.27 TEMPORARY FIELD OFFICES

A. As soon as practicable after award of Contract, and until final completion of the work, Contractor shall provide, maintain and later remove suitable temporary office(s). All field offices shall be in good repair, painted on the exterior, provided with adequate heating, lighting and maintained in a clean and sanitary condition at all times. Reference Contract Clause FAR 52.236-10, "Operations and Storage Areas."

B. The Contractor shall provide temporary office space for exclusive use of the Government inspectors, to include contracted inspectors. This office shall include, as a minimum, as desk, a suitable chair, and access to a phone line at no additional cost to the Government.

C. The Contractor is reminded that smoking in buildings on a Government facility is prohibited. A smoking area for employees, away from the main entrance of a building, must be provided.

1.28 TEMPORARY TOILET FACILITIES

A. The Contractor must provide all temporary toilet facilities. The temporary toilet facilities shall meet the requirements of health authorities having jurisdiction and shall be kept clean and in a sanitary condition at all times.

1.29 TELEPHONE AND COMMUNICATIONS SECURITY MONITORING

A. The Contractor shall provide telephone service at the field office for personal and subcontractor use. Arrangements with the telephone company will be the responsibility of the Contractor, as well as all charges for installation, services and removal.

B. All communications with DOD organizations are subject to communications security (COMSEC) review. Contractor personnel will be aware telephone communications networks are continually subject to intercept by unfriendly intelligence organizations. The DOD has authorized the military departments to conduct COMSEC monitoring and recording of telephone calls originating from, or terminating at, DOD organizations. Therefore, civilian Contractor personnel are advised any time they place a call to, or receive a call from, an USAF organization, they are subject to COMSEC procedures. The Contractor will assume the responsibility for ensuring wide and frequent dissemination of the above information to all employees dealing with DOD information.

1.30 UTILITIES

A. The Contractor shall coordinate installation of natural gas and electrical infrastructure, including required shut-downs, tie-ins, etc. with Cheyenne Light, Fuel & Power (CLF&P).

B. The Contracting Officer has determined that Government-operated utilities are not adequate and will not be furnished to the Contractor without charge where existing outlets are available. The Contractor may use reasonable amounts of specified utilities for this construction operation without charge. The Contractor is responsible for installing temporary service outlets, as necessary, and charges will be made in accordance with the clause entitled “Availability and Use of Utility Services, FAR Clause 52.236-14. Any expense incurred to gain access to these utilities (temporary tap-ins, etc.,) shall be the responsibility of the Contractor and all utilities shall be returned to their original configurations at the end of the contracts. No alterations to existing utilities shall be accomplished without the written permission of the Contracting Officer. The following utilities will be made available: **electricity and water.**

C. Contractor shall be responsible for gas charges once gas service is established until accepted by the Government.

1.31 UTILITY INTERRUPTIONS

A. All utility shutdowns require the prior approval of the Contracting Officer. Request for utility shutdown shall be made in writing at least 2 weeks prior to the expected date of implementation. As soon as actual shutdown date is known, the Contractor shall notify the Contracting Officer, in writing, requesting approval at least 8 work days prior to requested shutdown.

B. The Contractor's progress schedule shall include preliminary listing of all proposed shutdown dates. Every effort shall be made to make all shutdowns as brief as possible, and as limited in extent as possible.

1.32 EXCAVATING PERMIT

A. Contractor is required to secure an excavating permit from Base Civil Engineer's Office, AF Form 103, before proceeding with any exterior onsite excavating or digging. The Base Civil Engineer must have 3 to 4 working days' notice from the Contractor prior to permit being secured.

1.33 COMPRESSED AIR

A. Contractor shall provide all compressed air used for work under this Contract, including temporary lines and connections. All temporary lines, etc., shall be removed at the completion of the work.

1.34 WEATHER PROTECTION AND TEMPORARY HEATING

A. The Contractor shall provide and maintain weather protection as may be required to properly protect all parts of the structure from damage during construction.

B. The Contractor shall be responsible for repairs and maintenance to the heating system or units during the period during progress of building construction and shall deliver same to the Government, at termination of such use, in perfect condition, cleaning out all air ducts and replacing all filters. Any temporary heating shall be at the expense of the Contractor.

1.35 BLOCKING OFF BASE STREETS

A. At least 2 hours prior to the blocking of any street, the Contractor shall notify the COR, Base Fire Department and Base Security Police, identify the location, the reason and the estimated time of closure. No more than two streets shall be closed at any time, and the two shall be no closer than five blocks from each other. However, there shall be no closures without at least 8 days of prior notification to both the COR, Base Fire Department, Base Security Officer and the Contracting Officer.

1.36 ARCHEOLOGICAL, PALEONTOLOGICAL AND ENDANGERED SPECIES FINDS

A. Any archeological finds (evidence of human occupation) or paleontological finds (evidence of prehistoric plant or animal life) are to be reported to the Contracting Officer immediately and continue work in other areas without interruption. Protect native endangered flora and fauna and notify the Contracting Officer of any construction activities that might threaten endangered species or their habitats.

1.37 REAL PROPERTY/EQUIPMENT REPORT

A. The Contractor shall furnish, upon completion of the Project, DDForm 1354 checklist and master equipment list along with the "Real Property Installed Cost," form in triplicate, of all equipment installed in the facility, and the installed cost of each item. Furthermore, the listing shall include the location of each item and nameplate date.

B. Typically, the listing shall include: air conditioners, air handling units, condensers, fans, pumps, air compressors, transformers, unit heaters, regulators, direct current power supplies, latrine fixtures, motors, engines, motor or engine-driven equipment, cranes, drinking fountains, sinks, water coolers, generators, space heaters, water heaters, refrigerators, freezers, coolers, meters, gas detectors, humidifiers dehumidifier, air purifier, ovens, power units, fuel tanks, water tanks, elevators, welders, recorders, reels, scales, hydrants, intrusion detection equipment, fire detection and alarm equipment, emergency light sets, emergency eye wash, deluge showers, washers, dryers, dishwashers, bridge cranes, and like items of equipment.

C. Final payment will not be made to the Contractor until the Government has received and approved the listing. The Contractor shall use the "Real Property Installed Cost" form provided in the Preconstruction Contractor Guide or given at the Pre-performance Conference.

1.38 DAMAGES, REPAIRS

A. All damages by the Contractor's operations shall be repaired, or replaced, at the Contractor's expense, as directed by the Contracting Officer. Any Government property damaged as a result of the work, materials, or operations of the Contractor shall be restored at no additional expense to the Government.

B. All existing sidewalks, curbs, and pavement disturbed, broken or removed or otherwise damaged by the Contractor during performance of the work under this Contract shall be replaced by the Contractor at the Contractor's own expense. Replaced sidewalks, curbs, and pavements shall be smooth, shall blend into the existing work, and shall not present depressions or humps.

C. Reference Contract Clause FAR 52.236-9, “Protection of Existing Vegetation, Structures, Equipment, Utilities and Improvements.”

1.39 AS-BUILT DRAWINGS

A. The Contractor shall keep an accurate record of all deviations from the approved design drawings and specifications which may occur in the work as actually constructed, and shall submit to the Contracting Officer, at completion of the work, complete information including descriptions, drawings, dimensions, marked prints, etc., as required for correction of the tracings to the as-built conditions. The information is to be color coded for easy decoding as follows:

1. Red when showing information added to the Drawings.

2. Green when showing information deleted from the Drawings.

3. Blue and circled in blue to show notes.

B. The redlined Drawings shall be complete with any deviation in actual construction.

C. The Contractor shall submit contractually obligated Design/As-Built drawings including but not limited to architectural, civil, structural, mechanical, plumbing, fire protection, fire suppression, fire alarm, electrical, and landscape.

1.40 MAINTENANCE OF TRAFFIC AND SAFETY

A. Where possible, construction work shall not interfere with the normal operations of traffic, particularly emergency vehicles and equipment. Contractor is responsible for safety on the Project site.

B. The Contractor shall use only established haul routes. When materials are transported in prosecution of the work, vehicles shall not be loaded beyond the loading limit established by Federal, State or Local Law or regulation. When it is necessary to cross curbing or sidewalks, protection against damage shall be provided by the Contractor.

C. The Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas of the base with respect to all operations and the operations of subcontractors. The Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airfield or base.

D. With respect to the Contractor's own operations, and those of all the Contractor's subcontractor, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the base.

E. The Contractor shall furnish, erect, and maintain weighted barricades, warning signs, and other traffic control devices as required to maintain traffic and ensure the safety of aircraft and the Contractor's equipment. The Contractor shall make an estimate of all labor, materials, equipment, and coincidental necessary for providing the maintenance of aircraft and vehicular traffic.

1.41 SPECIAL CONDITIONS

A. Any Contractor's equipment that causes or generates electro-magnetic disturbances or interference shall be removed from service until properly repaired. The Contracting Officer may also require repositioning or removal of the equipment from the base.

B. The Contractor shall be responsible for the coordination of work with base communications personnel, who may be working in the area and making them aware of proposed work that may affect the work of their particular trade in process of performance.

1.42 COMMERCIALLY OWNED/OPERATED RADIOACTIVE SOURCES USED ON WYOMING AIR NATIONAL GUARD BASE, CHEYENNE, WYOMING

A. When using radioactive sources for soil compaction tests or stress/support studies for detection of structural/weld defects in structural framing, pressurized pipe, vessels, etc., on WYANG, the operator shall comply with the following requirements.

1. Prior to bringing the radiation generator on to WYANG, the Contractor shall provide the Base Radiation Safety Officer (RSO) and the Contracting Officer with the following information/ documentation for review and approval.

a. A copy of the Radioactive Source Permit with operational use conditions/restrictions with expiration date or a Certification of Exemption from licensure from the Nuclear Regulatory Commission (NRC) or Agreement State (AS).

b. A current list of trained and qualified employees that will be using the radioactive source.

c. The name of the Permit Radiation Safety Officer (PRSO), emergency contact telephone number, and current address for each source used on Selfridge.

d. Operating instruction(s)/technical order(s) for the equipment that contains the radioactive source.

e. Designated storage location of the radioactive source if it remains on Selfridge overnight.

f. Proposed marking of the storage location if it exceeds 2mR/hr as measured at the surface of the storage container.

g. A copy of the company Radiation Safety Program.

h. Emergency Response Plan in case of an emergency for a lost or damaged source and/or over exposure incident/injury.

i. Provide the portion of their contract that identifies the location(s) of where the source will be used, for how long, and for what type use.

2. After approval is received for use of the specific radiation generator, the Contractor shall:

a. Meet proper Department of Transportation (DOT) and NRC shipping criteria to include properly filled out shipping manifest(s), container marking/labels, and placards on the vehicle as needed when transporting the source onto and around base. Documents shall also allow Contractor to remove the source from the base, when needed. The source and the activity shall dictate which DOT and NRC regulations and CFRs are applicable.

b. These include, but not limited to 10 CFR Parts 19, 20, 21, 30, 33, 34, and 71 for the permit and operation itself; 29 CFR 1910,1096 for occupational safety and health activities when using the instrument; 40 CFR Part 190 for environmental protection activities; 49 CFR Parts 172 and 173 for transporting the instrument, and if the source is lost or stolen 10 CFR Parts 30, 40, 50, 70, 73, and 150.

3. The Contractor shall not:

a. Buy radioactive materials or accept radioactive materials into the Air Force inventory without approval from the Radioisotope Committee (RIC).

b. Buy or use radium without RIC approval.

c. Buy radio luminescent signs and markers solely for energy conservation in general administrative, industrial, and housing applications.

4. The base RSO, or representative, reserves the right to inspect work sites and terminate/suspend any operation involving a radioactive source deemed to be unsafe IAW applicable laws, rules and federal regulations.

1.43 HAZARDOUS MATERIAL USAGE

A. The Contractor shall establish a hazardous material (HM) storage and distribution system when HM is to be used. All HM required to support the Contract shall be reported to the Hazardous Material Pharmacy (HMP) using the Contractor HM Identification Form. The Contractor HM Identification Form will be provided to the Contractor at or prior to the Preconstruction meeting. Additional HM needed by the Contractor shall be identified to the Contracting Officer's Representative for approval by the Hazardous Material Pharmacy (HMP) (See Attachment "Contractor Hazardous Material Identification Form, Part I at the end of Section 01401, Hazardous Material Usage).

B. The Contractor planning to use HM for the work must register with the base Hazardous Material Pharmacy (HMP), Bldg. 105, prior to start of work in order to support the installation's compliance with Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements.

C. The Contractor shall maintain Contractor HM Identification Form for HM on the jobsite for inspection/verification.

D. The COR will verify that the HM identified to HMP is the only HM in use on the jobsite.

E. The Contractor shall provide the following to the HMP:

1. Provide a list of each material and quantity of material for all proposed HM. Hazardous Material (HM) shall be construed to mean any item that is:

a. A health hazard or physical hazard as defined in 29 CFR, 1910.1200(c).

b. Regulated in its disposal by EPA under 40 CFR.

c. Hazardous as defined by DOT regulations under 49 CFR.

d. Hazardous as defined by the Dangerous Goods Regulations of the International Air Transport Association.

2. Provide a Material Safety Data Sheet (MSDS) for each item on the list.

3. Typical examples of hazardous materials used on the jobsite include, but are not limited to:

   a. Petroleum based liquids/gases (gasoline, kerosene, diesel, propane, butane, acetylene, etc.).

   b. Explosives.

   c. Adhesives and glues.

   d. Shot charges for anchor systems.

   e. Volatile solvents (such as PVC cleaner and glues, paint thinners).

   f. Nonwater-based paints.

   g. Liquid sealants.

   h. Epoxies and coating systems.

   i. Acidic or alkali cleaners.

F. The Contractor shall establish a HM storage and issue location that complies with Federal, state and local environmental regulations. Materials issued shall be tracked for quantities used. Unused materials shall be inventoried and removed from the ANG installation prior to close out of the Contract or expiration date of the HM. Reports of material delivered, used and removed from the installation shall be submitted to the Contracting Officer monthly and prior to Contract closeout.

G. The Contractor shall comply with all Federal, state and local environmental standards.

H. The Contractor shall accompany the COR and the installation Environmental Manger (EM) on Project closeout inspection to ensure all used and unused HM has been removed from the installation. This requirement shall not be a punchlist item and must be accomplished prior to the Government accepting beneficial occupancy of the facility or construction item. (See Attachment "Contractor Hazardous Material Identification Form Close-Out Procedures, Part II at the end of Section 01401, Hazardous Material Usage).

I. Any material suspected of being hazardous that is encountered during performance of a project shall immediately be brought to the attention of the Contracting Officer, at which time a determination will be made as to whether hazardous material testing shall be performed. If the Contracting Officer directs the Contractor to perform tests, and/or the material is found to be of a

hazardous nature requiring additional protective measures, a modification may be required, subject to equitable adjustment under the terms of the Contract.

J. The Contractor is advised that friable and/or nonfriable asbestos-containing material may be encountered in Project areas. Friable asbestos-containing material is any material that contains more than 1 percent asbestos by weight, and, that hand pressure can crumb, pulverize or reduce to powder when dry. Nonfriable asbestos-containing materials are materials in which asbestos fibers are bound by a matrix material, saturate, impregnate or coating. Nonfriable asbestos-containing materials do not normally release airborne asbestos fiber during routine handling and end-use. However, excessive fiber concentrations may be produced during uncontrolled abrading, sanding, drilling, cutting, machining, removal, demolition, or other similar activities. 29 CFRs 1910.1001, 1910.1009 and 2916-55 shall be referenced in the event asbestos-containing materials are encountered. Friable asbestos-containing materials are not authorized for use in new construction or maintenance projects.

1.44 ENERGY AND WATER EFFICIENCY AND RENEWABLE ENERGY

A. The Government's policy is to acquire supplies and services that promote energy and water efficiency, advance the use of renewable energy products, and help foster markets for emerging technologies.

B. The Contractor shall include the provisions of energy-using products for construction, renovation, or maintenance of a public building by acquiring energy-using products designated by the Department of Energy's Federal Energy Management Program (FEMP).

1.45 SECURITY REQUIREMENTS

A. The Contractor shall comply with all security regulations imposed by the base/post commander and/or agency occupying the space where work is to be performed. Any necessary security clearances shall be obtained prior to commencement of work.

B. The Contractor shall ensure that all parts of the facility where work is being performed are adequately protected against vandalism and theft.

1.46 POLLUTION ABATEMENT

A. All work shall be performed in a manner minimizing pollution of air, water and land as required.

B. Transporting materials to or from the site shall be accomplished in a manner preventing materials or particles from becoming airborne. Earth materials shall be wetted or otherwise protected. Gravel, sand and concrete shall be contained within vehicles to prevent spillage. Tarpaulins must be fastened

over load before entering surrounding streets. Removal of any materials dropped or blown off vehicles shall be the responsibility of the Contractor.

C. Burning of any material is strictly prohibited.

D. Stream beds, lakes, drainage ways, sanitary and storm sewers, etc., shall not be polluted by fuels, oils, bitumen, acids or other harmful materials. Grading shall be accomplished to prevent surface drainage from the construction site containing harmful amounts of sediment from draining onto adjacent areas.

E. Flushing on concrete trucks is restricted to the location specifically designed for this purpose by the COR.

F. Excess mortar, plaster or drywall materials shall not be disposed of on Government property. Water utilized for plastering or drywall equipment shall be disposed of in accordance with the instructions of the COR, and under no circumstances shall water be disposed of in areas which are planted or scheduled to be planted.

1.47 WORK BY GOVERNMENT

A. The Government reserves the right to undertake performance by Government forces, for the same type or similar work as contracted herein, as the Government deems necessary or desirable, and to do so will not breach or otherwise violate this Contract.

1.48 REGULATIONS

A. The Contractor shall comply with all applicable Federal, state, local, DOD, National Guard Bureau, Army and Air Force regulations pertaining to safety, traffic control and fire prevention.

B. The Contractor, employees, and subcontractors are subject to, and shall abide by and comply with, all relevant statutes, ordinances, laws and regulations of the United States (including Executive Orders of the President) and any State (or other public authority now or hereafter in force). The Contractor agrees to observe and comply with all applicable state and Federal requirements regarding social security, workman's compensation, unemployment insurance and any other matters concerning employment applicable to the performance of this Contract or rules, regulations, directions and order not inconsistent herewith as may from time to time be issued by the Government. The unilateral act of any governmental body against any employee of the Contractor for the violation of a state or Federal law or regulation shall not excuse the Contractor from full compliance with the terms and conditions of this Contract.

C. The Contractor may use the Civil Engineering library which contains most applicable Army and Air Force publications as well as some commercial project data information or the following Contracting Resources on the Internet, http://users.interline.net:80/jc/contract.htm or DOD Acquisition Reform Home Page which links for several other sites with available publications, forms and project data information, http://www.acq.osd.mil/ar/. These may also be acquired from the Government Printing Office website, http://www.access.gpo.gov/su_docs.

D. The Contractor, employees, and subcontractors shall become familiar with and obey the regulations of the installation including fire, traffic, safety and security regulations while on the military installation. Those driving motor vehicles shall observe and obey all speed limits posted throughout the installation. Personnel should not enter restricted areas unless required to do so and only upon prior approval. All Contractor and subcontractor employees shall carry proper personal identification with them at all times.

E. Contractor's equipment shall be conspicuously marked for identification and parked or placed within approved areas only, out of the way of driveways, emergency access roads, and traffic. The Contractor shall ensure that all parts of the facility where work is being performed are adequately protected. The Contractor shall comply with all security regulations imposed by the base/post commander against vandalism and theft.

1.49 ENVIRONMENTAL IMPACT

A. All waste materials generated by any work under the contract performed on a Government installation shall be handled, transported, stored, and disposed of by the Contractor and subcontractors at any time in accordance with all applicable Federal, state, or local laws, ordinances, regulations, court orders, or other types of rulings having the effect of the law, including, but not limited to Executive Order 12088, 13 October 1978; the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 ET SEQ); the Clean Air Act as amended (42 U.S.C. Sec 1857 ET SEQ); the Endangered Species Act, as amended (16 U.S.C. Sec 1531, ET SEQ); the Toxic Substances Control Act, as amended (15 U.S.C. Sec 2601, ET SEQ); the National Historic Preservation Act, as amended (16 U.S.C. Sec 470, ET SEQ); the Solid Waste Disposal Act, Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6901 ET SEQ); and the Archaeological and Historic Preservation Act, as amended (16 U.S.C. Sec 469, ET SEQ); and the Wyoming Department of Environmental Quality (DEQ). Should the United States Government be held liable for any neglect or improper actions by the Contractor or any subcontractor regarding removal or disposal of any hazardous waste, the Contractor shall reimburse the Government for all such liability.

1.50 LEED SUBMITTALS

A. The Contractor shall provide documentation of materials and procedures as required in Section 18113, Sustainable Design Requirements.

2.0 PRODUCTS NOT USED

3.0 EXECUTION NOT USED

END OF SECTION 01000

SECTION 01001

AFFIRMATIVE PROCUREMENT

1.0 GENERAL

1.1 AFFIRMATIVE PROCUREMENT AND POLLUTION PREVENTION

A. Affirmative Procurement is a mandatory component of the Air Force pollution prevention program. The AF Installation Pollution Prevention Program Guide includes this goal for Affirmative Procurement: "100 percent of all products purchased each year in each of U.S. EPA's 'Guideline Item' categories shall contain recovered materials meeting U.S. EPA's Guideline Criteria." This document contains guidelines for implementing the RCRA, EO, DOD, and Air Force requirements.

1.2 AUTHORITY AND REFERENCES

A. The Resource Conservation and Recovery Act (RCRA), Section 6002 (42 U.S.C. 6962).

B. Executive Order (EO) 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition.

C. Title 40, Code of Federal Regulations (CFR), Part 247, Comprehensive Procurement Guideline for Products containing Recovered Material.

D. Federal Acquisition Regulations (FAR).

1.3 SUBMITTALS

A. Government approval is required for submittals with a "GA" designation. Submittals having an "FIO" designation are For Information Only. The following shall be submitted in accordance with Section 01300, Submittals:

1. SD-01 Data
   Product Data; GA

B. The Contractor shall submit manufacturer's material specifications, installation instructions, physical characteristics, etc, to show that the product meets project and specification requirements.

1. SD-13 Certificates
   Product Certificates; GA

C. The Contractor shall submit documentation certifying that products meet or exceed the specified requirements.

1. SD-14 Samples
   Product Samples; GA

D. The Contractor shall submit samples of the product intended for use for project record.

1.4 DEFINITIONS

A. Affirmative Procurement: The purchase of environmentally preferable products manufactured from recycled and reclaimed materials.

B. Acquisition: The acquiring by contract with appropriated funds for supplies or services (including construction) by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated. Acquisition begins at the point when agency needs are established and includes the description of requirements to satisfy agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling agency needs by contract.

C. Contractor: The prime Contractor, Subcontractor, material suppliers, and equipment suppliers who provide the products that will be used in the construction of this project.

D. Environmentally Preferable: Products or services having a lesser or reduced effect on human health and the environment when compared to competing products or services, serving the same purpose. This comparison may consider raw materials acquisition, production, manufacturing, packing, distribution, reuse, operation, maintenance, or product or service disposal. (Section 201, EO 12873)

E. EPA Designated Item: An item that is or can be made with recovered material; that is listed by the Environmental Protection Agency (EPA) in a procurement guideline (40 CFR, Part 427); and for which EPA has advised purchasing recommendations in a related Recovered materials Advisory Notice (RMAN). (FAR 23.402).

F. Executive Agent Or Agency: An executive agency as defined in 5 U.S.C. 105. For the purpose of this order, military departments, as defined in 5 U.S.C. 102 are covered under the auspices of the Department of Defense.

G. Form: The Affirmative Procurement Reporting Form found at the end of this section.

H. Pollution Prevention: Source reduction as defined in the Pollution Prevention Act of 1990 (42 U.S.C. 13102), and other practices that reduce or eliminate the creation of pollutants through (a) increased efficiency in the use of raw materials, energy, water, or other resources; or (b) protection of natural resources by conservation.

I. Post-Consumer Material: A material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. “Post-consumer material” is a part of the broader category of “recovered material”.

J. Procurement: The purchase and providing of products to be used in the construction of this project.

K. Product: Materials and equipment that will be used in the construction of this project.

L. Recovered Materials: Waste materials and by-products which have been recovered or diverted from solid waste, but such term does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process. (Section 205, EO 12873 and FAR 23.402).

M. Recyclability: The ability of a product or material to be recovered from or otherwise diverted from the solid waste stream for the purpose of recycling. (Section 206, EO 12873).

N. Recycling: The series of activities, including collection, separation, and processing by which products or other materials are recovered from the solid waste steam for use in form of raw materials in the manufacture of new products other than fuel for producing heat or power by combustion. (Section 207, EO 12873).

O. Recycled Material: A material utilized in place of raw or virgin material in product manufacturing consisting of materials derived from post-consumer waste, industrial scrap, and material derived from agricultural wastes, and other items, all of which can be used in new product manufacturer. (EPA Guidelines & OFPP Policy Letter 92-4).

P. Recycled Product: A recycled product is one made completely or partially from waste materials or by-products recovered or diverted from the solid waste stream.

Q. Solid Waste: Garbage, refuse, sludge and other discarded materials including those from industrial, commercial, and agricultural operations, and from community activities. This excludes solids or dissolved materials in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste water effluents, dissolved materials in irrigation return flow, etc. (EPA Guidelines).

R. Specification(s): A clear and accurate description of the technical requirements for materials, products, or services including the minimum requirement for materials’ quality and construction and any equipment necessary for an acceptable product. In general, specifications are in the form of written descriptions, drawings, prints, commercial designations, industry

standards, and other descriptive references.

S. Unreasonable Price: If the cost of the recycled content product exceeds the cost of a non-recycled item, the Air Force considers the cost to be unreasonable. (Air Force Affirmative Procurement Plan).

T. Verification: Procedures used by procuring agencies to confirm both vendor estimates and certifications of the percentages of recovered materials contained in the products supplied to them or to be used in the performance of a contract. (EPA Guidelines)

U. Waste Prevention: Any change in the design, manufacturing, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they are discarded. Waste prevention also refers to the reuse of products or materials.

V. Waste Reduction: Preventing or decreasing the amount of waste being generated through waste prevention, recycling, or purchasing recycled and environmentally preferable products.

1.5 REGULATORY BACKGROUND

A. Section 6002 of RCRA requires federal agencies to give preference in the acquisition process to products and practices that conserve and protect natural resources and the environment. EO 12873 requires federal agencies to expand waste prevention and recycling programs, implement affirmative procurement programs for the United States Environmental Protection Agency (EPA) - designated items, and procure other environmentally preferable products and services. The stated purpose of the Affirmative Procurement Program is to stimulate the market for recovered materials. As a result of EO 12873, the EPA issued the Comprehensive Procurement Guidelines (CPGs) that have established the mandatory procurement by federal agencies of 36 items produced with recovered materials. The EPA has also issued Recovered Material Advisor Notices (RMANs) to accompany the CPGs and provide detailed information on the designated items. Please direct all questions regarding the plan to the Contracting Officer for forwarding to the Environmental Office (to be supplied by 14OCE).

1.6 APPLICABILITY

A. These procedures apply to Contractors employed in the construction of projects at Cheyenne ANG Base, Wyoming. Please direct all questions regarding the plan to the Contracting Officer.

1.7 EXEMPTIONS

A. EPA Recommendations: The U.S. EPA's recommends minimum recycled content levels are mandatory for procurements of those items listed in the

Affirmative Procurement Reporting Form, unless one of the following exemptions applies. RCRA provides the following exemptions from the requirement to purchase EPA-designated items:

1. The product is not available from a sufficient number of sources to maintain a satisfactory level of competition (i.e., available from two or more sources).

2. The product is not available within a reasonable period of time.

3. The product does not meet the performance standards in applicable specifications or fails to meet reasonable performance standards of the procuring agency.

4. The product is not available at a reasonable price. For Air Force purposes, "unreasonable price" is defined as follows: If the price of the recycled-content product exceeds the cost of a non-recycled item, then the price is considered unreasonable.

B. Contractor Responsibility: The Contractor is responsible for completion of the Form with respect to the work and products being provided. The Prime Contractor is responsible for insuring that all sub-contractors comply with this order. Each contractor shall provide written documentation to support his/her decision not to acquire items meeting the minimum content levels. This documentation shall be forwarded to the Contracting Officer for review and approval. In the event the documentation fails to support the Contractor's findings, the Contracting Officer's Representative shall return the documentation to the Contractor citing the reason(s) for disapproval. The Contractor shall resubmit and address the deficiencies. Contractor is cautioned not to proceed with acquiring non-compliant materials until the Contracting Officer's approval is received.

1.8 U.S. EPA DESIGNATED ITEMS

A. The 54 U.S. EPA-designated items are listed below. Not all of these materials may be required in the construction of this project. Please refer to the drawings and specifications. The attached Affirmative Procurement Reporting Form shall be used to demonstrate compliance with the stated procurement requirements.

1. Paper Products: All paper and paper products, excluding building and construction paper grades.

2. Vehicular Products:

a. Lubricating oils containing re-refined oil, including engine lubricating oils, hydraulic fluids, and gear oils, but excluding marine and aviation oils.

b. Tires, excluding airplane tires.

c. Reclaimed engine coolants, excluding coolants used in non-vehicular applications.

3. Construction Products:

a. Building insulation products.

b. Structural fiberboard products for applications other than building insulation.

c. Laminated paperboard products for applications other than building insulation.

d. Cement and concrete, including products such as pipe and block, containing fly ash.

e. Cement and concrete, including concrete products such as pipe and block, containing ground-granulated blast furnace (GGBF) slag.

f. Carpet made of polyester fiber for use in low- and medium-wear applications.

g. Floor tiles containing recovered rubber or plastic.

h. Patio blocks containing recovered rubber or plastic.

i. Shower and restroom dividers/partitions containing recovered steel or plastic.

j. Reprocessed and consolidated latex paint for specific uses.

k. Carpet cushion.

l. Flowable fill.

m. Railroad grade crossing surfaces.

4. Transportation Products:

a. Traffic barricades used in controlling or restricting vehicular traffic.

b. Traffic cones used in controlling or restricting vehicular traffic.

c. Parking stops.

d. Channelizers used as temporary traffic control devices.

e. Delineators used as temporary traffic control devices.

f. Flexible delineators used as temporary traffic control devices.

5. PARK AND RECREATION PRODUCTS:

a. Playground surfaces containing recovered rubber or plastic.

b. Running tracks containing recovered rubber or plastic.

c. Plastic fencing.

d. Park benches and picnic tables.

e. Playground equipment.

6. LANDSCAPING PRODUCTS:

a. Hydraulic mulch products containing recovered paper or recovered wood.

b. Compost made from yard trimmings, leaves, and/or grass clippings.

c. Garden and soaker hoses containing recovered rubber or plastic.

d. Lawn and garden edging containing recovered rubber or plastic.

e. Food waste compost.

f. Plastic lumber landscaping timbers and posts.

7. NON-PAPER OFFICE PRODUCTS:

a. Office recycling containers.

b. Office waste receptacles.

c. Plastic desktop accessories.

d. Toner cartridges.

e. Binders.

f. Plastic trash bags.

g. Printer ribbons (re-inked ribbons or re-inking equipment/service for ribbons).

h. Plastic envelops.

i. Solid plastic binders.

j. Plastic clipboards.

k. Plastic file folders.

l. Plastic clip portfolios.

m. Plastic presentation folders.

8. MISCELLANEOUS PRODUCTS:

a. Pallets

b. Sorbents.

c. Industrial drums.

d. Awards and plaques.

e. Mats.

f. Signage, including sign supports and posts.

g. Manual-grade strapping.

1.9 INTENT

A. The intent of this section is to increase the awareness of all Contractors as to the availability of products manufactured from, or that contain recycled materials, thereby increasing the use of these products in the construction of this project.

B. The various sections of the specifications contain references to products to be used in the construction of this project. The listed product may or may not be manufactured from or contain recycled materials. Therefore, all Contractors, Subcontractor, equipment suppliers, and material suppliers are responsible for compliance with this specification. Recycled products shall be used wherever possible subject to the exemptions as per the paragraph entitled *Exemptions*. Substitution of recycled materials or recycled products for specified products are subject to the provisions of the Article entitled *Exemptions*.

1.10 RECYCLED OR RECOVERED PRODUCTS

A. All construction materials to be used in this project, unless on existing exemption list, is to be identified on the Form at the end of this section.

1.11 QUALITY ASSURANCE

A. Companies specializing in the manufacture of products that comply with the requirements of this section shall have a minimum of 3 year's documented experience.

2.0 PRODUCTS

2.1 PARTIAL LIST OF PRODUCT SOURCES AND INFORMATION

A. The following is a partial list of companies that manufacture products using recycled materials. This partial list is presented to establish a standard of quality and does not infer that other manufacturers do not qualify. All products intended for use on this project, whether listed below or not, shall be submitted to the Contracting Officer's Representative in accordance with specification Section 01300, Submittals.

1. General Data:

   a. GreenSpec Binder, Environmental Building News, www.ebuild.com.

   b. Certified Forest Products Council, www.cerifiedwood.org/.

   c. Wiley Series in Sustainable Design, www.wiley.com/.

   d. The Carpet and Rug Institute, www.carpet-rug.com/.

   e. Information, McGraw-Hill, dialogue@mcgraw-hill.com.

   f. Florida Directory of Recycled Product Vendors, www.2.dep.state.fl.us/waste/programs/rbac/downloads/rbac_dir.pd.

   g. Oikos Green Building Source, News, searchable products data base, library, www.oikos.com.

   h. Green Design Network, News, publications, databases, www.grfeendesign.net.

   i. Greenworks Recycled Content 7 product Guide, detailed vendors directory, www.metrokc.gov/greenworks/recycontent.htm.

2. Division 3 – Concrete:

   a. GranCem, granulated blast-furnace slag. www.grancem.com/

   b. Syndesis,cement-based, pre-cast product workable with wood tools, www.syndesisinc.com/.

3. Division 4 – Masonry:

a. Hebel building Systems, autoclaved aerated concrete blocks, www.heble.com/.

b. Ytong Florida Ltd., autoclaved aerated concrete blocks, www.ytong-usa.com/.

4. Division 6 – Carpentry:

a. Avonite, solid surfacing, www.avonite.com/.

b. Chemical Specialities, wood treatment, www.treatedwood.com/.

c. Homasote Company, structural fiberboard, www.homasote.com/.

d. Isoboard, fiberboard composed of straw fibers and non-toxic resins, www.isoboard.com/.

5. Division 7 – Thermal & Moisture Protection:

a. Furo-Last Roofing, recycled PVC walkway pads, 1-800-248-0280.

b. Johns Manville, Insulation products, www.jm.com/.

c. Owens-Corning, insulation products, www.owenscornig.com/.

6. DIVISION 9 – FINISHES:

a. Armstrong World Industries, Inc.-Flooring Systems, www.armstrong-floors.com/.

b. Armstrong World Industries, Inc.-Ceiling Systems, www.ceilings.com/.

c. Benjamin Moore & Co., VOC free acrylic interior latex paint, www.benjamiinmoore.com/.

d. CanFibre Group Ltd., all-green medium-density fiberboard, www.canfibre.com.

e. Chemrex Inc., low-e interior paint, www.chemrax.com.

f. Collins & Aikman Floor coverings, carpet with 100 percent post-consumer backing, www.powerbond.com/.

g. Environmental Stone Products, stone manufactured from 100 percent recycled glass, www.environmentalstone.com/.

h. Glidden: residential interior latex paints 100 percent free of VOC, www.icipaintstores.com/.

i. Homasote Inc. sound barrier, www.homasote.com/.

j. Isoboard Enterprises, Inc., panel made from wheat straw and nontoxic resins, 1-503-242-7345.

k. Marley-Flexco Co., flooring made from 95 percent recycled truck and bus tires, www.marleyflexco.com/.

l. The Mat Factory, Inc., interlocking roll-up tiles made from 100 percent post-consumer tire rubber and PVC plastic from electric cable covers, 1-949-645-3122.

m. Sherwin Williams, VOC compliant paints and enamels, www.sherwin.com/.

n. SierraPine Limited, formaldehyde-free particleboard and medium density fiberboard containing recycled/recovered wood fiber, www.sierrapine.com/.

o. Summittville Tiles, impervious porcelain tiles using feldspar tailings, www.summitville.com/.

p. Tectum, natural-fiber acoustical ceiling and wall panels, www.tectum.com/.

q. Tiles with natural fibers, tiles made of a bio-alloy material and natural fibers, www.maderatile.com.

r. USG Interiors, Inc., synthetic gypsum board, www.usg.com/.

s. Decorative Architectural Tiles, floor, counter & wall tile made from 100 percent postconsumer glass, 1-808-885-7812.

t. Forbo, linoleum flooring utilizing renewable resources, www.forbo.com/ .

7. Division 10 – Specialties:

a. The Access Store, modular ramping system made from 100 percent recycled rubber, www.accessstoe.com/.

8. Division 12 – Furnishings:

a. Guilford of Maine, fabric from 100 percent recycled materials, www.terratex.com/.

b. Safe Solutions, LLC, furniture manufactured from waste wood, 1-970-247-3333.

9. Division 14 - Conveying Systems:

    a. Montgomery KONE, AC girlies elevators, www.montgomery-kone.com/.

10. Division 16 – Electrical:

    a. Advance Transformer Company, linear reactor ballast, www.advancetransformer.com/.

    b. Artemide Inc., energy efficient cold-cathode lighting, www.artemide.com/.

    c. Edison Price Lighting, track mounted metal-halide PAR 30 &38 lamps, 1-212-521-6995.

    d. Leviton Manufacturing Corporation, Inc., occupancy sensors, www.leviton.com/.

    e. Phillips Lighting, energy efficient compact fluorescent lamps, www.phillips.com/lighting.

    f. Osram Sylvania, mercury-free lamps and energy efficient fluorescent lamps, www.osramsylvania.com/

    g. Sensor Switch, lighting control occupancy sensors, www.sensorswitch.com/.

    h. Venture Lighting, pulse-start high performance lamp-ballast system, www.venturelighting.com/.

3.0 EXECUTION

3.1 INSTALLATION

A. All products shall be installed per manufacturer's instructions.

3.2 SUPPLEMENTS

A. The supplements listed below, following "END OF SECTION," are a part of this Specification:

1. Affirmative Procurement Reporting Form.

END OF SECTION 01001

AFFIRMATIVE PROCUREMENT REPORTING FORM

(PER EXECUTIVE ORDER 13101)

PROJECT NUMBER: _____

BLDG NUMBER: _____

PROJECT MANAGER: _____

PROJECT INSPECTOR: _____

CONTRACTOR: _____

This form is to be completed by the Contractor and submitted through Contracting Officer to CECC. It is the responsibility of the Construction Inspector to submit this data to the Base Environmental Manager who in-turn reports IAW E.O. 13101, Federal Acquisition, Recycling, and Waste Prevention.

RECYCLED OR RECOVERED PRODUCT	TOTAL RECOVERED MATERIALS CONTENT (RMC) (%)	ACTUAL RMC (%)	QUANTITY USED/UI	EXEMPTED 1,2,3,4
Rock Wool Insulation	75%			
Fiberglass Insulation	20-25%			
Cellulose Loose Fill/Spray-On Insulation	75%			
Perlite Composition Board Insulation	23%			
Plastic Rigid Foam Insulation	9%			
Plastic Foam In Place Insulation	5%			
Plastic Foam, Glass Fiber Reinforced Insulation	6%			
Phenolic Rigid Foam Insulation	5%			
Structural Fiber Board	80-100%			
Laminated Paper Board	100%			
Cement/Concrete (FLYASH)	SEE SPEC1			
High Fly Ash Flowable Fills	95%			
Low Fly Ash Content Flowable Fill	6-14%			
Carpet (PET)	25-100%			
Bonded Polyurethane Carpet Cushion	15-50%			
Jute Carpet Cushion	40%			

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Cement	ASTM C595, "Standard Specification for Blended Hydraulic Cements" ASTM C150, "Standard Specification for Portland Cement" AASHTO M 240, "Blended Hydraulic Cements"
Concrete	ASTM C618, "Standard Specification for Fly-Ash and Raw or Calcined Natural Pozzolans For Use as a Mineral Admixture in Portland Cement Concrete" ASTM C311, "Standard Methods of Sampling and Testing Fly-Ash and Natural Pozzolans For Use as a Mineral Admixture in Portland Concrete Cement" ASTM C989, "Ground-Granulated Blast Furnace Slag for Use in Concrete Mortars" AASHTO M 302, "Ground-Granulated Blast Furnace Slag for Use in Concrete and Mortars" American Concrete Institute Standard Practice ACI 226.R1, "Ground-Granulated Blast Furnace Slag as a Cementitious Constituent in Concrete"

RECYCLED OR RECOVERED PRODUCT	TOTAL RECOVERED MATERIALS CONTENT (RMC) (%)	ACTUAL RMC (%)	QUANTITY USED/UI	EXEMPTED 1,2,3,4
Synthetic Fibers Carpet Cushion	100%			
Rubber Carpet Cushion	60-90%			
Rubber Plastic Patio Blocks	90-100%			
Rubber or Plastic Floor Tile	90-100%			
Steel Restroom Divider/Partition	16%			
Plastic Restroom Divider/Partition	20-100%			
Concrete Railroad Crossing	15-20%			
Rubber Railroad Crossing	85-95%			
Steel Railroad Crossing	25-30% BOF/100% EAF2			
Traffic Cones Made from PVC, LDPE, Crumb Rubber	50-100%			
Traffic Barricades (Type I and II only) Made From HDPE, LDPE, PET, Steel, Fiberglass	100%			
Channelizers, Plastic	25-95%			
Channelizers, Rubber Base	100%			
Delineators, Plastic	25-90%			
Delineators, Rubber Base	100%			
Delineators, Steel Base	25-50%			
Flexible Plastic Delineators	25-85%			
Parking Stops, Plastic or Rubber	100%			
Parking Stops, Concrete Containing Coal Fly Ash	20-40%			
Parking Stops, Concrete Containing Ground-Granulated Blast Furnace Slag	25-70%			
Playground Surfaces, Including Rubber or Plastic	90-100%			
Plastic Fencing for Use to Control Snow, Drifting Sand, or as a Safety Barrier	90-100%			
Running Tracks. Including Rubber or Plastic	90-100%			
Plastic Park Benches and Picnic Tables	100 %			
Plastic Composite Park Benches and Picnic Tables	100%			
Aluminum Park Benches and Picnic Tables	25%			
Concrete Park Benches and Picnic Tables	15-40%			
Steel Park Benches and Picnic Tables	25-30 % BOF/100% EAF			
Plastics Playground Equipment	100%			
Plastic Composites Playground Equipment	95-100%			
Steel Playground Equipment	25-30 % BOF/100%			

_____ 2. Designated items can be made from steel manufactured in either a Basic Oxygen Furnace (BOF) or an Electric Arc Furnace (EAF).

RECYCLED OR RECOVERED PRODUCT		TOTAL RECOVERED MATERIALS CONTENT (RMC) (%)	ACTUAL RMC (%)	QUANTITY USED/UI	EXEMPTED 1,2,3,4
		EAF			
Aluminum Playground Equipment		25%			
Garden Hose, Rubber or Plastic		60-65% post-consumer materials			
Soaker Hose, Rubber or Plastic		60-70% post-consumer materials			
Lawn/garden edging, plastic or rubber		30-100%			
Paper-Based Hydraulic Mulch		100%			
Wood-Based Hydraulic Mulch		100%			
Compost Purchase or Use Compost Made From Yard Trimmings, Leaves, Grass Clippings, and Food Waste		100%			
HDPE Lumber Timbers and Posts		75-100%			
Mixed Plastics/Sawdust Lumber Timbers and Posts		100%			
HDPE/Fiberglass Lumber Timbers and Posts		95%			
Other Mixed Resins Lumber Timbers and Posts		95-100%			
Latex Paint; White, Off-White or Pastel Colors		20%			
Latex Paint; Gray, Brown, Earth-Tones, Other Dark Colors		50-99%			
Consolidated Latex Paint (When Color and Performance Don't Matter).		100%			
Plastic Non-Road Signs		80-100%			
Aluminum Signs		25%			
Plastic Sign Posts and Supports		80-100%			
Steel Sign Posts and Supports		25-30 % BOF/100% EAF			
Awards and Plaques	Glass	75-100			
	Wood	100%			
	Paper	40-100			
	Plastic and Plastic/ Wood Composite	50-100			

The following exemptions may apply to the non-procurement of recycled/recovered content materials:

1) The product does not meet appropriate performance standards
2) The product is not available within a reasonable time frame
3) The product is not available competitively (from two or more sources)
4) The product is only available at an unreasonable price (compared with a comparable non-recycled content product.)

CERTIFICATION

I hereby certify the Statement of Work/Specifications for the requisition/procurement of all materials listed on this form comply with EPA standards for recycled/recovered materials content.

CONTRACTOR	Contract Inspector	Environmental Management

SECTION 01010

SUMMARY OF WORK

1.0 GENERAL

1.1 RELATED DOCUMENTS

The drawings, general provisions of the contract and the requirements of Division 1, General Requirements, apply to the work of all sections.

A. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder

B. Project Description:

1. This project consists of the complete construction, as indicated on the Drawings and in the Specifications, of a new C-130 Flight Simulator Training Facility for the Wyoming Air National Guard, 153rd Airlift Wing, Cheyenne, Wyoming. See Civil Architectural Structural, Mechanical and Electrical Drawings which designates the work to be accomplished.

2. The scope of the project includes demolition of existing concrete pavement, excavation for foundations, utility improvements, new building construction, site grading, and resurfacing to the limits indicated on the drawings.

3. The new C-130 Flight Simulator Training Facility is a facility of approximately 11,200 gross square feet. The C-130 Flight Simulator Training Facility is comprised of one end user.

1.2 SECTION INCLUDES

A. Work By Government

B. Government Supplied Products

C. Contractor Use Of Site

D. Working Hours

E. Work Sequence

F. Winter Exclusion Period

G. Safety Standards

H. Project Safety

I. Permits

J. Security

K. Government Occupancy

L. Definitions

1.3 WORK BY GOVERNMENT

A. The Government shall undertake no work under this contract.

B. Any items and work indicated on the Drawings or in the Specifications as N.I.C. will be furnished and installed by the Government.

1.4 GOVERNMENT SUPPLIED PRODUCTS

A. The Government shall supply no products under this contract.

B. Contractor's Responsibilities:

1. Receive and unload products at site; inspect for completeness or damage.

2. Handle, store, install and finish products.

3. Repair or replace items damaged after receipt.

1.5 CONTRACTOR USE OF SITE

A. Limit use of site to allow:

1. Use of site vicinity by persons authorized entry to the Wyoming Air National Guard Base.

2. Confine operations to areas where construction shall occur. If necessary to use portions of site beyond these limits, obtain permission in writing from Base Civil Engineer. Be responsible for all damages and restore site.

3. Keep all existing access and entrances clear and available to the Government and Government's employees and authorized civilian personnel at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site

4. Keep existing emergency fire exits unrestricted when buildings are occupied.

B. Utility Outages and Shutdown:

1. Government will continue operations of existing facilities at site during progress of the work. Maintain continuous service of utilities and telephone. Do not work in occupied areas without prior written permission from Base Civil Engineer.

2. Advise Base Civil Engineering Operations and utility company at least 48 hours in advance of projected outage or shutdown if it becomes necessary to temporarily disrupt operations or have access to occupied areas.

C. Government Occupancy

1. Government Occupancy: Authorized government personnel will occupy areas adjacent to the site during the entire construction period. Cooperate with the Government to minimize conflicts and facilitate Government usage. Perform the Work so as not to interfere with Government operations.

2. Coordinate with the Government to minimize conflict and to facilitate the Government operations.

1.6 WORKING HOURS

A. Normal working hours for the Contractor will be 0700 to 1700, excluding Saturdays, Sundays and Federal holidays. Notify the Contracting Officer, in writing, three days in advance if work is desired during other time periods. Frontier Days celebration activities occur during the last two weeks of July. Work during the Frontier Days will be at the Contractor's discretion. Access to the Base will be difficult for workers and suppliers during Frontier Week. If Inspectors will be available, a modified work period may be authorized. If Inspectors are required to work other than their normal duty/days solely for the benefit of the Contractor, the actual cost of inspections at the overtime rates will be charged to the Contractor and an adjustment made to the contract price.

1.7 WORK SEQUENCE

A. Before construction begins, a construction schedule shall be prepared by the Contractor and reviewed/approved by the Contracting Officer. A critical path progress schedule shall be submitted. The schedule should consist of an arrow diagram and associated listings and should cover all work to be done on the project. The arrow diagram shall be sufficiently detailed to indicate activities such as shop drawing submittal and review, equipment manufacturer and delivery, construction activities by disciplines including subcontractors. Each activity on the diagram shall be labeled with a description, duration, scheduled

start date, latest completion date, and total float. The critical path shall be indicated on the arrow diagram by a heavy line.

B. During the construction period, coordinate construction schedule and operations with the Contracting Office. An AF Form 3064 (Progress Schedule) is required.

1.8 WINTER EXCLUSION PERIOD

A. No excavation or backfill of utility trenches or structures shall be accomplished from November 1 to April 15 without prior written approval by the Base Civil Engineer. Any excavation or backfill activities started prior to November 1 shall be scheduled such that activities are completed by November 1 and no trenches or excavations shall remain open after November 1. The Contractor is responsible for all winter or cold weather protection for work performed throughout the project.

1.9 SAFETY STANDARDS

A. Comply with requirements of the Base Safety Officer for the protection of Government Personnel or property.

B. Comply with the rules, regulations, standards and requirements of the Department of the Defense, Wyoming Department of Environmental Quality (DEQ), EPA and OSHA regarding disturbing or removing hazardous materials.

C. Comply with corps of Engineers Safety & Health Requirements Manual EM 385-1-1 (Oct. 1992), OSHA Standards, and Department of Defense rules, regulations, standards, and requirements regarding working safety.

D. Comply with Wyoming Occupational Health and Safety rules and regulations for construction.

E. See Sections 01060 Safety and Policies and Procedures, 01401 Hazardous Material Usage.

1.10 PROJECT SAFETY

A. The Contractor is solely responsible for all safety on the project including, but not limited to, traffic control, trench, confined space entry, equipment and materials storage and compliance by all employees with Base Regulations. Particular care shall be exercised in connection with operation of vehicles and other equipment on the Base. Amy damage to property or persons as a result of the Contractor's operations or personnel shall be remedied to the satisfaction of the Government. Project safety shall be coordinated with the Government prior to commencing construction. The Contractor shall designate a Safety Officer to the Government. The Safety Officer shall be

knowledgeable with Federal, State, Local and Base safety requirements. The Safety Officer shall be on the project site any time the Contractor has personnel on Base performing work on the project. The Safety Officer can be a qualified normal employee.

1.11 PERMITS

A. It shall be the Contractor's responsibility to obtain all necessary permits as required by state and local codes and regulations. The Contractor shall confirm that a valid permit has been issued prior to beginning construction.

B. The Contractor shall submit to the Wyoming Department of Environmental Quality (DEQ) a "Notice of Intent" (NOI) for coverage under the State's General NPDES Permit for Storm Water Discharge from Construction Sites (Permit No. WR10-0000). In accordance with this permit, the Contractor shall develop a Pollution Prevention Plan before submitting the NOI to the DEQ.

C. The Contractor shall also be required to obtain coverage under the State's General Permit for discharge of water from hydrostatic and disinfection testing of new water mains.

D. For information or construction site discharge requirements, the Contractor should contact the Wyoming Department of Environmental Quality at 307-777-7781.

E. A copy of this plan and submittal letter shall be forwarded to the Base Civil Engineer for the project files.

F. The Contractor shall obtain a Digging Permit (AF Form 103) prior to any excavation from the Base Civil Engineer's office.

1.12 SECURITY

A. Contractor shall provide:

1. Contractor shall provide the Base Civil Engineer's Office with the Names, Social Security Number, and Date of Birth on all Employees working on this project on this Base.

2. The Contractor shall provide Make, Model, Color, Tag Number and State Tag Registration; and Proof of Insurance, Date of Expiration of Insurance of any Vehicle (Car and Trucks Entrancing and Exiting Base).

3. The General Contractor shall furnish a List of all Sub Contractors, and a Point of Contact, Phone Number, Cell Phone Number for Site Supervisor, E-Mail Address, and Fax Number.

1.13 GOVERNMENT OCCUPANCY

A. The project area is on the Wyoming Air National Guard Base. As such, all of the area is subject to ongoing Air National Guard operations. The facilities served by this project will remain occupied and in use during the project. Security, Confined Space Entry and access requirements are contained in Section 01500. Limitations on service outages are contained in Section 02700.

1.14 DEFINITIONS

A. Government: U.S. Government, owner of the project.

B. Contracting Officer (CO): Individual authorized to act on behalf of the Government in implementing these Contract Documents.

C. Contracting Officer's Representative (COR): Technical advisor to the Contracting Officer (CO), primary construction inspector, and Point of Contact (POC) for the Contractor on Base.

D. Contractor: Construction contractor, authorized to undertake work under these Contract Documents.

2.0 PRODUCTS Not Used.

3.0 EXECUTION Not Used.

END OF SECTION 01010

SECTION 01019

CONTRACT CONSIDERATIONS

1.0 GENERAL

1.1 SECTION INCLUDES

A. Contract Price

B. Bid Options

C. Application for Payment

D. Change Procedures

E. Defect Assessment

F. Measurement and Payment

G. Alternatives

1.2 CONTRACT PRICE

A. The C-130 Flight Simulator Training Facility is a lump sum contract. The payment will be full compensation for all labor, materials, services, and equipment necessary for completion of the C-130 Flight Simulator Training Facility shown on the drawings and in the Contract Documents and Specifications.

B. Contractor Responsibilities:

1. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.

2. Promptly inspect products upon delivery for completeness, damage and defects. Submit claims for transportation damage to carrier.

1.3 BID OPTION ITEMS

A. The description of the work for each Bid Option is described on the drawings and specifications. Conform to the Technical Sections and the Drawings for requirements.

B. Bid Option items shall include all work required including overhead and profit.

1.4 APPLICATIONS FOR PAYMENT

A. Submit three copies of each application for payment.

B. Content and Format: In a format acceptable to the Contracting Officer.

C. Payment Period: Monthly.

1.5 CHANGE PROCEDURES

A. The Contractor may propose changes by submitting a request for change to the Contracting Officer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01600. Changes are not in effect until approved by the Contracting Officer in writing.

B. Construction Change Directive: The Contracting Officer may issue a directive, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Price or Contract Time. Promptly execute the change.

1.6 DEFECT ASSESSMENT

A. Replace the Work, or portion of the Work, not conforming to specified requirements.

B. If, in the opinion of the Contracting Officer, it is not practical to remove and replace the Work, the Contracting Officer will direct an appropriate remedy or adjust payment.

1.7 MEASUREMENT AND PAYMENT

A. Payment shall be by lump-sum basis. The contractor shall submit a schedule of values for various work items prior to the start of construction. The schedule of values shall be approved by the Contracting Officer and will become the basis for payments throughout the project.

1.8 ALTERNATIVES

A. Accepted Options will be identified in the Contract Documents.

B. Coordinate related work and modify surrounding work as required.

2.0 PRODUCTS Not Used.

3.0 EXECUTION Not Used.

END OF SECTION 01019

SECTION 01020

ADMINISTRATIVE INSTRUCTIONS

1.0 GENERAL

1.1 SUMMARY

A. A list of subcontractors and suppliers that will be involved with this project shall be given to the Contracting Officer for review and approval immediately after the contract has been awarded. This list must be received by the Contracting Officer before the contracts may be signed.

B. All additional work that requires compensation to the Contractor for items that are not included in the contract shall require a written Change Order before work may be done.

C. Prior to the start of construction, the Contractor(s), Contracting Officer, all subcontractors and other interested parties shall attend a Pre-Construction Conference; time, place and data to be determined after awarding the contract(s). Subsequently, a representative of the Contractor shall conduct a weekly conference to review progress and discuss any problems that may be incurred.

D. Contracts for work under this proposal will obligate the Contractor and Subcontractor not to discriminate in employment practices.

E. The Contractor shall notify the Contracting Officer a minimum of 48 hours in advance of the need for a survey to establish project control. The Contractor shall be responsible for all surveys including As-Constructed surveys.

F. The Government shall have the right to make reasonable changes in the grades as they are shown on the Drawings.

The Contractor shall arrange his work to allow 48 hours advance notice for setting of stakes for the next step of his operation to prevent work delays while waiting for construction grades.

G. The Government will obtain all easement and franchises required for the project. Contractor shall limit his operation to the area obtained and shall not trespass on private property.

Exterior perimeter fencing <u>shall not</u> be left open overnight or when the work site is not occupied.

H. All construction work under this contract on right-of-ways, easements, over private property or franchise, shall be confined to the limits of such

easements, right-of-way or franchise. All work shall be accomplished so as to cause the least amount of disturbance and a minimum amount of damage. The Contractor shall schedule his work so that trenches shall not be left open on weekends or holidays, or be left open for more than twenty-four (24) hours. Trenches that will present a danger to vehicular or pedestrian traffic will be closed at the end of each day's work.

1. The Contractor shall remove such existing structures as may be necessary for the performance of the work and if required, shall rebuild the structures thus removed in as good a condition as found with minimum requirements as herein specified. He shall also repair all existing structures which may be damaged as a result of the work under this contract.

2. All cultivated areas, either agricultural or lawns, and other surface improvements which are damaged by actions of the Contractor shall be restored a nearly as possible to their original condition.

3. Existing fences and gates are to be restored to original or better condition.

   Prior to excavation on an easement or private right-of-way, the Contractor shall strip topsoil from the trench or construction area and stockpile or windrow it in such a manner that it may be replaced by him upon completion of construction. All fences, markers, mail boxes, or other temporary structures shall be removed by the Contractor and immediately replaced after the trench has been backfilled, in their original positions. The Contractor shall notify the Government and property owner at least twenty-four (24) hours in advance of any work done on easements or private right-of-ways.

4. The Contractor shall assume all responsibility for restoration of the surface of all streets (traveled ways) used by him and damaged.

I. Testing and quality assurance shall be the responsibility of the Contractor and shall be performed by an independent testing laboratory approved by the Contracting Officer at no additional cost to the Government.

The Contractor will be responsible for scheduling testing. Density tests shall be performed by an approved commercial testing laboratory to determine compliance with the Specifications.

1. Density Compliance:

   a. Standard/Modified Proctor Moisture Density Determination (ASTM D 698, 1557) as required.

   b. Field Density Test (ASTM D 1556, ASTM D 2167, ASTM D 2922):

c. For backfill of water and sewer lines density tests shall be performed at the following intervals.

1) At least every 300 feet at 1-foot lifts starting at the spring line to finish grades in those areas where water and sewer located within the roadway or pavement sections. In addition, a minimum of one test per 1-foot lift shall be performed at trench crossings with all roadways and at locations as directed by the Engineer.

2) One test shall be made for each 500 square yards or less for each layer of specified depth for all other pavement areas in which embankment materials are placed and compacted.

3) A copy of all tests shall be furnished to the Government daily. Trenches and embankment areas improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

4) One test shall be made for each 500 square yards or less for each layer of specified depth for all subgrade and base course placed and compacted in pavement areas.

2. Concrete Testing:

a. Combined aggregate gradations, tests for air content, slump, yield, strength, as required for concrete pavements, footings, and foundations.

3. Plant Mix Pavements

a. Samples to demonstrate conformance with mix design tests to include Marshall stability, gradation, oil content, maximum theoretical specific gravity (Rice Value) and cores for in place density samples.

b. One complete set of tests for each 750 tons of plant mix placed. A minimum of two test sets required for less than 750 tons of material placed.

c. See specification sections for additional testing requirements.

J. WATER

1. Obtaining, furnishing, and properly applying water for embankments, subgrades, surfacing covers, dust control, and landscaping is the responsibility of the Contractor.

2. Water required for compaction of embankments, subgrade and gravel courses may be obtained from the Cheyenne Board of Public Utilities or from other sources.

3. If obtained from the Cheyenne Board of Public Utilities or Wyoming Air National Guard (Base) Distribution Center, one fire hydrant in the construction area shall be designated as the source of supply. The Cheyenne Board of Public Utilities or Base shall be reimbursed for the cost of the water used on the project by the Contractor. The Contractor will be required to obtain a permit and meter from the Cheyenne Board of Public Utilities. All connections to fire hydrants shall have backflow prevention.

4. The amount the Contractor shall reimburse the Cheyenne Board of Public Utilities or the Base will be determined by the metered usage from the designated fire hydrant.

END OF SECTION 01020

SECTION 01027

APPLICATIONS FOR PAYMENT

1.0 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

1.3 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

B. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

1. Contractor's construction schedule.
2. Application for Payment form.
3. List of subcontractors.
4. Schedule of alternates/additives.
5. List of principal suppliers and fabricators.
6. Schedule of submittals.

C. Submit the Schedule of Values to the Contracting Officer at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.

D. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for Schedule of Values.

E. Identification:

1. Include the following Project identification on the Schedule of Values:

   a. Project name and location

   b. Name of Contracting Officer.

   c. Contracting Officer's project number.

   d. Contractor's name and address.

   e. Date of Submittal.

2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

   a. Generic Name.

   b. Related Specification Section.

   c. Name of Subcontractor.

   d. Name of Manufacturer Or Fabricator.

   e. Name of Supplier.

   f. Change Orders (Numbers) that have affected value.

   g. Dollar Value.

   h. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.

4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

F. Margins of Cost:

1. Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

2. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

G. Schedule Updating:

1. Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Contracting Officer and paid for by the Government.

B. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

C. Payment Application Forms: Use forms provided by Contracting Officer for Application of Payment.

D. Application Preparation:

1. Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Government. Incomplete applications will be returned without action.

2. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.

3. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal:

1. Submit 6 executed copies of each Application for Payment to the

Contracting Officer by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.

2. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Contracting Officer.

F. Initial Application for Payment:

1. Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:

a. List of Subcontractors.

b. Schedule of Values.

c. Contractor's Construction Schedule (preliminary if not final).

d. Submittal Schedule (preliminary if not final).

e. List of Contractor's Principal Consultants.

f. List of Contractor's Staff Assignments.

g. Copies of Authorizations and Licenses from Governing Authorities for Performance of the Work.

h. Certificates of Insurance and Insurance Policies.

i. Performance and Payment Bond (if required).

j. Initial Settlement Survey and Damage Report, (if required).

G. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

H. Administrative actions and submittals that shall proceed or coincide with this application include.

1. Warranties (Guarantees) and Maintenance Agreements.

2. Test/Adjust/Balance Records.

3. Maintenance Instructions/O and M Manuals.

4. Meter Readings.

5. Startup Performance Reports.

6. Changeover Information Related To Government's Occupancy, Use, Operation and Maintenance.

7. Final Cleaning.

8. Application for Reduction of Retainage, and Consent of Surety.

9. List of Incomplete Work, Recognized as Exceptions to Architect's Certificate of Substantial Completion.

I. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:

1. Completion of Project closeout requirements.

2. Completion of items specified for completion after Substantial Completion.

3. Assurance that unsettled claims will be settled.

4. Assurance that Work not complete and accepted will be completed without undue delay.

5. Transmittal of required Project construction records to Government.

6. Proof that taxes, fees and similar obligations have been paid.

7. Removal of temporary facilities and services.

8. Removal of surplus materials, rubbish and similar elements.

9. Change of door locks to Government's access.

2.0 PRODUCTS - Not Used

3.0 EXECUTION - Not Used

END OF SECTION 01027

SECTION 01030

ENVIRONMENTAL

1.0 GENERAL

A. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

B. The Contractors staging area and materials storage area shall be confined to within the area directed by the Contracting Officer.

C. The Contractor is responsible for his own work area, storage area and accepts the liability of negligent damage or loss of equipment during the project life.

D. The disposal of solid waste, used petroleum products, sewage or other trash discarded or waste material is the Contractor's responsibility. The Contractor's responsibility also includes any waste materials generated from cleanup of spills and any hazardous wastes generated by this project.

E. Any petroleum products spilled shall be cleaned up immediately with notifications made to the Base Fire Department and Environmental Flight. The Contractor shall be responsible to ensure any wastes generated that require manifesting are signed by an authorized Base representative from the Environmental Flight. Copies of completed manifests must be received by the signer within 35 days, thus indicating receipt of the shipment by the disposal facility.

F. All waste materials will be disposed of in accordance with EPA, DOT, OSHA and state and local requirements.

G. For all products containing hazardous materials, the Contractor must submit a Material Safety Data Sheet (MSDS) for approval from Bio-environmental Engineering, prior to transporting any hazardous materials on the Base.

H. The Contractor shall submit a site specific Health and Safety Plan (HASP) for approval by the Contracting Officer prior to the start of construction.

I. A copy of the HASP shall be available on the job site and all of the Contractor's employees shall be aware of its contents and where it is located.

J. See Section 01060, Safety Policies and Procedures for additional requirements.

K. Fuel delivery operations will be ongoing during construction at this site. The Contractor shall coordinate with the Contracting Officer concerning construction activities that affect access to fueling facilities.

2.0 PRODUCTS Not used.

3.0 EXECUTION

A. All waste materials shall be removed from the Base and lawfully disposed of.

B. The Contractor shall provide temporary security fence when construction operations require removal of any permanent fencing for excavation or access. The project site shall remain secured at all times.

C. The use of erosion control materials, (i.e., silt fence, straw bales, etc.) Shall be installed during construction to prevent erosion and sediment from affecting adjacent property. See Section 01420, Environmental Protection and Section 01561, Erosion and Sediment Control.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT Not used

END OF SECTION 01030

SECTION 01040

PROJECT COORDINATION

1.0 GENERAL

1.1 SECTION INCLUDES

A. Drawings and general provisions of Contract, along with Division-1 General Requirements – Specification Sections apply to the work of all sections.

B. Reference Section 18113 for LEED requirements and Section 19113 for Commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination drawings.

2. Administrative and supervisory personnel.

1.3 CONSTRUCTION MOBILIZATION

A. Coordinate with Contracting Officer and Base Civil Engineers Office in allocation of mobilization areas of sites, for field offices and sheds, for hauling routes, delivery access traffic, and parking facilities.

B. During construction, coordinate use of site and facilities with Contracting Officer.

1.4 COORDINATION

A. Coordination:

1. Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

2. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

3. Where availability of space is limited, coordinate installation of different

components to assure maximum accessibility for required maintenance, service and repair.

4. Make adequate provisions to accommodate items scheduled for later installation.

5. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

B. Administrative Procedures:

1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

a. Preparation of schedules.

b. Installation and removal of temporary facilities.

c. Delivery and processing of submittals.

d. Progress meetings.

e. Project close-out activities.

C. Conservation:

1. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

2. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work. Refer to other sections for disposition of salvaged materials that are designated as Government's property.

1.5 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

b. Indicate required installation sequences.

c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Contracting Officer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Staff Names:

1. Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

2. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

2.0 PRODUCTS Not Used

3.0 EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Contracting Officer.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated.

J. Refer questionable mounting height decisions to the Contracting Officer for final decision.

3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.

10. Puncture.
11. Abrasion.
12. Heavy traffic.
13. Soiling, staining and corrosion.
14. Combustion.
15. Electrical current.
16. High speed operation.
17. Improper lubrication,
18. Unusual wear or other misuse.
19. Contact between incompatible materials.
20. Destructive testing.
21. Misalignment.
22. Excessive weathering.
23. Unprotected storage.
24. Improper shipping or handling.
25. Theft.
26. Vandalism.

END OF SECTION 01040

SECTION 01060

SAFETY POLICIES AND PROCEDURES GENERAL

1.0 GENERAL

1.1 SECTION INCLUDES

A. Contractor required health and safety plan. See section 01060, Safety Policies and Procedures, and section 01420, Environmental Protection, for sample requirements.

B. Construction Hazard Plan.

1.2 RELATED SECTIONS

A. Section 01300, Submittals - (Job Hazard Analysis, Job Safety And Health Plan, Hazard Response Plan)

B. Section 01030, Environmental

C. Section 01420, Environmental Protection

D. Section 01700, Contract Closeout

1.3 REFERENCES

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

1. OSHA 1910 R.E.G. - 29CFR, OSHA 1910.120.

1.4 SUBMITTALS

A. Submittals for WYANG Approval: The following items shall be submitted for WYANG approval:

1. Designation of Safety Representative: The Contractor shall designate in writing a qualified employee OSHA Trained under 1910.120 responsible for the overall supervision of all accident prevention activities. Duties shall include ensuring applicable safety requirements are incorporated into work methods and inspecting the jobsite to ensure that safety measures and instructions are actually being applied. This person shall be on site at all time that work is in progress.

2. The Contractor shall be trained/certified in OSHA 1910.120 procedures. All other employees performing site work will meet OSHA 1910 training requirements for their job capacity.

B. Submittals for Information Only: The following items shall be Contractor certified:

1. Job Hazard Analysis: Contractor shall develop a job hazard analysis for presentation at the pre-construction conference. The Contractor's job hazard analysis shall list potential hazards that could arise during the course of the work.

2. Job Safety and Health Plan:

a. The Contractor shall develop a Job Safety and Health Plan for presentation at the Pre-construction conference. The Contractor's Safety Plan shall make whatever provisions are necessary to conduct work in accordance with current OSHA standards.

b. The following are minimum requirements for the health and safety plan:

1) Safety Plans: Safety Plans will be the responsibility of the Contractor for construction areas identified by the installation and/or WYANG as areas of known hazards only. These plans are required by 29 CFR 1910 and are the responsibility of the Contractor. This requirement will be coordinated through the Health and Safety Program of the military installation by the Contractor.

2) Minimum Requirements for the Health and Safety Plan are as follows:

a) Must be kept on site, and must be written.

b) Will contain a hazard analysis (safety and health risk) for each site task and operation (to be supplied by the installation).

c) Will include employee training (per paragraph (3) of 1910.120).

d) Will include personal protective equipment to be used by employees for each of the site tasks and operations (paragraph (g) (5) of 1910.120).

e) Will include provision for medical surveillance (paragraph (f) of 1910.120).

f) Will include the frequency and types of air monitoring, personal monitoring, environmental sampling techniques, instruments to be used (their maintenance and calibration).

g) Will include a site control program (per paragraph (d) of 1910.120) to be coordinated with the installation.

h) Will include a decontamination procedure (per paragraph (k) of 1910.120).

i) Will include an emergency response plan (per paragraph (1) of 1910.120).

j) Will include a confined space entry procedure (per 1910.146, 147 or program equivalent).

k) Will include provision for spill containment (per paragraph (j) of 1910.120).

l) Will include pre-entry briefings (prior to each site task activity) for all employees involved in the task, supervision, or emergency response.

m) Will include telephone notification of accidents and followed by a written report of the accident.

n) Written verification of adherence to the "plan" by a Safety and Health Supervisor is required (the supervisor must meet the 1910.120 training requirements for supervisors).

o) Deficiencies will be corrected immediately upon discovery and after consultation with the WYANG Contracting Officer.

p) Erect a safety bulletin board at the job site.

3. Hazard Response Plan: The plan unplanned or non-predicted discovery of such hazards as transite pipe, contaminated soils, and other possible hazards will be addressed within an Emergency Response Plan (EMR) by all contractors. This requirement will be coordinated through the Health and Safety Program of the military installation by the Contractor (sample provided by Contracting Officer).

4. Material Safety Data Sheets will be maintained at the site for all hazardous materials in use.

1.5 MONTHLY SAFETY MEETINGS

A. The Contractor will schedule subsequent safety meetings with Contractor and Subcontractor personnel on a monthly basis. Minutes of safety meetings shall be prepared and signed by the Contractor. Concurrence signed by Inspection Section and the original submitted to the Contracting Officer's Representative for inclusion in the contract file.

1.6 LIFE OF CONTRACT REQUIREMENTS

A. The Contractor shall comply with 29 CFR 1910.120 and all provisions of this section during the life of the contract.

2.0 PRODUCTS NOT USED

3.0 EXECUTION

3.1 HEAD PROTECTION (HARD HATS)

A. All work sites under this contract are designated Hard Hat Areas. The Contractor shall post the area and shall ensure that all personnel, vendors and visitors use hard hats while within the limits of the work site.

3.2 PRE-OUTAGE COORDINATION MEETING

A. Utility outages shall be coordinated with the Contracting Officer.

3.3 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

A. The Contractor shall establish a full protection program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identity responsibility, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

END OF SECTION 01060

SECTION 01200

PROGRESS MEETINGS

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, along with Division – 1 General Requirements – Specification Sections, apply to the work of all sections.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Pre-Construction Conference

2. Progress Meetings

3. Field Engineering

B. Construction schedules are specified in another Division - 1 General Requirements Section.

1.3 PRE-CONSTRUCTION CONFERENCE

A. The Contracting Officer will schedule a pre-construction conference and organizational meeting at Project site or other convenient location as soon as possible following the Notice of Award of the contract and prior to commencement of construction activities.

B. Attendees: The Base Civil Engineer, Contracting Officer and his consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:

1. Tentative construction progress schedule.

2. Critical Work sequencing.

3. Designation of responsible personnel. List of subcontractors. Contact list for responsible personnel.

4. Procedures for processing field decisions and Change Orders.

5. Procedures for processing Applications for Payment.

6. Distribution of Contract Documents. Submission of executed bonds and insurance certificates.

7. Submittal of Shop Drawings, Product Data and Samples.

8. Preparation of record documents and closeout procedures

9. Use of the premises.

10. Office, Work and storage areas.

11. Equipment deliveries and priorities.

12. Safety procedures.

13. First Aid.

14. Security.

15. Housekeeping.

16. Working hours.

17. Scheduling.

D. Meeting Minutes: Minutes shall be taken by the Contractor and distributed to the Contracting Officer, Base Civil Engineer, and Architect/Engineer.

1.4 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at regularly scheduled intervals (weekly). Notify the Contracting Officer of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to the Contracting Officer if he desires, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect Progress. Include topics for discussion as appropriate to the current status of the Project, such as but not limited to:

1. Review 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 Submittal Schedule and status of submittals.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Effect of proposed changes on progress schedule and coordination.

D. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

E. Review the present and future needs of each entity present, including such items as:

1. Interface requirements.
2. Time.
3. Sequences.
4. Deliveries.
5. Off-site fabrication, delivery schedules and problems.
6. Access.
7. Site utilization.
8. Temporary facilities and services.
9. Hours of Work.

10. Hazards and risks.

11. Housekeeping.

12. Quality and Work standards.

13. Change Orders.

14. Documentation of information for payment requests.

F. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

G. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.5 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.

2. Date.

3. Name of Contractor.

4. Name of Contracting Officer.

5. RFI number, numbered sequentially.

6. Specification Section number and title and related paragraphs, as appropriate.

7. Drawing number and detail references, as appropriate.

8. Field dimensions and conditions, as appropriate.

9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the contract sum, Contractor shall state impact in the RFI.

10. Contractor's signature.

11. Attachments: Include drawings, descriptions, measurements, photos, product data, shop drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Contracting Officer's Action: Contracting Officer will review each RFI, determine action required, and return it. Allow seven working days for Architect's / Engineer's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.

    b. Requests for approval of substitutions.

    c. Requests for coordination information already indicated in the Contract Documents.

    d. Requests for adjustments in the Contract Time or the Contract Sum.

    e. Requests for interpretation of Architect's / Engineer's actions on submittals.

    f. Incomplete RFIs or RFIs with numerous errors.

2. Contracting Officer's action may include a request for additional information, in which case Architects / Engineer's time for response will start again.

3. If Contractor believes the RFI response warrants change jin the Contract Time or the Contract Sum, notify Contracting Officer in writing within 10 days of receipt of the RFI response.

D. On receipt of Contracting Officer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Contracting Officer within seven days if Contractor disagrees with response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. Project name.
2. Name and Address of Contractor.
3. Name and address of Contracting Officer.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Contracting Officer's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.6 FIELD ENGINEERING

A. Contractor shall locate and protect survey control and reference points and notify the Contracting Officer of any discrepancies.

B. Control datum for survey is that shown on Drawings.

C. Verify set-backs and rights-of-way; confirm drawing dimensions and elevations.

D. Provide field engineering services. Establish elevations, lines and levels, utilizing recognized engineering survey practices.

2.0 PRODUCTS Not Used

3.0 EXECUTION Not Used

END OF SECTION 01200

SECTION 01230

BID OPTIONS

1.0 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for options.

1.3 DEFINITIONS

A. Bid Option: An amount proposed by bidders and stated in the Bidding Requirements that may be added or deducted to the Base Bid amount if the Government decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Document.

1. The cost for each option is the net addition or deduction to the Contract Sum to incorporate options into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the option into Project.

1. Include as part of each option, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of option.

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

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

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

2.0 PRODUCTS Not Used

3.0 EXECUTION

3.1 SCHEDULE OF BID OPTIONS

A. **Bid Option 1:** The following item shall be incorporated as Bid Option 1:

1. Horizontal Louver Blinds (Windows). See Specifications Section 12491.

2. Building Interior Signage. See Specification Section 10431 Signs. Sign details are shown on Drawing A27 Building Signage.

B. **Bid Option 2:** The following item shall be incorporated as Bid Option 2:

1. Flight Simulator Exterior Facility Sign and electrical lighting. The exterior building sign constructed of concrete and split face block with precast concrete caps along with the electrical work associated with furnishing and installing conduits, wiring, and light fixtures to illuminate the sign. Facility sign details are shown on drawing C6, C19. Electrical details are shown on drawingE101, E200.

C. **Bid Option 3:** The following items shall be incorporated as Bid Option 3:

1. Walkway Lighted Bollards. The exterior lighting along the walkways to the C-130 Flight Simulator Training Facility are shown on the Electrical Site drawing E101, E200

D. **Bid Option 4:** The following item shall be incorporated as Bid Option 4:

1. Furnish and Install Landscape Irrigation system. The landscape irrigation system includes the piping from the supply line stubbed outside the mechanical room along the south wall, sprinkler heads, remote spray zone valves, isolation valves, valve boxes, drip emitters, remote drip control zone valves, and wall mounted controller and appurtenances to provide a complete and functional irrigation system. The Irrigation system details are shown on drawing L1, L2 and specification Section 02810 Irrigation.

E. **Bid Option 5:** The following item shall be incorporated as Bid Option 5:

1. Furnish and install weed barrier, rock mulch, concrete landscape curbing, planting of shrubs, trees, and placement of sod. Work includes the preparation and grading of planting areas, placement of topsoil and amendments along with maintenance and watering until final acceptance of the project. The landscaping plant schedule and details are shown on drawing L1, L2, L3 and specification Sections 02911-Sod, and 02955-Landscape.

F. **Bid Option 6:** The following item shall be incorporated as Bid Option 6:

1. Design/Build a Solar PV System along the southern facing roof of the WST High Bay. The solar photovoltaic (PV) system is a design/build task outlined in the Statement of Work attached to this specification section. The PV system includes all design, permitting, labor, materials, equipment, coordination, communication systems, metering, monitoring, and installation to provide a complete and functional system. See Statement of Work for guidelines.

END OF SECTION 01230

SAMPLE PRICING SCHEDULE

BASE ITEMS					
ITEM NO.	DESCRIPTION	QUANTITY	UNIT	Unit Price	AMOUNT
0001	Construction FFP Entire Work Complete for the Construction of C-130 Flight Simulator Training Facility Project NO. DPEZ 089017 Per Volume I, Part A & B of the Specifications and the Drawings dated August 1, 2013.	JOB	1 LS	XXX	$_____
TOTAL AMOUNT (BASE ITEMS 0001)					**$_____**

BID OPTION ITEMS					
BO-0001	All work complete for furnishing and installing 1. Horizontal Louver Blinds, Specification Section 12491 2. All work complete for installation of interior Building Signage, Specification Section 10431 and Drawing A27.	JOB	1 LS	XXX	$_____ $_____
TOTAL AMOUNT BO-0001 $_____ (Additive)					
BO-0002	All work complete for furnishing and installing the Flight Simulator exterior facility sign and electrical lighting. Drawings C6,C19, E101, E200 and electrical specifications.	JOB	1 LS	XXX	$_____
TOTAL AMOUNT BO-0002 $_____ (Additive)					
BO-0003	All work complete for furnishing and installing exterior walkway lighted bollards at locations shown on Drawing E101, E200 and described in the electrical specifications.	JOB	1 LS	XXX	$_____
TOTAL AMOUNT BO-0003 $_____ (Additive)					

BO-0004	All work complete for furnishing and installing a landscape irrigation system as shown on the drawings L1, L2 and described in the specifications Section 02810 Irrigation.	JOB	1 LS	XXX	$_____
TOTAL AMOUNT BO-0004 $_____ (Additive)					
BO-0005	Provide all work complete in place for furnishing and installing landscape materials consisting of weed barrier, rock mulch, concrete landscape curb, topsoil, shrubs, trees and sod as shown on the drawings L1,L2,L3 and described in the specifications Section 02911-Sod and 02955-Landscape.	JOB	1 LS	XXX	$_____
TOTAL AMOUNT BO-0005 $_____ (Additive)					
BO-0006	Provide all work to complete the design/build and installation of a complete and totally functional Solar Photovoltaic (PV) System at the Flight Simulator Training Facility.	JOB	1 LS	XXX	$_____
TOTAL AMOUNT BO-0006 $_____ (Additive)					
GRAND TOTAL AMOUNT (BASIC ITEMS PLUS ALL OPTION ITEMS) $_____					

BID OPTION No.6

STATEMENT OF WORK

Wyoming Air National Guard's Flight Simulator-Cheyenne, Wyoming

Solar PV System

The Wyoming Air National Guard intends to procure solar photovoltaic (PV) systems as a Bid Option for the 153rd Airlift Wing C-130 Flight Simulator Training Facility at the Cheyenne, Wyoming Base.

The Wyoming Air National Guard has chosen to pursue the following site: -Site 1: Flight Simulator Training Facility Roof.

A detailed proposal shall be submitted for the indicated area; however, the Wyoming Air National Guard reserves the right to select priority options based on final pricing. The optimal configuration of priority areas and sizes of PV power (DC rating) shall be proposed by the contractor and shall be based on the system which provides the best economic returns for the Wyoming Air National Guard.

1.0 DESCRIPTION OF WORK

1.1 SITE DESCRIPTIONS

A. This work involves the complete design and construction of a fully functioning Solar PV system including, but not limited to the equipment selection, structures evaluation for installation location, permitting, bonding and construction of a photovoltaic system.

B. The proposal shall describe how solar power is interconnected to the flight simulator electrical distribution system. Contractor shall assess the proposed site area, provide construction details and plans to ensure topographical conditions are suitable for the proposed construction.

C. The plan shall at a minimum, identify the array plan view, possible shadow zones, inverter/transformer locations, spacing, structural details, roof mount details and (above and below grade) wire routing. All site preparation work shall be accomplished by the contractor and schedules shall be approved by the government Project Manager and Contracting Officer's Representative (COR) prior to commencing work.

D. The installed systems shall meet the following minimum requirements:

1. Have a recoup investment of not more than 21 years.

2. Solar efficiency of at least 15%.

3. Warranty product/workmanship – 10years.

4. Operating temperature range, -40 to + 185 degrees F.

5. Cover Materials – Tempered Glass.

6. Frame Materials – Anodized Aluminum.

7. Impact Resistance (Hail at Wind MPH) – 50 mph.

8. Warranty power at 80% (years) -20 years.

9. Roof area to be covered is approximately 1400 sq. ft. (south facing half of wst high bay roof, 4/12 slope).

1.2 SITE: C-130 FLIGHT SIMULATOR TRAINING FACILITY

A. The site includes the southerly facing area of roofing on the WST High Bay of the Flight Simulator Training Facility. The roof is constructed of a metal truss system which incorporated a design loading of 10 psf for future PV System. The roof system is a standing seam metal roof.

B. The electric power generated by this Solar PV system may be supplied to the closest switchgear that connects to the Facility distribution system adjacent to the Flight Simulator Facility.

C. Contractor shall coordinate with the COR and the Facility Manager for proper phasing of the work in order not to hinder and aggravate traffic and parking conditions at the Wyoming Air National Guard Base.

D. The final system configuration shall allow automatic operation without operator intervention. System design and equipment specifications shall minimize maintenance requirements. The system shall have Main Metering capabilities. In addition, metering shall be provided to monitor performance of the arrays, with the data to be used by facility personnel. This metering shall measure the output of each combiner box, and may be located at each re-combiner box. This monitoring is for the purpose of tracking performance and alarming conditions of individual arrays that are under-performing. Performance shall be logged every 15 minutes. This monitoring shall be connected to existing WYANG local metering system via a wired RS485 and if necessary a fiber connection to all re-combiner boxes.

E. The PV metering system shall be connected into the WYANG Utility Metering System WYANG has an existing metering system in place. The Contractor will be responsible for interconnecting with the existing system for data transfer. The system shall have Main Metering capabilities for each individual site.

1.3 SYSTEM REQUIREMENTS

A. Main Individual Site Metering system shall:

1. Be revenue grade (ANSI C12.20 -0.2)

2. Comply with EN50160, EC 61000-4-30 Class A, and IEEE 1159

3. Be capable of disturbance direction detection

4. Contain at least 5MB of onboard memory with data logging and event recording capacity to account for network outages and downtime.

5. Contain a minimum of 5 digital inputs

6. Contain multiple electromechanical and solid-state outputs to allow a high level of integration with 3rd party devices and systems.

7. Include LAN (Ethernet or wireless) connectivity which allows remote monitoring and troubleshooting and for connection with the utility metering data aggregation systems.

8. Collect and transmit system performance data to include at a minimum solar irradiance, DC power, AC real power, AC current, AC voltage, and power factor; ambient air temperature, PV cell temperature and AC energy produced (hourly, daily, monthly, yearly). Logging shall be recorded in 15-minute intervals.

9. Provide remote monitoring of real-time system performance data (as outlined above) on a web-based portal. All service fees associated with data collection, transmission, monitoring, and hosting shall be borne by the contractor for a period of two (2) years from system startup.

1.4 CONTRACTOR REQUIREMENTS

A. The Contractor Shall:

1. Be solely responsible for compliance to federal, state and local Safety (OSHA, etc.), Life and Fire Safety (NFPA, etc.) and Environmental (EPA, etc) rules and regulations. Contractor shall submit all required programs, plans and documents with respect to regulatory compliance (Project Specific Safety Plan, etc.).

2. Be solely responsible for the verification of existing conditions ensuring to ascertain the site conditions hat may affect required equipment clearances, electrical, metering, control and mechanical requirements of the contract;

3. The contractor shall comply with, review, and incorporate any interconnection agreements, utility-required disconnects, and utility-grade meters into this project.

4. The contractor shall assist the Contracting Officer to apply for and obtain the maximum applicable state grants or incentives for a photovoltaic construction for their site from the local utility provider, Cheyenne Light Fuel and Power. Contractor shall pay any application fee(s) for Cheyenne Light Fuel and Power rebate(s) and will be reimbursed after completion of the project.

5. Determine the techniques, means, method, and materials of construction to meet the requirements of this contract and provide a proposal to accomplish the work described herein.

6. Provide all labor, materials, equipment, supervision and management required to implement the proposal and to provide a fully operational system.

7. Provide all general construction work. Any structural and architectural work must be approved by the WYANG's Contracting Officer's Representative (COR) prior to construction. Also Contractor shall comply with local and WYANG building code requirements and have a Wyoming-licensed Structural Engineer review and stamp solar construction.

8. Coordinate with WYANG and local authorities to minimize pedestrian and traffic disruptions during delivery and construction.

9. Provide manufacturer start-up, testing and document final operation.

10. Provide as-built documentation, record drawings, Operation and Maintenance (O&M) manuals and operator training.

11. PV modules shall have minimum 20-year limited warranty that modules will generate no less than 80% of rated output under Standard Test Conditions (STC). PV modules that do not satisfy this warranty condition for any reason shall be replaced within two (2) weeks. Warranties on any replacement PV modules shall be for 20 years from date of replacement. The respective shippers shall prepay shipping costs in each direction. Panels shall be part on the CEC list of approved modules.

12. All PV systems shall carry a five-year warranty from both the manufacturer and the installer, including parts and labor. Warranty shall start on the date of Substantial Completion.

13. Provide the WYANG a complete turn-key, commissioned and warranted system as outlined in this contract.

2.0 TECHNICAL REQUIREMENTS

A. The contractor is solely responsible for determining the techniques, means, methods, and materials of construction to meet the requirements of this contract. All work shall comply with OSHA and local code requirements including seismic requirements. All products that are listed, tested, identified, or labeled by Underwriters Laboratories (UL), Factory Mutual (FM), Edison Testing Laboratories (ETL), or other National Testing Organization shall be used when available. With Contracting Officer approval, non-listed products are only permitted when listing does not exist. Disconnects and switches shall be DC rated when used in DC applications.

B. The inverter(s) disconnects and associated electrical equipment must be located in an area that is accessible, weather-protected and secure. Disconnects and over-current devices shall be mounted in approved boxes, enclosures, or panel boards. Metal enclosures/boxes shall be bonded to the grounding conductor. An electrical meter with built-in modem shall be provided that is capable of recording kWh produced by the PV system and instantaneous kW of the system.

C. Transformers, if required, shall have an efficiency of greater than 97%. Transformers shall be housed in a NEMA 3R enclosure.

D. Inverters shall be UL 1741 Certified. Inverters shall have a minimum 5-year warranty. Inverters shall not be located in direct sun.

E. The PV solar panel mounting structure shall be corrosion-resistant.

F. NOTE: The contractor shall stage all contract work with the COR and Engineering representative to minimize system downtime (i.e. electrical shutdown). Any system downtime (i.e. electrical shutdown) shall be scheduled during weekends and/or after business hours. Downtimes shall be approved by the COR and Engineering representative at least two weeks prior to the shutdown. Coordinate all work with the COR and Engineering representative.

3.0 ROLES AND RESPONSIBILITIES

A. **Documentation**: The Wyoming Air National Guard, COR will provide the contractor with copies of existing site documents based upon availability and need.

1. The contractor shall request other government documentation deemed pertinent to the work accomplishment directly from the COR. The contractor shall consider the COR as the final source for needed government documentation when the contractor fails to secure the

documents by other means. The contractor is expected to use common knowledge and resourcefulness in securing all other reference materials, standard industry publications, and related materials that are pertinent to the work.

B. **Communications:** The contractor shall maintain frequent communications with the COR and other designated Wyoming Air National Guard staff and the contract Team to conduct work in progress reviews. Progress reports shall be delivered to the COR and other authorized assigned representative or designee on a monthly basis via electronic mail.

C. **Credits/Incentives or Grants:** WYANG will retain all REC (Renewable Energy Credits), Incentives and/or associated with the scope of work in this solicitation.

4.0 CONTRACTOR REQUIREMENTS, CONFIDENTIALITY AND NON-DISCLOSURE

A. The contractor shall follow all Government rules and regulations regarding information security to prevent disclosure of sensitive information to unauthorized individuals or organizations.

B. Contractor staff and management may have access to some privileged and confidential materials of the United States Government such as budget and strategic plans. These printed and electronic documents are for internal use only, are not to be copied or released without permission, and remain the sole property of the United States Government. Some of these materials may be protected by the Privacy Act of 1974 (revised by PL 93-5791) and Title 18. Unauthorized disclosure of Privacy Act or Title 18 covered materials is a criminal offense.

C. Regulatory standard of conduct governs all personnel directly and indirectly involved in procurements. All personnel engaged in procurement and related activities shall conduct business in a manner above reproach and, except as authorized by statute or regulation, with complete impartiality and with preferential treatment for none. The general rule is to avoid strictly any conflict of interest or even the appearance of a conflict of interest in Government-contractor relationships.

5.0 OTHER PERSONNEL CONSIDERATIONS

A. Personnel assigned by the contractor to the performance of work on this contract shall be acceptable to WYANG in terms of personal and professional conduct and technical knowledge. Should the assignment to this contract of any person by the contractor be deemed to conflict with the interests of WYANG, or in the event performance is deemed to be unsatisfactory at anytime during the life of the contract, the Contracting Officer may notify the contractor and request the person be immediately removed from the

assignment. The reason for removal will be documented and a request to receive personnel replacement within three (3) business days of the notification will be made. Replacement personnel qualifications shall be equal to or greater than those of the personnel being replaced. Employment and staffing difficulties will not be justification for failure to meet established schedules.

B. The contractor must notify Wyoming Air National Guard ten (10) calendar days in advance and the Project Manager (PM) and COR will approve or reject new proposed contractor key personnel for the performance of this contract. The contractor shall submit a resume of qualifications and the Contractor Personnel Change Control form to the PM and COR and all other direct employees proposed for the project. The PM and COR will approve all contractor employees prior to bringing on duty via Contractor Personnel Change Request Form, at any time from date of award to the end of the contract, contractor personnel are no longer available, the WYANG will approve the qualifications of proposed replacement personnel and will reject individuals who do not meet the qualifications set forth herein. All contractor employees are subject to immediate removal from performance of this contract when they are involved in a violation of the law, WYANG security, confidentiality requirements, and/or other disciplinary reasons.

6.0 DELIVERABLES – SUBMITTALS – SCHEDULES:

A. Contractor shall submit the following construction documentation and all catalog material to the COR for approval before a notice to proceed is issued by the Contracting Officer. Submissions shall include:

1. Provide a schedule that demonstrates complete fulfillment of all contract requirements. The schedule shall include milestone dates, including equipment ordering and delivery dates, activity start and end dates, man-loading estimates, and activity description. The schedule shall be submitted as part of the design and shall be approved prior to receiving the notice to proceed. An updated schedule shall be submitted prior to progress meetings as work progresses.

2. Contractor shall submit all permits associated with the construction project prior to receiving notice to proceed.

B. The following submittals shall be approved prior to ordering any equipment:

1. Manufacturer’s complete technical literature for the selected panel, including net peak capacity;

2. Inverter, including required DC voltage and how the proposed PV arrays will operate within the Maximum Power Point (MPP) of the inverter at different cell temperatures using Keesler AFB, MS weather data.

C. Individual panels shall be tested prior to construction on mounts. Record open-circuit voltage and short-circuit current for each panel. Submit these test results to the COR.

D. Provide 50% and 100% construction designs for approval. All final construction designs shall be reviewed and approved by the government COR. The drawing submissions will be CAD-based and include specific locations, routings, etc typical of a construction submission.

E. After award Contractor shall submit:

1. Performance and Payment Bonds – Due to Contracting Officer 10 Calendar Days after award.

2. Proof of Insurance – Due to Contracting Officer 10 Calendar Days after award.

3. Submit quality control, safety, and environmental plans.

a. Contractor Quality Control Plan (CQCP): The contractor shall develop a quality control plan and shall furnish to WYANG for review no later than 30 calendar days after the receipt of notice to proceed. The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. WYANG will consider an interim plan for the first 45 calendar days of operation. Construction will be permitted to begin only after acceptance of the CQCP or acceptance of an interim plan applicable to the particular feature of the work to be started. Work outside of the features of the work included in an accepted interim plan will not be permitted to begin until acceptance of a CQCP or another interim plan containing the additional features of the work to be started. After acceptance of the CQCP, the Contractor shall notify the Contracting Officer's Representative in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

b. Safety Plan: Comprehensive safety plan shall be implemented by the Contractor to eliminate injuries occurring relative to providing the design and construction services for this project. Construction will be permitted to begin only after WYANG's acceptance of the Safety Plan. Contractor is responsible for providing enough project lead time to allow for WYANG review of Safety Plan before acceptance. The Department of Labor OSHA requires that all Contractors involved in construction on WYANG owned or leased property comply with the Incorporation of General Industry Safety and Health Standards applicable to Construction Work and Technical Amendments, Final Rule 29 CFR Parts 1910 and 1926 as published in the Federal Register Volume 58, No. 124, June 30, 1993. In addition, any

Contractor that performs construction type work on any WYANG project as defined by the Scope of the referenced regulation is required to; (1) Provide and maintain his own protective equipment and devices, etc; and (2) Require all subcontractors used on site to follow these same provisions in the regulation.

c. Environmental Plan: Comprehensive environmental plan shall be implemented by the Contractor to prevent environmental pollution during, and as result of, construction operations under this contract. Construction will be permitted to begin only after WYANG's acceptance of the Environmental Plan. Contractor is responsible for providing enough project lead time to allow for WYANG review of Safety Plan before acceptance. The plan shall include the identification and resolution of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life or affect other species of importance to human.

F. The performance periods and submission schedules for each phase of design are indicated below.

1. Contractor shall submit Preliminary 50% design analysis, drawings, and specifications to the WYANG for review and approval no more than 45 calendar days after NTP is issued. This submittal will include drawings, outline specifications, design analysis, a design documentation report, quantity and cost estimates, an construction cost estimate, a proposed construction schedule, site plans identifying all right of ways, a complete order of work clause describing the required sequence of construction operations, and other supporting documents.

2. The Contractor shall submit 100% design analysis, drawings, and specifications for the WYANG review and approval with implementation/rejection of comments provided by the WYANG during 50% review no more than 45 calendar days after receipt of preliminary design review comments. This submittal will include detailed working drawings and specifications necessary for the effective coordination and efficient execution of the construction work. The final design shall also include a construction contractor submittal register, design analysis, a design documentation report, quantity and cost estimates, an construction cost estimate, a proposed construction schedule, site plans identifying all right-of-way (for construction and perpetual operations), and other supporting documents.

3. The Contractor shall submit final design analysis, drawings, and specifications with implementation/rejection of the WYANG comments provided during 100% for review and approval, 28 calendar days after

receipt of final design review comments. This submittal will include same items that are required for the final design submittal.

G. During the construction phase, Contractor shall submit Coordination (Shop) Drawings to the WYANG for review and approval.

H. In addition to the elements mentioned above, the contractor shall submit to the WYANG

1. Progress reports to the WYANG.

2. Inspection report.

3. Test reports.

4. Upgraded schedule.

5. Contractor shall provide for review and approval by WYANG, any stand-by power provisions or partial requirements standards required by the local utility and required as part of this construction. Provide cost information relative to the agreements and any other equipment that may be required by the utility and proposed system construction.

I. During the completion of the project, the Contractor shall submit

1. Punch-list to the WYANG for review.

2. Final inspection report.

3. O& M manual.

4. Warranty documents.

J. Upon completion of the project, the Contractor Shall Submit

1. Engineering calculations used to determine design characteristics of the PV system, and sizing and selection of system components. Engineering calculations include, but are not limited to, structure, module operating temperature, conductor sizing, and over-current device ratings. Calculations shall be on 8½ inch by 11 inch sheet, suitable for side binding.

2. Detailed drawings of the PV mounting system and how it is integrated to the roof support structure; submit engineering calculations used to determine the canopy's structural integrity considering appropriate wind loads.

3. Connection Wiring Diagram: Provide a wiring diagram for complete system construction. Diagram shall show how components are wired;

including but not limited to terminal blocks, wire sizes, wire connections, connection to external devices and ground connections.

4. Engineering data and calculations indicating acceptable system load limits are met for each site.

K. Upon completion of the construction, the contractor shall demonstrate the performance of the system to the Field Inspector and COR and shall submit the documentation, items and other information listed below.

1. The contractor shall provide all information pertinent to the equipment for preventative maintenance and replacement. Include full product documentation from manufacturer, installer and/or supplier. Data shall be both electronic (PDF, Word and AutoCAD) and hardcopy, on 8 1/2 inch by 11 inch sheet, suitable for side binding. Include 3 copies of the items listed below and other features as recommended by the manufacturer.

   a. As-built versions of the submittals and drawings shall be both electronic and hard copy.

   b. Construction drawings and field wiring diagrams.

   c. Operators manuals for each system component including detailed instructions on how to operate the system, programming and installation instructions, emergency operating procedures, default program values and set points, listing of field programmed variables and set points, equipment wiring diagrams, product model number, with Name, Address and Telephone number of local representative, starting, operating, and shut down procedures. Include normal and emergency shutdown procedures, schedule of maintenance work, if any, recommended cleaning agents and methods, replacement parts list, including internal fuses, and warranty information.

   d. Provide a formal 2-hour on-site training session instructing operators at the medical center in the operation and maintenance of the new system, including operation and maintenance of inverters, disconnects and other features as requested by WYANG. WYANG shall be permitted to video tape this training for official use. Contractor shall instruct the WYANG personnel in removal and installation of panels, including wiring and all connections. At the time of training the Contractor shall furnish, for the equipment specified, operation and maintenance manuals, record drawings and recommended spare parts lists identifying components adequate for competitive supply procurement for operation and maintenance of system. The operation and maintenance manuals shall include maintenance schedules for all equipment.

e. Provide the WYANG with written instructions and procedures for all components of the system. At the time of training the Contractor shall furnish, for the equipment specified, operation and maintenance manuals, record drawings and recommended spare parts lists identifying components adequate for competitive supply procurement for operation and maintenance of system. The operation and maintenance manuals shall include maintenance schedules for all equipment.

f. Startup report including system and individual panel performance. System and individual panel performance shall be compared to expected performance and shall include at a minimum solar irradiance, DC energy, AC energy, ambient air temperature and PV cell temperature. System performance shall be measured and reported for at least one full day.

g. If the performance monitoring of the constructed array indicates the array is not meeting its required performance predictions it shall be corrected by the Contractor at the Contractor's expense within thirty (30) calendar days of notification. Following correction, performance monitoring will again be performed until the array meets required performance predictions. Measurements made under actual construction and temperature will be normalized to STC.

7.0 PROJECT ACCEPTANCE

A. **Project Acceptance:** All submittals and deliverables must be received and approved by the COR before final acceptance of the line item will be made.

END OF SECTION 01230

SECTION 01300

SUBMITTALS

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor shall perform no portion of the Work for which the Contract Documents require submittals and review of Shop Drawings, Product Data, Samples or similar submittals, until the respective submittals have been approved by the Contracting Officer.

B. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section. The requirements of Division 1, General Requirements, apply to the Work of all Sections.

C. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals.

1.3 GENERAL SUBMITTAL PROCEDURES

A. General

1. All submittals shall be addressed to the Contracting Officer unless specifically noted otherwise or unless instructed in writing by the Government.

2. Receive, check, approve as required, and submit all items required by the Contract Documents.

3. Maintain accurate record log of dates sent and received for all submittals. Provide the Contracting Officer and Government access to such log.

4. Supply Government forms: Contracting Office or Base Civil Engineer will supply Government forms.

B. General List of Required Submittals

1. Except as otherwise required by the Contract Documents, the following is general list of required submittals and time frame for submitting.

2. Prior to Date of Government-Contractor Agreement

   a. Items as required by the Bidding Documents.

3. Prior to Commencement of Work

   a. Certificates of Insurance.

   b. Installer Certifications

4. Within 3 days of Date of Government-Contractor Agreement

   a. Performance, Labor and Material Payment Bonds.

5. Prior to first Application for Payment and within time limits established elsewhere in the Contract Documents

   a. Contractor and Supplier List

   b. Contractor's Construction Schedule

   c. Schedule of Values

   d. Submittal Schedule

6. As work progresses

   a. Updated Contractor's Construction Schedules

   b. Wage Rate and Payroll Certificates

   c. Affidavit and Waiver of Lien.

   d. Daily Construction Reports

   e. Progress Construction Photographs

   f. Shop Drawings

   g. Product Data

   h. Samples

   i. Record Information Submittals

      1) Test Reports

      2) Special Guarantees and Warranties

      3) Maintenance and Operating Instructions

4) Material Certifications

5) Calculations

7. With request for Final Payment

a. Record Documents - As Constructed Drawings

b. Provide a reproducible copy.

c. Extra Stock

d. Final Construction Photographs

e. Complete package of Shop Drawings, Operation & Maintenance Manuals and Product Data.

1) Final Affidavits and Waivers of Lien

2) Certificate of Inspection

3) Certificate of Occupancy

C. Submittal Coordination

1. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

3. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by need to review submittals concurrently for coordination.

4. Contracting Officer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Submittal Processing

1. Allow sufficient review time so that installation will not be delayed as result of time required to process submittals, including time for resubmittals.

2. Allow minimum of 14 days for review (from date Contracting Officer receives submittal until date it is sent back). Allow additional time if processing must be held up to permit coordination with subsequent

submittals. Contracting Officer will advise Contractor when a submittal being processed must be held for coordination.

3. If intermediate submittal is necessary, process same as initial submittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to Contracting Officer sufficiently in advance of the Work to permit processing.

E. Submittal Preparation

1. Place permanent label or title block on each submittal for identification.

2. Provide a minimum blank space of 3.5-inch by 8.5-inch for review stamps of Contractor and Contracting Officer.

3. Include following information on label or title block:

a. Name of entity that prepared submittal

b. Project name

c. Date

d. Name and address of A/E

e. Name and address of Contractor

f. Name and address of Subcontractor

g. Name and address of Supplier

h. Name of manufacturer

i. Number and title of appropriate Specification Section

j. Drawing number and detail references, as appropriate

k. Status (new or prior submittal date and number)

F. Submittal Transmittals

1. Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Contracting Officer using a transmittal form. Submittals received from sources other than Contractor will be returned without action. Submit a minimum of six copies of each submittal. One copy of which will be returned to the Contractor. Submit additional copies for subcontractors.

2. On transmittal, record relevant information and requests for data. On transmittal, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Documents.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Within 14 days of execution of Government-Contractor Agreement, submit graphic process schedule showing proposed critical dates for starting and finishing the Work of each trade, which will enable Contractor to meet established completion dates.

B. Prepare schedule in form of bar chart, as acceptable to Contracting Officer.

C. Keep schedule current and submit latest copy with each Application for Payment. Modification or updating of schedule shall not constitute basis for claim for extra payment if portions of the Work do not become available at established dates.

D. Take all appropriate steps to keep loss of time to minimum.

E. Keep up-to-date copy of schedule posted on site at all times.

1.5 SUBMITTAL SCHEDULE

A. General

1. Prior to first Progress Payment, submit complete schedule of submittals.

2. Coordinate submittal schedule with list of Subcontracts, Schedule of Values and list of products as well as Contractor's Construction Schedule.

3. Prepare schedule in chronological order; include submittals required during first 90 days of construction. Provide following information:

   a. Scheduled date for first submittal

   b. Related Specification Section number

   c. Submittal category

   d. Name of Subcontractor

   e. Description of the part of the Work covered

   f. Scheduled date for resubmittal

B. Distribution

1. Following response to initial submittal, print and distribute copies to Contracting Officer, Government, Subcontractors, and other parties required to comply with submittal dates indicated. Post copies in project meeting room and field office.

2. When revisions are made, distribute to same parties and post in same locations.

C. Schedule Updating

1. Revise schedule after each meeting or activity, where revisions have been recognized or made. Issue updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

A. Prepare daily construction report, recording following information concerning events at site; submit duplicate copies at weekly intervals:

1. List of subcontractors at site

2. Approximate count of personnel at site

3. High and low temperatures, general weather conditions

4. Accidents and unusual events

5. Meetings and significant decisions

6. Stoppages, delays, shortages, losses

7. Orders and requests of governing authorities

8. Change orders received, implemented

9. Equipment or system tests and start-ups

10. Partial Completions, occupancies

11. Substantial Completions authorized

1.7 CONSTRUCTION PHOTOGRAPHS

A. General

1. Photograph from locations to adequately illustrate condition of construction and state of progress as determined by the Contracting Officer.

B. Prints

1. Color prints with imprinted date.

2. Paper: Single weight, white base

3. Finish: Smooth surface, glossy

4. Size: 3 inches by 5 inches (minimum)

5. Identify each print on back, listing: name of project; orientation of view; date and time of exposure; name and address of photographer; photographer's numbered identification of exposure.

C. Progress Construction Photographs

1. Provide color photographs taken by cutoff date for **each** scheduled Application for Payment.

2. Photograph exterior from three different views.

3. Photograph interior from two different views.

4. Photograph site work progress.

D. Final Construction Photographs

1. Provide photographs taken on or after Date of Substantial Completion.

2. Photograph exterior from three different views.

3. Photograph interior from two different views.

E. Submittals

1. Progress construction photographs: Submit two prints of each view with Application for Payment. Retain negatives and one print of each view for submittal with Final Application for Payment.

2. Final construction photographs: Submit negatives and one print of each view with Final Application for Payment.

1.8 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. General

1. Shop Drawings, Product Data and Samples are sole responsibility of Contractor.

2. Only those Shop Drawings and Product Data will be reviewed:

   a. Where details of fabrication, installation or attachment are required to supplement the Contract Documents.

   b. Where there are deviations from the Contract Documents for any reason. (This procedure is not for purpose of reviewing substitutions.)

   c. Where further documentation is required to show Contractor's proposed product or system is in conformance to every requirement of a performance specification.

3. Only Shop Drawings and Product Data required by the Contract Documents will be reviewed.

4. Shop Drawings and Product Data shall be submitted in sufficient detail to permit Contracting Officer to:

   a. Review that product or system is as specified or shown.

   b. Review chosen details of fabrication, installation or attachment.

   c. Review for conformance to requirements of performance specifications, line item by line item.

B. Submittal Process

1. Submit properly processed and identified items as required by the Contract Documents.

2. Late or untimely submittals shall not be cause to reduce Contracting Officers review time, to accept lower quality, or to delay project completion.

3. Contractor shall be solely responsible for scheduling and coordinating of submittals among Subcontractors.

4. Allow sufficient time for proper handling, review, fabrication and delivery. If numerous items are submitted at one time, additional review time shall be allowed as determined by Contracting Officer.

C. Shop Drawings

1. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as

basis of Shop Drawings. Standard information preapred without specific reference to the project is not considered Shop Drawings.

2. Shop Drawings shall show the following:

   a. General arrangement of each product or assembly by necessary plans, elevations and sections.

   b. Dimensions, finishes, location in building and details of fabrication and installation.

   c. Identification of products and materials included, part numbers.

   d. Compliance with specified standards.

   e. Notation of coordination requirements and dimensions established by field measurement.

   f. Wiring diagrams and schematics for all equipment with electric motors or wiring.

3. Sheet Size: Except for templates, patterns and similar full size drawings, submit Shop Drawings on sheets 24 inches by 36 inches. Sheets shall be prepared in legible manner with sheets generally filled completely to minimize number of sheets.

4. Submittal: Submit one correctable translucent reproducible print and six (6) blue-or black-line prints for Contracting Officers review; reproducible print will be returned.

5. When Shop Drawings are revised and resubmitted, all revised and/or added items since previous submittal shall be circled.

6. If only certain parts of a completed or partially completed Shop Drawing are submitted for review, these items for review shall be circled.

7. Entire submittal of Shop Drawings will be returned unreviewed when revised or added items have not been circled.

8. Shop Drawings that are submitted for reference as an aid to review another portion of the Work will not be reviewed.

D. Product Data

1. Collect Product Data into single submittal for each element of construction or system. Product Data includes printed information such as manufacturers installation and instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring

diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as Shop Drawings.

2. Mark each submittal to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate applicable information. Submit only those catalog pages showing required item.

3. Include following information:

   a. Manufacturer's printed recommendations

   b. Compliance with recognized trade association standards

   c. Compliance with recognized testing agency standards

   d. Application of testing agency labels and seals

   e. Notation of dimensions verified by field measurement

   f. Notation of coordination requirements

4. Submittal: Unless otherwise indicated, submit six copies of each required submittal; Contracting Officer will retain five and return other copy. Additional copies for subcontractors, suppliers, etc. are in addition to above.

   a. Submittals up to 8.5-inch by 14-inch size: Submit two copies on white opaque paper suitable for reproduction; Contracting Officer will retain five and return other.

   b. Submittals over 8.5 inches by 14-inch size: Submit one correctable translucent reproducible print and three prints for Contracting Officers review; reproducible print will be returned.

   c. Equipment submittals consisting of 10 pages or more: May be submitted in 3-ring binders with cover page for stamps; six copies.

5. The Contracting Officer will stamp only the cover letter together with random product data sheets.

E. Samples

1. Submit full size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed.

2. Mount, display, or package Samples to facilitate review of qualities indicated.

3. Where indicated to match Control Sample, prepare to match Contracting Officers Sample.

4. Submit Samples for review of appearance characteristics, for final check of these characteristics with other elements, and for comparison of these characteristics between final submittal and actual component as delivered and installed.

5. Contracting Officer will review required Samples. Such review will be for appearance only. Compliance with all other requirements of the Contract Documents is responsibility of Contractor.

6. Where variation in color, pattern, texture or other characteristics are inherent in material or product represented, submit multiple units (not less than 3), that show full rance of variations.

7. Unit materials (such as brick, floor tile, ceiling tile): Unless otherwise indicated, submit standard size units in sufficient quantity to show full range.

8. Submittal: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit (3) identical sets; one will be returned marked with action taken.

9. Distribution of Samples: Prepare and distribute additional sets to all parties involved. Show distribution on transmittal forms.

F. Contractor's Check

1. Prior to delivering submittals, check each item for:

   a. Conformance to submittal requirements.

   b. Conformance of materials and details to the Contract Documents.

   c. Accuracy of all measurements.

   d. Field construction criteria related thereto.

2. Reject items, which do not conform to these requirements and return them to originator with explanation for rejection. Do not submit rejected items to Contracting Officer. Do not submit items that are not required by the Contract Documents.

3. For each item approved by Contractor, stamp item with approval stamp to warrant and represent approval.

4. Contractor is totally responsible for following items that will not be reviewed by Contracting Officer:

   a. Deviations from Contract Documents which have not been identified as such by Contractor.

   b. Dimensions to be confirmed and correlated at site.

   c. Fabrication process information.

   d. Means, methods, techniques, sequences, procedures of construction and construction safety.

   e. Coordination of the Work for all trades.

G. Contracting Officers Review

1. Deliver or send each item, shipping charges prepaid, to Contracting Officer.

2. Contracting Officer will reject immediately any item without further review if it is not:

   a. Accompanied by specified transmittal containing required information.

   b. Submitted in proper form.

   c. Stamped "**APPROVED"** by Contractor.

3. If submittal has been previously submitted and was marked "**CONFORMS"** or **"CONFORMS AS NOTED"** and transmittal letter does not state that additional corrections or additions to submittal have been made, then such submittal will not be reviewed again.

4. Review will be for conformance to design concept and compliance with information given in the Contract Documents. Contracting Officer will make notations directly on reproducible.

5. Review is intended to foresee unacceptable products and to minimize possibility of their rejection at site. Review shall not be construed as:

   a. Permitting departure from the Contract Documents, unless specifically so noted.

   b. Relieving Contractor of responsibilities for errors or omissions.

   c. Acceptance of an assembly in which an approved item is a part.

d. Approval of variations from previously approved items.

e. Approval of dimensions

H. Contracting Officers Action Stamp

1. Contracting Officers will review each Submittal, stamp to indicate action taken, and return to Contractor. Compliance with specified characteristics is Contractor's responsibility.

2. Where submittals are stamped **"CONFORMS AS IS"**, that part of the Work covered by the Submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

3. Where submittals are stamped **"CONFORMS AS NOTED"**, that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and the requirements of the Contract Documents; final acceptance will depend on that compliance.

4. Where submittals are stamped **"DOES NOT CONFORM, REVISE AND RESUBMIT"**, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

   a. An item will be stamped **"DOES NOT CONFORM, REVISE AND RESUBMIT"** if it does not conform to the Contract Documents and the variation is not permitted, or if the item is extensively marked-up.

   b. Do not permit submittals stamped **"DOES NOT CONFORM, REVISE AND RESUBMIT"** to be used at the project site, or elsewhere where Work is in progress.

I. Returned for Resubmittal

1. Items which do not meet requirements of this Section, or which are stamped **"DOES NOT CONFORM, REVISE AND RESUBMIT"**, will be returned for correction and resubmittal by the same process. Contracting Officer will indicate reasons for rejection and will retain one print or sample to check against resubmittal.

2. Any item not prepared as required by the Contract Documents or not prepared in a professional or workmanlike manner requiring excessive review time, including items that require more than 2 submittals, will be accessed a back charge by the Government for such extra time.

3. Make indicated changes only, unless further change is required for conformance to the Contract Documents.

4. Direct attention on the item to all revisions, other than those requested, and explain such in detail on transmittal form.

5. Contractor shall be completely responsible for changes not indicated or specifically noted as revised.

J. Acceptance and Use

1. Items stamped **"CONFORMS AS IS"** and "**CONFORMS AS NOTED"** will be returned to Contractor who shall reproduce copies from original stamped reproducible.

2. Distribute copies as required to transmit information to all parties involved.

3. Contracting Officer will retain prints of approved Shop Drawings and Product Data as well as one Sample, for comparison with Work installed.

4. Keep copies of each approved item on project site at all times for reference.

5. Retain original reproducible and corrected tracing of each item until Final Completion of the Work and turn them over to Contracting Officer.

6. Do not commence Work requiring Shop Drawings, Product Data, or Samples until submittal has been processed by Contracting Officer and has been stamped **"CONFORMS AS IS"** or **"CONFORMS AS NOTED".**

1.9 RECORD INFORMATION SUBMITTALS

A. General

1. Record Information Submittals include submittals upon which Contracting Officer is not expected to take responsible action and are so identified in the Contract Documents. Such submittals include but are not limited to: test reports; surveys; surveyor's certifications; special guarantees and warranties; maintenance and operating instructions; installer's certification; installer qualification data; material certification; and calculations.

2. Record Information Submittals shall be sent to Contracting Officer for informational purposes only. Comply with Technical Sections for required information to be submitted. Contents of such submittals and

compliance with all other requirements of the Contract Documents shall be sole responsibility of Contractor.

3. Do not proceed with Work requiring Record Information Submittals until submittal has been processed and receipt acknowledged through a Letter of Acknowledgement. Allow minimum of 14 days from date Contracting Officer receives submittal until date acknowledgement is sent back. No stamp will be placed on Record Information Submittals.

B. Installer Certification

1. Installer Certification is required for all installers of product systems listed as requiring such in the **"SUBMITTALS"** paragraphs of the Technical Specifications.

2. Installer Certification shall consist of written certification from manufacturer of product system listed certifying that Installer is approved by manufacturer for installing specified product system. Provide copy of certification to Contracting Officer prior to commencement of Work.

C. Material Certification

1. Material Certification is required for all materials listed as requiring such in the **"SUBMITTALS"** paragraphs of the Technical Specifications.

2. Material Certification shall consist of written certification from manufacturer of material listed certifying that all such material used in the Work meets requirements specified in the Contract Documents and is being utilized in conformance with manufacturers recommendations. Provide certification to Contracting Officer as Work progresses.

D. Guarantees and Warranties

1. Definitions

a. "Guaranty": A separate contract by a third party, covering responsibility if a principal fails to perform.

b. "Warranty": A principals own assurance that it will assume stipulated responsibilities.

2. General

a. Guarantees and warranties are in addition to all other guarantees and warranties required elsewhere in the Contract Documents. They shall not preclude the Contractor's responsibilities under governing laws or the warranty specified in the General Conditions.

b. Submit certificates of all specified guarantees and warranties properly dated and executed.

c. In the written guarantees and warranties, indicate products and performance covered, remedy in event of failure of product or process to perform as specified, and length of warranty and guaranty period.

d. Such guarantees and warranties shall run for entire period specified to the Government and the then current Owner, regardless of any transfer of ownership of the project, or portions thereof, by sale, assignment, act of law, or otherwise.

3. Manufacturer warranty

a. Where a manufacturer warranty is required in the Technical Specifications, manufacturer shall warrant, to the Government and Contractor, all of its Work in accordance with the requirements of the Technical Specifications and this Section.

b. Provide such in writing, signed by an officer of the manufacturer, for a period commencing at Date of Substantial Completion and as specified in the Technical Specifications.

c. Contractor shall be jointly and severally liable with manufacturer for all requirements of the manufacturer warranty.

4. Installer guaranty and warranty

a. Where an Installer guaranty and warranty is required in the Technical Specifications, the Installer shall guarantee and warrant, to the Government and Contractor, to repair or replace, without cost or undue hardship to the Government or Contractor, the Work specified, including materials and equipment, that is found to be defective, that is not in accordance with the Contract Documents, that fails to perform as specified in the Contract Documents, that does not meet generally recognized standards by quality or does not perform in accordance with generally recognized standards of performance for such Work, including materials and equipment, whichever is greater.

b. Such guaranty and warranty shall include removal and replacement, without cost or undue hardship to the Government or Contractor, of all other Work, including materials and equipment, which is damaged as a result of such defects, nonconformance with the Contract Documents, or failure to meet quality or performance standards of this Work, including materials and equipment, or as a result of removal or replacement of this Work, including materials and equipment.

c. Such guaranty and warranty shall also include payment for all other damages resulting from such defects, nonconformance with the Contract Documents, or failure to meet quality or performance standards of this Work, including materials and equipment.

d. Provide such in writing, signed by an officer of the Installer, for a period commencing at Date of Substantial Completion and as specified in the Technical Specifications.

e. Contractor shall be jointly and severally liable with the Installer for all requirements of the Installer guaranty and warranty.

E. Maintenance and Operating Instructions

1. Submit written instructions for operating each piece of equipment and for maintaining equipment and finished surfaces for Government's personnel, to extent of their involvement with such procedures or as required in the Technical Specifications.

2. List for each product, the name, address, and telephone number of Subcontractor, maintenance contractor and source of supply.

3. Include such information as: emergency instructions, spare parts list, copies of warranties, wiring diagrams, recommended turn around cycles, inspection procedures, shop drawings and product data, fixture lamping schedule, and manufacturers recommended cleaning materials and methods.

4. Organize into suitable sets of manageable size. Bind properly indexed data in individual heavy duty 2", 3-ring loose leaf vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Submit 4 copies.

5. Operations and maintenance manuals shall be submitted to the Government, through Contracting Officer, when equipment is delivered to project site. Failure to deliver manuals will be cause to withhold payment for equipment.

1.10 RECORD DOCUMENTS

A. General

1. Maintain at site, for the Government, one copy of all Drawings, Specifications, approved copies of Building Department Documents, Addenda, Change Orders, Modifications, Shop Drawings, Product Data and Samples in good order and marked currently to record all changes made during construction. These Record Documents shall be available to the Government.

2. Maintain all Record Documents at site during each step of the Work. Do not use Record Documents for construction purposes; protect from deterioration and loss in secure, fire resistive location.

3. Deliver to Contracting Officer for the Governments files, at completion of the Work, an accurate set of marked-up Record Documents, including a copy of the project Manual and screened mylar wash-offs of Drawings, showing project, insofar as actual construction or installation differs from the Contract Documents. Final Payment will not be made until receipt of complete Record Documents.

4. Contractor shall make sure that no Documents are used with the seal of the A/E, and every Document shall bear following note:

   Record Document
   (DATE)

   This Document was prepared by (NAME OF CONTRACTOR) to incorporate construction changes and has not been reviewed or approved by _____. Care shall be taken in any further use of this Document for this project. This Document may be used for informational purposes for extensions of this project or for any other project.

5. The Record Documents produced by the Contractor will be used by the Government as provided and will not be reviewed or approved by the A/E. Accordingly, the Contractor assumes full responsibility for any further use made of such Documents.

B. Record Drawings

1. Include drawings for all site, general, plumbing, heating, ventilation and air conditioning, and electrical trades. Record all changes and information such as:

   a. Elevations at bottom of foundations in relation to finished first floor.

   b. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

   c. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

   d. Changes of dimensions, plan arrangements, materials, and details.

   e. Changes made by Field Order or by Change Order.

   f. Details not on original Contract Drawings.

C. Record Specifications

1. Note in each Specification Section the actual manufacturer's trade name, catalog number, and Supplier of each product incorporated into the Work. Note changes made by Change Order.

D. Record Samples

1. Immediately prior to Substantial Completion, meet at site with Contracting Officer and Government to determine which approved Samples are to be transmitted to Government for record purposes. Deliver such Record Samples to Governments Sample storage area.

2. DD Form 1354, "Transfer and Acceptance of Military Real Property". The Contractor shall provide information, quantities, and cost data as broken out in categories requested by the 153 CES Real Property personnel. The information required relates to the cost of construction for the building, mechanical and electrical systems, site work, and appurtenances.

2.0 PRODUCTS Not Used.

3.0 EXECUTION Not Used.

END OF SECTION 01300

SECTION 01400

QUALITY CONTROL

1.0 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance - control of installation.

B. Tolerances.

C. References and standards.

D. Inspecting and testing laboratory services.

E. Environmental monitoring.

F. Health and Safety Plan.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals.

B. Section 01600 - Material and equipment.

C. Reference Section 18113 for LEED requirements and Section 19113 for Commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.3 QUALITY CONTROL SERVICES

A. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Contracting Officer.

B. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

C. Requirements of customized fabrication and installation procedures, not related to production of standard products.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of

standard products as well as customized fabrication and installation procedures.

2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

3. Requirements for the Contractor to provide quality control services required by the Contracting Officer or authorities having jurisdiction are not limited by provisions of this section.

1.4 CONTRACTOR RESPONSIBILITIES

A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Government's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.

1. The Contractor shall employ and pay an independent agency, approved by the Contracting Officer, to perform specified quality control services.

B. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility

1. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

C. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

1. Provide access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.

2. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

3. Providing facilities for storage and curing test samples, and delivery of samples to testing laboratories.

4. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

5. Security and protection of samples and test equipment at the Project site.

D. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Contracting Officer and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Contracting Officer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

3. The agency shall not perform any duties of the Contractor.

E. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

F. The Contractor is responsible for scheduling times for inspection, tests, taking samples and similar activities.

1.5 QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Contracting Officer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.6 TOLERANCES

A. Monitor installation tolerance control of Products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Contracting Officer before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.7 REFERENCES AND STANDARDS

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids, except where a specific date is established by code.

C. Obtain copies of standards where required by Product specification sections.

D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.8 TESTING SERVICE

A. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Contract Documents.

B. The Contractor will employ a geotechnical and materials testing firm for field and laboratory testing and quality control of soil, concrete and other related construction materials. This firm shall be acceptable to the Contracting Officer.

C. Reports will be submitted by Contractor in triplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

1. Date of issue.

2. Project title and number.

3. Name, address and telephone of testing agency.

4. Dates and locations of samples and tests or inspections.

5. Name of individuals making the inspection or test.

6. Designation of the Work and test method.

7. Identification of product and Specification Section.

8. Complete inspection or test data.

9. Test results and an interpretation of test results.

10. Ambient conditions at the time of sample-taking and testing.

11. Comments or professional opinion as to whether inspected or tested.

12. Work complies with Contract Document requirements.

13. Name and signature of laboratory inspector.

14. Recommendations on retesting.

D. Testing does not relieve Contractor of responsibility to perform Work to contract requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by Contractor on instructions by the Contracting Officer. Payment for re-testing will be charged to the Contractor.

1.9 INSPECTION SERVICES

A. The Contractor will perform inspections and other services specified in individual specification sections and as required by the Contracting Officer.

B. Inspecting may occur on or off the project site. Perform off-site inspecting as required by the Contracting Officer.

C. Reports will be submitted by the Contractor to the Contracting Officer, in triplicate, indicating inspection observations and indicating compliance or non-compliance with Contract Documents.

D. Inspecting does not relieve Contractor to perform Work to contract requirements.

E. The Government will periodically inspect the project, at its discretion.

1.10 ENVIRONMENTAL MONITORING

A. Soil materials excavated will be monitored by the Contractor to detect possible hazardous concentrations of Volatile Organic Compounds (VOC) in the soil and/or bedrock and groundwater, if encountered.

B. Monitoring will be done by use of a photoionization detector (PID) with a lamp energy of 10.6 eV (electron volt) using an electrode-less ultraviolet discharge lamp with Teflon stainless steel chamber. The Contractor will follow the Manufacturer's recommendations in regard to calibration, proper operating temperature of the instrument, and avoidance of condensation and dust on the lamp. The lamp will be cleaned in accordance with Manufacturer's recommendations. A spare PID will be maintained on site. Acceptable monitors include the MiniRae PID, the Thermo Environmental Instruments Model 580, the Photovac TIP, and the HNU PI 101.

C. Monitoring and reporting will be done:

1. Once for each 100 cubic yards of soil excavated during sewer line construction wherein excavation or trenching are undertaken.

2. For excavation done in connection with installation of service lines, once for each 150 feet of trench excavated.

D. Concentrations of VOCs will be reported in parts per million, in accordance with the requirements of Section 01300. Should VOC concentrations in excess of 50 ppm be detected, contact Bioenvironmental Services (Phone: 307-772-6163) immediately.

E. The minimum qualification requirement for the operator of the monitor is successful completion of the OSHA 40-hour Health and Safety for Hazardous Materials Operations Training Course.

1.11 HEALTH AND SAFETY PLAN

A. Work on this project will be done in accordance with the requirements of a Health and Safety Plan to meet OSHA requirements. This plan will be prepared by the Contractor in advance of the start of construction. A copy of this Health and Safety Plan will be submitted to the Contracting Officer for approval prior to the start of construction.

2.0 PRODUCTS Not Used.

3.0 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

3.4 NOTIFICATION OF NON-COMPLIANCE

A. The Contracting Officer will notify the Contractor of any detected non-compliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor at the site of the Work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply

promptly, the Contracting Officer may issue an order stopping all or part of the Work until satisfactory corrective action has been taken. No part of the time lost due to such stop work orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

END OF SECTION 01400

SECTION 01401

HAZARDOUS MATERIAL USAGE

1.0 GENERAL

1.1 GENERAL

A. The Contractor shall establish a hazardous material (HM) storage and distribution system when HM is to be used. All HM required to support the Contract shall be reported to the Hazardous Material Pharmacy (HMP) using the Contractor HM Identification Form. The Form may be altered to enhance tracking. The Contractor HM Identification Form will be provided to the Contractor at or prior to the Pre-Construction meeting. Additional HM needed by the Contractor shall be identified to the Contracting Officer's Representative (COR) for approval by the HMP (see Contractor Hazardous Material Identification Form at the end of this section).

B. The Contractor planning to use HM for the work shall register with the installation HMP prior to start of work in order to support the installation's compliance with Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements.

C. The Contractor shall maintain a Contractor HM Identification Form for all HM on the job site for inspection/verification.

D. The COR will verify that the HM identified to the HMP is the only HM in use on the job site.

E. The Contractor shall provide the following to the HMP:

1. Provide a list of each material and quantity of material for all proposed HM. Hazardous Material (HM) shall be construed to mean any item that is:

   a. A health hazard or physical hazard a defined in 29 CFR, 1910.1200(c).

   b. Regulated in its disposal by EPA under 40 CFR.

   c. Hazardous as defined by DOT regulations under 49 CFR.

   d. Hazardous as defined by the Dangerous Goods Regulations of the International Air Transport Association.

2. Provide a material safety data sheet (MSDS) for each item on the HM list.

3. Typical examples of hazardous materials used on the job site include, but are not limited to:

   a. Petroleum based liquids/gases (gasoline, kerosene, diesel, propane, butane, acetylene, etc.).

   b. Explosives.

   c. Adhesives and glues.

   d. Shot charges for anchor systems.

   e. Volatile solvents (such as PVC cleaner and glues, paint thinners).

   f. Non-water-based paints.

   g. Liquid sealants.

   h. Epoxies and coating systems.

   i. Acidic or alkali cleaners.

F. The Contractor shall establish a construction-specific HM storage and issue location that fully complies with federal, state and local environmental regulations. Materials issued shall be tracked for quantities used. Unused materials shall be inventoried and removed from the Air Force Base installation prior to closeout of the Contract or expiration date of the HM. Reports of materials delivered, used and removed from the installation shall be submitted to the Contracting Officer monthly and prior to Contract closeout.

G. The Contractor shall comply with all federal, state and local environmental standards.

H. The Contractor shall accompany the Contracting Officer's Representative (COR) and the installation Environmental Manager (EM) on project closeout inspection to ensure all used and unused HM has been removed from the installation. This requirement shall not be a punch list item and must be accomplished prior to the government accepting beneficial occupancy of the facility or construction item. (See Contractor Hazardous Material Identification Form Closeout Procedures at the end of this section.)

1.2 SUPPLEMENTS

A. The supplements listed below, following “END OF SECTION,” are part of this Specification.

1. Contractor Hazardous Material Identification Form.

2. Contractor Hazardous Material Identification Form Closeout Procedures.

2.0 PRODUCTS NOT USED

3.0 EXECUTION NOT USED

END OF SECTION 01401

CONTRACTOR HAZARDOUS MATERIAL IDENTIFICATION FORM

Part I Date: _____

This part is to be completed by Contractor prior to the construction start date, and shall be maintained on the job site.

Contractor Company: (Name) _____

Proposed work Term: (Date) _____ to (Date) _____

Contractor Point of contact: (Full Name) _____

Phone Number: (24 hr emerg no.) _____

Cell Phone/Pager: (Cell) _____ (pager) _____

Submittal Information		**Storage and Usage Information**		
HM to be Used Mfg/Product	**MSDS Attached (Yes/No)**	**Amount on Site*, Transient or Stored**	**Amount Used Up in Process**	**Used or Unused Amount Removed from Cheyenne Fire Station**

Note: This form is good for a 1 month period and is to be submitted to the hazardous material pharmacy (HMP). All HM (hazardous material) used thereafter will be identified to the Contracting Officer's Representative for approval by the HMP. See Part II for Contractor closeout procedures. The HMP phone number is _____.*Transient amount reflects amount brought daily but not stored overnight. Use separate lines for transient and storage amounts.

HMP Team Approval Signatures:

COR (Contracting Officer's Representative) _____

EM (Environmental Manager) _____

SG (Bio-environmental Engineer) _____

SO (Safety Officer) _____

CONTRACTOR HAZARDOUS MATERIAL IDENTIFICATION FORM
CLOSEOUT PROCEDURES

Part II

Attach this to Part I

The Contractor shall accompany the Contracting Officer's Representative and the Environmental Manager on the closeout inspection to ensure all used and unused HM has been removed from the installation.

Closeout Approval Signatures: Signature Date

Contractor _____

Contracting Officer's Representative _____

EM (Environmental Manager) _____

SECTION 01420

ENVIRONMENTAL PROTECTION

1.0 GENERAL

1.1 SECTION INCLUDES

A. The work covered by this Section consists of furnishing all labor, materials and equipment and performing all work required for the prevention of environmental degrading during, and as a result of construction operations under this contract. These requirements are in addition to any environmental protection requirements elsewhere in these specifications.

B. For the purpose of this specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents, not naturally occurring at the site, which adversely affect human health, human welfare; unfavorably alter ecological balances important to human life; affect other species of importance to humans; or degrade the utility of the environment for aesthetic and recreational purposes. The control of environmental pollution by the Contractor requires consideration of air, water, and land, and involves noise control, solid waste management and management of radiant energy and radioactive materials, as well as other pollutants. This Section also requires the protection of cultural and historic resources.

C. Contractor shall coordinate the work of this Section with the work called for under the various sections of Division 2, Site Work.

1.2 RELATED SECTIONS

A. Section 01561, Erosion And Sediment Control.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.3 CONTRACTOR'S GENERAL ENVIRONMENTAL COMPLIANCE OBLIGATIONS

A. Contractor (and any Subcontractor, agent or representative) shall comply with all applicable Federal, State, and local laws and regulations providing for environmental protection and pollution control and abatement. These include, but are not limited to, the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Toxic Substances Control Act, Federal Insecticide Fungicide and Rodenticide Act, Coastal Zone Management Act, Endangered Species Act, National Historic Preservation Act, Safe Drinking

Water Act, Emergency Planning and Community Right-to-Know Act, Oil Pollution Act, Archeological Resources Protection Act, Pollution Prevention Act and National Pollution Discharge Elimination System (NPDES). Contractor has the duty to determine for itself where such laws and regulations apply. Although Contractor may request assistance from the Contracting Officer in delineating applicable environmental laws and regulations, Contractor has an independent responsibility to make its own determination and to do so in a timely fashion.

1.4 FINES OR PENALTIES FOR ENVIRONMENTAL NON-COMPLIANCE

A. The Contractor shall be responsible for paying any fines or penalties assessed against WYANG or the installation for environmental violations resulting from acts or omissions of the Contractor or its employees, Subcontractors, or agents. This obligation is in addition to any fines or penalties that may be assessed against the Contractor for the same conduct. Contractor may either reimburse these fines or penalties through the Contracting Officer, or with the consent of the Installation environmental management office, conveyed through the Contracting Officer, the Contractor may pay such fines or penalties directly to the regulatory agency or agencies concerned.

1.5 CONTRACTOR'S LIABILITY FOR ENVIRONMENTAL DAMAGES

A. Contractor agrees to hold harmless and indemnify WYANG and the installation for any and all damages of any kind resulting from environmentally harmful activities by the Contractor, Contractor's employees or agents or Subcontractors. "Damages" includes, but is not limited to, personal injury, property damage (including diminution of value), or death, environmental restoration and response costs, natural resource damages, expert witness and attorney's fees, and reimbursement of any and all expenses incurred to obtain permits as a result of Contractor's failure to identify or obtain permits for itself or WYANG or the installation.

1.6 CONTACTS WITH ENVIRONMENTAL REGULATORY OFFICIALS

A. Contractor shall, through the Contracting Officer, immediately advise the installation environmental management function of the content of all contacts with federal, state, or local environmental regulators, before, during, and after the performance of this contract concerning the performance of this contract.

1.7 FEDERAL COMPLIANCE WITH RIGHT-TO-KNOW AND POLLUTION PREVENTION LAWS

A. Contractor will, upon request, provide the Installation with information it may need to comply with Right-to-Know and Pollution Prevention laws and relevant Executive Orders. Such information may include Material Safety Data Sheets or amounts of chemicals used, stored or disposed of.

2.0 PERMITS

2.1 PERMITS FOR EQUIPMENT USED BY CONTRACTOR IN PERFORMING WYANG CONTRACTS

A. For equipment used in the performance of this contract, Contractor shall obtain in Contractor's name and at no additional expense to WYANG, all permits, coordination, certifications or other regulatory authorization necessary to perform and complete the work required by this contract under applicable environmental laws and regulations. "Applicable environmental laws and regulations" includes, but is not limited to: the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Toxic Substances Control Act, Federal Insecticide Fungicide and Rodenticide Act, Coastal Zone Management Act, Endangered Species Act, National Historic Preservation Act, Safe Drinking Water Act, Emergency Planning and Community Right-to-Know Act, Oil Pollution Act, and Pollution Prevention Act and State, County and Local laws and regulations on the same subjects.

2.2 PERMITS NEEDED FOR CONSTRUCTION, EXCAVATION, MODIFICATION, RENOVATION, DEMOLITION, INSTALLATION, OR OTHER ALTERATION OF BUILDINGS, STRUCTURES, EQUIPMENT, INSTALLATIONS, REAL PROPERTY OR SYSTEMS ON A GOVERNMENT INSTALLATION

A. Contractor shall, after consultation with the appropriate Installation environmental management function, identify all Federal, State, County, or local permit requirements under all applicable environmental laws and regulations as defined in (A.) above. Contractor shall then prepare and submit in draft all applicable permit applications and all supporting data to the Contracting Officer, who will submit same to the installation environmental management office. Permits that must be submitted by the installation will be submitted by the installation, and applications for permits that must be submitted by the Contractor will be returned to the Contractor after review.

3.0 MATERIALS

3.1 RECYCLED MATERIALS

A. Materials used in this Contract shall be, to the greatest extent practicable and consistent with financial prudence, made of recycled materials or of materials that are recyclable. where construction debris such as concrete or asphalt or wood can be recycled, this alternative will be discussed in the waste management plan and coordinated with the installation.

3.2 ASBESTOS

A. Asbestos material will not be included in this Project. (New construction.)

3.3 POLYCHLORINATED BIPHENYLS (PCBS)

A. PCBs will not be used or included in this Project. (New construction.)

3.4 LEAD BASED PAINT

A. Lead based paint will not be included in this Project. (New construction.)

3.5 OZONE-DEPLETING SUBSTANCES

A. "Class I Substance," as used in this clause, means any substance designated as Class I by the Environmental Protection Agency (EPA) (40 CFR Part 82), including, but not limited to, chlorofluorocarbons, halons, carbon tetrachloride, and methyl chloroform.

B. "Class II Substance," as used in this clause, means any substance designated as Class II by EPA (40 CFR Part 82), including, but not limited to, hydro chlorofluorocarbons.

C. As required by 42 USC 767j(b),c and (d) and 40 CFR Part 82, Subpart E, the Contractor shall label products which contain Class I or Class II ozone-depleting substances or are manufactured with a process that uses Class I or Class II ozone-depleting substances, or containers of Class I or Class II ozone-depleting substances, as follows:

1. "WARNING: Contains (or manufactured with, if applicable) _____*_____, (a) substance(s) which harm(s) public health and the environment by destroying ozone in the upper atmosphere." *The Contractor shall insert the name of the substance(s).

D. The Contractor shall comply with the applicable requirements of Section 608 and 609 of the Clean Air Act (42 USC 7571g, National Recycling and Emission Reduction Program and 7671h, Servicing of Motor Vehicle Air Conditioners) as each or both apply to the contract.

3.6 PESTICIDES

A. Except as may be specified elsewhere in this contract, Contractor will not use or apply pesticides (such as herbicides or weed-killers, insecticides, or rodenticides) without the specific written approval of the installation environmental office.

4.0 EXECUTION (WORK PRACTICES)

4.1 GENERAL: SITE DISTURBANCE DURING CONSTRUCTION ACTIVITIES

A. Contractor shall use industry-recognized best management practices to avoid creation of fugitive dust emissions and to avoid and control storm water runoff

from the construction site and any temporary roads that may be used for access to it.

B. Water sprinkling may be used to control dust.

C. Contractor shall perform all work under this contract in such a manner that no pollutants of any kind are released into ditches, storm drains, streams, lakes, or other surface waters of the site.

4.2 PROTECTION OF WATER RESOURCES

A. General: The General Contractor shall not pollute storm drainage, streams, lakes, or reservoirs with fuels, oils, bitumens, calcium chloride, acids, construction wastes or other harmful materials or pollutants. It is the responsibility of the General Contractor to determine and comply with all applicable federal, state, municipal, and Installation regulations.

B. Spillage: The General Contractor shall take special measures to prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides, cement, and surface drainage from entering public waters. In the event of a spill, the Installation Fire Department and Environmental Office shall be notified immediately.

C. Washing and Curing Water: Water used in aggregate processing, concrete curing, foundation, and concrete lift clean-up and other waste water shall not be allowed to enter the storm drainage system.

4.3 PROTECTION OF LAND RESOURCES

A. General: It is intended that the land resources within the Project boundaries and outside the limits of permanent work performed under this Contract be preserved in their present condition or be restored to a condition after completion of construction that will appear to the natural and not detract from the appearance of the Project. The General Contractor shall limit construction activities to areas defined by the Drawings or Specifications.

B. Prevention of Landscape Defacement: Except in areas marked on the plans to be cleared, the General Contractor shall not deface, remove, cut, injure or destroy trees or shrubs without specific written authority. Trees designated to be saved shall be protected from either excavation or filling within the root zone. No ropes, cables, or guys shall be fastened or attached to any existing trees for anchorage unless specifically authorized by the Contracting Officer. The General Contractor shall in any event be responsible for any damage resulting from such use.

C. Restoration of Landscape Damage: Any trees or other landscape features scarred or damaged by the General Contractor's equipment or operations shall be restored as nearly as possible to the original condition at the General

Contractor's expense. The Contracting Officer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of. All scars made on trees not designated on the plans to be removed by equipment construction operations, or by the removal of limbs larger than 1-inch in diameter shall be coated immediately with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced landscape personnel. Tree trimming with axes shall not be permitted. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the General Contractor and are beyond saving in the opinion of the Contracting Officer, shall be immediately removed and replaced with a nursery-grown tree of the same species.

5.0 WASTE DISPOSAL

5.1 POLLUTION PREVENTION

A. The Contractor should use prior planning to find those materials that will minimize the creation of waste in general and hazardous waste in particular.

5.2 WASTE DISPOSAL FOR CONTRACTS TO BE PERFORMED ON WYANG PROPERTY OR OTHER GOVERNMENT FACILITY

A. Disposal of Non-RCRA Wastes: All non-hazardous wastes generated on the facility as a result of this contract must be disposed of properly. Prior to creation of such wastes, the Contractor shall submit to the Installation environmental management function, through the Contracting Officer, a plan for disposal of wastes. Such plan shall include the types of waste to be created, how they shall be stored, managed and disposed. Contractor shall follow this plan once it has been approved by the Contracting Officer. Such wastes will not be created until approved by the Contracting Officer.

6.0 UNEXPECTED SITE CONDITIONS

6.1 CONTAMINATED SOIL OR GROUNDWATER

A. Unless otherwise specified elsewhere in this contract, site has been inspected and is, consistent with best professional judgment, free of environmental contamination or pollution. However, unexpected conditions can always arise. Contractor or Subcontractor personnel may encounter soil or groundwater that is suspected to be contaminated, either because of odors, colors, free liquids, or other suspicious conditions. Should this occur, Contractor will immediately notify the base environmental office, and take necessary initial measures to protect workers, the site, and other personnel.

6.2 UNEXPLODED MUNITIONS

A. No munitions or munitions-related materials are known or expected to be

present on site. However, should suspected munitions-type material be encountered, Contractor should immediately notify the installation environmental office and receive advice before disturbing the questionable material.

6.3 UNEXPECTED ARTIFACTS OR RELICS

A. Should Contractor's employees in the course of site preparation or other work on this contract find unexpected historic or archeological remains, such as bones, arrow points, pottery remnants, foundations, or other evidence of previous uses of the site, Contractor will cease further site-disturbing activity and immediately notify the Installation environmental office and the Contracting Officer.

END OF SECTION 01420

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.0 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, ventilation, water, and sanitary facilities, communication (telephone, fax, internet).

B. Temporary Controls: Barriers, enclosures and security fencing, protection of the Work, and water control.

C. Construction Facilities: Access roads, parking, progress cleaning, temporary buildings, and laydown area.

D. Confined Space Entry.

E. Temporary Fueling Facility: Mobile fueling source versus temporary fueling tank.

F. Maintain continuous access for fuel deliveries and other fuel operations.

1.2 RELATED SECTIONS

A. Section 01700 - Contract Closeout: Final cleaning.

B. Reference Section 18113 for LEED requirements and Section 19113 for Commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.3 TEMPORARY ELECTRICITY

A. Contractor to provide for power service required from source identified by Contracting Officer.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations, as necessary.

B. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes, as necessary.

C. Maintain lighting and provide routine repairs.

1.5 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.6 TEMPORARY WATER SERVICE

A. Provide and maintain suitable quality water service required for construction operations at time of project mobilization.

1.7 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide at time of project mobilization.

1.8 TEMPORARY FUELING FACILITY

A. It is preferred that a Mobile Fueling Service be used for fueling contractor vehicles and equipment.

B. Any spills associated with fueling, lubricating, or use of vehicles and equipment shall be cleaned up immediately. Notification of spills must be made to the Base Fire Department and Environmental Flight. Disposal of wastes generated in cleanup will be done using proper manifesting IAW Section 01030 Part 1, paragraph D and E of these specifications.

1.9 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades for rights-of-way and for access to existing buildings.

C. Provide protection for plants, shrubs, and trees which are to remain. Replace damaged plant materials.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.10 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Do not allow silt from surface drainage, saw cuttings, or trench dewatering to enter any storm sewer system in accordance with the requirements of appropriate discharge permits and best management practices.

1.11 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.

C. Prohibit traffic from landscaped areas.

1.12 SECURITY

A. Provide security to protect Work and existing facilities from unauthorized entry, vandalism or theft.

B. Coordinate with Government's security program.

C. Temporary fire protection.

1.13 ACCESS ROADS

A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.

B. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Existing on-site roads may be used for construction traffic.

1.14 PARKING

A. Arrange with Contracting Officer for temporary surface parking areas to accommodate construction personnel.

B. When site space is not adequate, provide additional off-site parking.

C. Do not allow vehicle parking on existing pavement.

1.15 CONFINED SPACE ENTRY

A. Contractor will provide fully qualified and trained personnel for any required confined space entry. It is anticipated that this contract will require entry into "permit-required confined space." Contractor must establish, operate, and

maintain its own confined space entry program. This will include permit processing, providing the Contractor's own rescue team, and ensuring that the program complies with 29 CFR 1910.146 and AFOSH STD 91-25 (Nov. 1994).

B. Manholes, vaults, tunnels, and certain pits and other spaces with limited openings for entry/exit or with limited space and not meant for human habitation area considered confined spaces. All are to be considered "permit-required confined spaces" until they have been determined to be "non-permit-required confined spaces."

C. The Contractor's permitting process will include any WYANG personnel that may be required to enter the subject space. The Contractor's confined space program shall be maintained without reliance on WYANG personnel or services except that coordination shall be made with Bio-environmental Services (BES) (Phone: 772-6163) to obtain known hazard information and Base-instituted precautions for those spaces. The Contractor permitting process shall provide for entry of necessary WYANG personnel.

D. Prior to entry, the Contractor shall notify and coordinate with the Base Fire Department (Phone: 772-6338) and BES. The Contractor will assume all emergency rescue responsibilities. The Contractor shall notify BES of any problem encountered.

E. The Contractor will debrief with BES at the end of the entry operations to assist in the development of lessons-learned from any problems or hazards encountered or created during the entry operations.

1.16 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from closed or remote spaces, prior to enclosing the space.

C. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off site.

1.17 FIELD OFFICES, SHEDS AND LAYDOWN AREA

A. Field offices, storage sheds, temporary enclosures.

B. Locate offices and sheds a minimum distance of 50 feet from existing structures.

C. Contractor temporary laydown and storage area: Within the project area; to be designated by the Contracting Officer.

D. No signs are allowed without Contracting Officer's permission except those required by law.

1.18 REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to final inspection.

B. Grade site as indicated on the drawings.

C. Clean and repair damage caused by installation or use of temporary work. This includes cleanup of any fuels / oils / fluids caused by the Contractor's vehicles and equipment.

D. Restore existing facilities used during construction to original condition.

1.19 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:

1. Building Code requirements.

2. Health and safety regulations.

3. Utility company regulations.

4. Police, Fire Department and Rescue Squad rules.

5. Environmental protection regulations.

B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities".

1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.

2. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.20 PROJECT CONDITIONS

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

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

2.0 PRODUCTS

2.1 MATERIALS

A. General: Provide new materials; if acceptable to the Contracting Officer undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Lumber and Plywood:

1. For job-built temporary offices, shops and sheds within the construction area, provide UL labeled, fire treated lumber and plywood for framing, sheathing and siding.

2. For fence and vision barriers, provide exterior type, minimum 3/8" thick plywood.

3. For safety barriers, and similar uses, provide minimum 5/8" thick exterior plywood.

C. Paint: Comply with requirements of Section 09900 "Painting."

1. For job-built temporary offices, shops, sheds, fences and other exposed lumber and plywood, provide exterior grade acrylic-latex emulsion over exterior primer.

2. For sign panels and applying graphics, provide exterior grade alkyd gloss enamel over exterior primer.

3. For interior walls of temporary offices, provide two coats interior latex flat wall paint.

D. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide

translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.

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

F. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1-1/2" I.D. for line posts and 2-1/2" I. D. for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment; if acceptable to the Contracting Officer undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.

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

D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.

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

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.

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

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

I. First Aid Supplies: Comply with governing regulations and size for crew and Project.

J. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces, sized for crew and Project. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommend classes for the exposures, sized for crew and Project.

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

3.0 EXECUTION

3.1 INSTALLATION

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

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

3.2 TEMPORARY UTILITY INSTALLATION

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

1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

B. Use Charges: The Contracting Officer will pay the use charges for temporary water service and temporary electric power. The Contractor will be responsible for all hook-ups and installation. Cost or use charges for all other temporary facilities are not charged to the Contracting Officer, and will not be acceptable as a basis of claims for a change order.

C. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

1. Sterilization: Sterilize temporary water piping prior to use.

D. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.

1. Except where overhead service must be used, install electric power service underground.

2. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

E. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.

F. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Install telephone on a separate line for each temporary office and first aid station.

1. At each telephone, post a list of important telephone numbers.

G. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.

1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.

2. Connect temporary sewers to the base system as directed by the Contracting Officer.

3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.

H. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.

1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Government.

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

C. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

D. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.

E. Field Offices: Provide insulated, weather tight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:

1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table and plan rack and a 6-shelf bookcase.

2. Equip with a water cooler and private toilet complete with water closet, lavatory and mirror-medicine cabinet unit.

F. Project Manager Field Offices (On-site Government Representative)

1. The Contractor shall provide for the Project Manager's sole use, the equivalent of one new and un-used office trailer, at least fifty-five feet in length by twelve feet wide, providing two private offices, of not less than twelve feet in length.

2. Office: Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

3. Locate offices and sheds a minimum distance of 30 feet from existing and new structures.

4. The trailer shall be equipped with a handicap bathroom, sturdy office furniture, plan table and plan rack.

5. The remainder of the floor space shall be an open area with 20 new folding chairs and sturdy folding tables to accommodate 20 persons.

6. The trailer shall be heated and air conditioned.

7. The exterior windows and doors shall be properly secured with anti-theft screens and dead-bolt locks.

8. The trailer shall be delivered, set up, blocked, leveled and tied down by the Contractor.

9. The Contractor shall install and maintain safety stairs, deck and handrails, and a four foot gravel walk for the duration of the project.

10. The Contractor shall install, pay and properly maintain all utilities, including electrical, water, sewer, and two hard telephone lines for the project's duration.

11. The Project Manager shall pay for the monthly telephone and electric service to the trailer.

12. The Contractor shall provide bi-weekly janitorial services.

13. The trailer shall be provided for the duration of the Contract, commencing within 15 days of the Notice to Proceed.

14. The trailers, field offices, and sheds can not be placed on site until the Program Manager gives approval of the location plan provided by the Contractor.

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

H. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used materials.

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

1. Provide safety showers, eye-wash fountains and similar facilities for convenience, safety and sanitation of personnel.

J. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.

1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg. F (7 to 13 deg C).

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

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.

3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.

4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire-retardant treated material for framing and main sheathing.

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

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

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

1. Locate fire extinguishers where convenient and effective for their intended purpose.

2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.

4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

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

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

E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

F. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, hearing, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.

2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Contracting Officer requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of the Contractor.

2. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:

a. Replace air filters and clean inside of ductwork and housings.

b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.

c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION 01500

SECTION 01520

WASTE MANAGEMENT

1.0 GENERAL

1.1 WORK INCLUDED

A. This Section covers the Work necessary to collect and separate construction debris for re-use and cycling.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.2 DEFINITIONS

A. Construction and Demolition Waste – Solid wastes such as building materials, packaging and rubble resulting from construction, remodeling, demolition and repair of buildings/facilities, paving and infrastructure.

B. Recyclable Materials – Products and materials that can be recovered and remanufactured into a new product. Recyclable materials include, but are not limited to, the following;

1. Metals (ferrous and non-ferrous), including banding metal studs, ductwork, and piping.
2. Asphaltic concrete paving
3. Portland cement concrete
4. Gypsum products
5. Paper and cardboard
6. Wood products, including structural, finish, crates and pallets
7. Brick and masonry
8. Carpet and padding
9. Plastics
10. Copper wiring

C. Recycling Facility: A business that specializes in collecting, handling, processing, distributing, or remanufacturing waste materials generated by

demolition and new construction projects, into products or materials that can be used for this project or by others.

D. Salvage and Reuse: Existing usable product or material that can be saved and reused in some manner on the project site. The Contracting Officer must approve materials for reuse. Materials that can be salvaged and reused must comply with the applicable technical specifications and include, but are not limited to, the following:

1. Dimensional lumber and other wood products
2. Structural steel
3. Soil
4. Masonry products
5. Plants

E. Salvage for Resale: Existing usable product or material that can be saved and removed intact (as is) from the project site to another site for resale to others without remanufacturing.

F. Deconstruction: Demolition by disassembly usually in reverse order of construction, i.e. those components installed last were removed first. This method allows for more material to be salvaged.

G. Lead Paint: Paint or other surface coatings that contain lead equal to or in excess of 1.0 milligram per square centimeter or 0.5 percent by weight (5,000 ppm).

1.3 SUBMITTALS

A. Submit a Waste Management Plan before starting construction.

1.4 CONSTRUCTION WASTE MANAGEMENT

A. General Intent

1. The Contractor shall use all means available to divert to the greatest extent practical and economically feasible, construction and demolition waste from landfills and incinerators.

B. Construction Waste Management Operations

1. Take a pro-active, responsible role in management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Establish a construction waste management program that includes the following categories:

a. Minimizing Packaging Waste

b. Salvage and reuse

c. Salvage for resale and donation

d. Recycling

e. Deconstruction

f. Disposal

2. A diligent effort shall be made to salvage and reuse products and materials. Waste materials that cannot be salvaged and reused, and have value as being recyclable, shall be recycled. Only materials unable to be economically savaged or recycled shall be transported to a landfill or incinerator. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling construction waste for this project. Revenues or other savings obtained for recycling or returns shall accrue to the Contractor, except revenues generated from Base recycling activities.

C. Construction Waste Management Plan

1. Perform a waste analysis to determine the types and quantity of construction waste, anticipated and identify salvage for resale, salvage and reuse, recycling and disposal options available. Within 30 days after contract award and prior to performing any demolition work, submit a Waste Management Plan for review and approval. The Waste Management Plan shall include the following:

a. Projected quantity and cost of disposing of all waste materials as if there would be no salvage or recycling on this project

b. A list of waste materials that will be salvaged for resale, salvaged and reused, and recycled.

c. Anticipated net cost savings determined by subtracting the cost of handling and transporting from the following:

1) Savings due to reuse of demolished materials

2) Revenue from the sale of salvaged and recycled materials

3) Landfill or incinerator tipping fees saved due to diversion of materials to recycling.

d. Name, address, and phone number for each landfill or incinerator facility to be utilized.

e. Tipping fee for each landfill or incinerator.

f. Identification of each recycling facility to be utilized and means of transportation.

g. Description of the method to be employed in recycling waste materials and description of the method that will be sued to protect recycled materials from contamination.

2.0 PRODUCTS Not Used

3.0 EXECUTION

3.1 PROGRAM IMPLEMENTATION AND MONITORING

A. Implement and maintain, for the duration of the project, the construction waste management program. Establish a method of monitoring and documenting the program, and submit a periodic report with each application for payment that includes the following:

1. Amount (by weight) and type of waste materials disposed of in a landfill or incinerator, the tip fee per ton, and the total cost of disposal including transportation costs, container rental cost, etc.

2. Amount (by weight) and type of materials salvaged for sale, salvaged for reuse, and recycled. Provide destination, means of transportation, cost of transportation and handling, tipping fee savings and revenue generated for each material.

3. Cost savings due to salvaging, reusing, and recycling materials.

B. Hazardous Materials/Hazardous Wastes

1. This project contains Asbestos Materials and Lead Paint. Please refer to the appropriate specification sections and drawings for locations and abatement. If any non-acceptable materials such as hazardous materials or hazardous wastes are encountered beyond the identified areas on the drawings, notify the Contracting Officer.

3.2 SALVAGE AND REUSE

A. Encourage the practice of efficient waste reduction and waste management when, sizing, cutting, and installing products and materials.

3.3 SEPARATION OF RECYCLABLE WASTE MATERIALS

A. Provide the necessary containers and bins, to facilitate the waste management program, that are clearly and appropriately marked. Prevent contamination of recyclable materials from incompatible products and materials. Separate construction waste at the project site by one of the following methods:

1. Source Separated Method: Waste products and materials, that are recyclable, are separated from trash and sorted into appropriately marked separate containers and then transported to the receptive recycling facility for further processing. Trash is transported to a landfill or incinerator.

2. Co-Mingled Method: All construction waste is placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed and the remaining trash is transported to a landfill or incinerator.

3. Other methods proposed by the Contractor and approved by the Contracting Officer.

END OF SECTION 01520

SECTION 01561

EROSION AND SEDIMENT CONTROL

1.0 GENERAL

1.1 DEFINITIONS

A. Soil Erosion Stabilization:

1. Ground surfaces exposed during the wet season (November 1 through April 30).

2. Areas which will not be subjected to heavy wear by ongoing construction traffic.

3. Temporary and long-term stabilization of new or disturbed ditches, swales, or disturbed ground with intermittent construction traffic.

1.2 RELATED SECTIONS

A. Section 01420, Environmental Protection.

B. Section 02910, Seed.

C. Section 02955, Landscape.

D. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product Data: Commercial products.

B. Quality Control Submittals:

1. Environmental Protection Plan and General Permit:

a. Prior to commencing construction activities or delivery of materials to the site, the Contractor shall complete and submit to the Contracting Officer for the Base Civil Engineer's signature, a completed Notice of Intent (NOI) in accordance with the format and within the timeframe prescribed by the applicable federal and State of Wyoming jurisdictions and comply fully with the terms of the corresponding general permit.

b. Prior to commencing construction activities or delivery of materials to the site, the Contractor shall complete and submit to the Contracting Officer for approval a Storm Water Pollution Prevention Plan (SWPPP). Reference 40 CFR 450.21 as a guide for content requirements for storm water control site plans, and adjust it accordingly to meet site-specific permit requirements and project-specific construction activity. This plan shall be in accordance with the general NPDES permit. The SWPPP shall address as a minimum a 10 year storm event. 1) The plan shall address a site narrative, each activity that disturbs soil and ground cover, the Best Management Practices (BMP) to prevent storm water run-off and erosion control, source control and housekeeping BMPs, and interim and permanent stabilization practices. a) The plan shall contain the following information:

1) Watershed name.

2) 8-digit hydrologic unit code (HUC).

3) Permit references (e.g., ID No., type, NOI).

4) Soil type.

5) Native vegetation type.

6) Discharge locations (existing and planned).

7) Drainage.

8) Slope and terrain.

9) Total construction area (acres).

10) Total site area disturbed (acres).

11) Total construction cost ($000).

12) -pervious/impervious site areas (before and after):

a) Paved and unpaved road areas.

b) Paved and unpaved parking area.

c) Aquatic area (onsite or nearby).

13) BMPs selected:

a) Descriptive name.

b) Drainage area served.

c) Estimated control efficiency.

d) Estimated cost of implementing selected practice.

14) Construction Cost:

a) Total construction cost.

b) Estimated cost to implement storm water control site plan.

15) Run-off Information:

a) Average run-off coefficient (before and after construction).

b) Design storm (frequency, intensity).

c. The plan will address the schedule of activities and relate them to the locations and legends shown on the plan's site map and the timeframes to be recorded in the site log.

d. As a minimum, the site map will show the site boundary, perimeters of control areas, and areas where construction will occur. Graphically depict the construction activities that will occur within the site and each demarcated perimeter area, locate the BMPs chosen for use by symbol and legend, and provide an index of area demarcations and activity symbols to their corresponding narrative description and site log timeframes.

e. A site log will be maintained providing a permanent record of events called for in the site plan and kept in the job site office from the start to the end of construction.

1) The site log shall have a certification signature block whereby the designated construction site manager of qualified storm water professional certifies that the storm water control site plan is in effect and that all measures required before groundbreaking have been implemented.

2) An additional certification signature block for the construction site manager or qualified storm water professional shall be provide to certify that the affected site area is stabilized, all remaining storm water control measures have been upgraded to their final design configuration, and all construction site control areas have been removed and returned to their final stabilized state.

3) Record when soil disturbance starts and ends for any sequenced portion of the project or sectioned area of the site.

4) Record when any control areas are activated and when they are disassembled and cleaned up to restore them to their original state.

5) Record when runoff and erosion control BMP is installed and/or implemented, and indicate whether an inspection schedule is established to monitor its state and condition.

6) Record rain events (time, duration, intensity) and describe any observations on the effectiveness of the storm water control site plan to handle the event.

7) Develop and display the site log and the inspection schedule for each item and activity requiring inspection as part of the site control plan. Date and describe any inspection findings and describe any response actions, if required.

8) The original site log shall be submitted to the Contracting Officer at the completion of construction.

9) Retainage shall be withheld from payment until the site log and as-built documentation on permanent erosion control systems are submitted to and approved by the Contracting Officer.

1.4 DELIVERY, STORAGE, AND PROTECTION

A. Seed:

1. Furnish in standard containers with seed name, lot number, net weight, percentages of purity, germination, hard seed, and maximum weed seed content, clearly marked for each container of seed.

2. Keep dry during storage.

B. Hydro Seeding Mulch: Mark package of wood fiber mulch to show air dry weight.

1.5 SEQUENCING AND SCHEDULING

A. Obtain permits specified in Article SUBMITTALS, paragraph Quality Control Submittals above, prior to installing erosion and sediment control devices.

B. Install erosion and sediment control devices before starting earth disturbance activities.

C. Complete Soil Preparation: Seeding, fertilizing, mulching and matting on disturbed ground not receiving hard surface that will be disturbed for 2 days during the wet season or 7 days during the dry season.

D. Notify Contracting Officer at least 3 days in advance of:

1. Materials delivery.

2. Start of stabilization activity.

E. Seeding: Seeding and mulching to disturbed surfaces, which will not be subjected to construction traffic, shall be completed by September 1 to have an established stand by November 1.

1.6 MAINTENANCE

A. Operations:

1. Seeded Areas: Perform during construction period to include:

a. Watering: Keep seeded surface moist.

b. Washouts: Repair by filling with topsoil, fertilizing, seeding, and mulching.

c. Mulch: Replace wherever and whenever washed or blown away.

d. Reseed unsatisfactory areas or portions thereof immediately if a satisfactory stand has not been produced.

2. Inspect, repair, and replace as necessary all erosion control measures during the time period from start of construction to completion of construction. Inspect a minimum of at least once every 7 days or after a 1/2-inch storm event in a 24-hour period. At no time shall more than one-foot of sediment be allowed to accumulate in any erosion control device, the cleaning operation shall not dispose of sediment offsite.

2.0 PRODUCTS

2.1 FERTILIZER

A. Commercial, uniform in composition, free-flowing, not less than 50 percent organic non-burning composed product suitable for application with equipment designed for that purpose.

B. Fertilizer shall have the following minimum percentage of plant food by weight:

1. Granular Form Fertilizer:

C. Nitrogen: 16 percent.

D. Phosphoric Acid: 16 percent.

E. Potash: 16 percent.

2.2 SEED

A. As specified.

2.3 MULCH

A. Wood Cellulose Fiber Mulch:

1. Specially processed wood fiber containing no growth or germination inhibiting factors.

2. Dyed a suitable color to facilitate inspection of material placement.

3. Manufactured such that after addition and agitation in slurry tanks with water, the material fibers will become uniformly suspended to form a homogenous slurry.

4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.

2.4 COMPOST

A. Certified Class A bio solids compost meeting all federal and state health and safety regulations of the United States Environmental Protection Agency and Texas Commission on Environmental Quality.

B. Maximum size 3/8-inch.

C. Manufacturers and Products:

1. Akzo Industries, Ashville, NC; Curlex Mat.

2. North American Green, Evansville, IN; S150 blanket.

2.5 EROSION CONTROL MATTING

A. Excelsior mat or straw blanket; staples as recommended by matting manufacturer.

B. Manufacturers and Products:

1. Akzo Industries, Ashville, NC; Curlex Mat.

2. North American Green, Evansville, IN; S150 blanket.

2.6 SOIL TACKIFIER

A. Derived from natural organic plant sources containing no growth or germination-inhibiting materials.

B. Capable of hydrating in water, and to readily blend with other slurry materials.

C. Wood Cellulose Fiber: Add as tracer, at rate of 150 pounds per acre.

D. Manufacturers and Products:

1. Chevron Asphalt Co.; CSS-1.

2. Terra; Tack AR.

3. J-Tack; Reclamare.

2.7 REINFORCED PLASTIC COVERING

A. Co-extruded, copolymer laminate reinforced with a nonwoven grid of high strength nylon cord submersed in a permanently flexible adhesive media allowing for equal tear resistance in all directions.

B. Black in color and ultraviolet stabilized.

C. Physical Requirement (Minimum Average Roll Values):

1. Tear Strength: 130 pounds.

2. Elongation: 620 percent.

3. Minimum Thickness: 6 mil.

D. Manufacturers:

1. Reef Industries, Inc., Houston, TX.

2. Griffolyn Co., Houston, TX.

2.8 CLEARING LIMIT FENCE

A. Ultraviolet stabilized polyethylene or polypropylene safety fence, 4 feet in height, and yellow or orange in color.

2.9 SILT/SEDIMENT FENCE

A. Wire Mesh Material: As recommended by manufacturer of filter fabric; strong enough to support applied loads.

B. Support Posts: As recommended by manufacturer of filter fabric.

C. Fasteners: Heavy-duty wire staples at least 1-inch long, tie wires, or hog rings, as recommended by manufacturer of geotextile.

D. Filter Fabric: Polyester, polypropylene, or nylon filaments, woven into a uniform pattern, distinct and measurable openings.

1. Filaments: Resistant to damage from exposure to ultraviolet rays and heat.

2. Material Edges: Finish so that, filaments retain their relative positions under stress.

E. In accordance with requirements of Table No. 1:

Table No. 1 - Filter Fabric

Physical Property	Required Value	Test Method
Weight, pz/sq yd, min.	4	ASTM D 3776
Equivalent Opening Size, max.	50-70	U.S. Standard Sieve
Grab Tensile Strength, lb, min.	160	ASTM D 4632
Elongation, % max.	25	ASTM D 1682
Mullen Burst Strength, psi, min.	350	ASTM D 3786
Ultraviolet Radiation Resistance, % Strength Retention	70	ASTM D 4355

F. Manufacturers:

1. Polyfelt, Evergreen, AL.

2. Dupont Co., Wilmington, DE.

3. Mirafi, Inc., Charlotte, NC.

2.10 STRAW BALES

A. Machine baled clean salt hay or straw of oats, wheat, barley, or rye, free from seed of noxious weeds, using standard baling wire or string.

2.11 POSTS FOR STRAW BALES (IF ACCEPTED BY LOCAL PRACTICE)

A. 2-inch by 2-inch untreated wood or commercially manufactured metal posts.

2.12 BIOFILTER BAGS

A. Bags: Made of burlap, jute, geotextile or other pervious material capable of holding contents while allowing water to pass through bag. Bags shall have minimum dimensions of 2 feet long by 1 foot high by 1 foot wide.

B. Contents: Wood chips, bark, straw or other approved material.

3.0 EXECUTION

3.1 GENERAL

A. Erosion control measures are required during all construction and site disturbance activity and shall remain until permanent site ground covers are in place.

3.2 SOIL PREPARATION

A. Before start of hydro seeding and after surface has been shaped and graded, and lightly compacted to uniform grade, scarify soil surface to minimum depth of 1 inch.

3.3 FERTILIZER

A. Apply evenly over area in accordance with manufacturer’s instructions. Mix into top 1-inch of soil.

B. Application Rate: 23 pounds per 1,000 square feet (1,000 pounds per acre).

3.4 SEEDING

A. Prepare 1-inch depth seed bed; obtain Contracting Officer's acceptance prior to proceeding.

B. Apply by hydro seeding method on moist soil, but only after free surface water has drained away. Prevent drift and displacement of mixture into other areas.

C. Application:

1. Prepare and apply slurry as follows:

a. Seed Mix: 4 pounds per 1,000 square feet.

b. Fertilizer: 5 pounds per 1,000 square feet.

c. Wood Cellulose Fiber Mulch: 2,500 pounds per acre.

d. Water: As necessary.

3.5 MULCHING

A. Apply uniformly on disturbed areas that will remain undisturbed for 7 days or more, as requested by Contracting Officer, and on all seeded areas with a slope steeper than 5 percent. Do not apply mulch on seeded areas that will be immediately covered with erosion control matting.

B. Application: Sufficiently loose to permit penetration of sunlight and air circulation, and sufficiently dense to shade ground, reduce evaporation rate, and prevent or materially reduce erosion of underlying soil.

1. Wood Cellulose Fiber: 1,000 to 1,500 pounds per acre.

3.6 EROSION CONTROL MATTING

A. Place on seeded slopes 3H:1V and steeper, staple/stake in place and with the appropriate overlap in accordance with the manufacturer's instruction.

3.7 SOIL TACKIFIER

A. Apply on areas mulched.

B. Spray on after mulch is in place.

C. Apply in quantities sufficient to equal retention properties of a CSS-1 asphalt emulsion being applied at rate of 400 gallons per acre.

3.8 REINFORCED PLASTIC COVERING

A. Place on areas where hydro seeding and erosion control matting have not controlled erosion, and over all temporary stockpiles.

B. Install in single thickness, strips parallel to direction of drainage.

C. Maintain tightly in place by using sand bags on ropes with a maximum 10-foot grid spacing in all directions.

D. Tape or weight down full length, overlap seams at least 12 inches.

E. Remove at final acceptance unless notified otherwise by Contracting Officer.

3.9 CLEARING LIMIT FENCE

A. Install in accordance with manufacturer’s standard instructions and before beginning clearing and grubbing operations.

3.10 SILTS/SEDIMENT FENCE

A. Install prior to starting earth disturbing activities upslope of fence.

B. One-piece filter fabric or continuously sewn to make one-piece filter fabric for full height of the fence, including portion buried in the toe trench.

C. When joints are necessary, splice filter fabric together only at a support post, with a minimum 6-inch overlap, and securely fasten both ends to support post.

D. Filter fabric shall not extend more than 30 inches above the ground surface. Securely fasten to upslope side of each support post using ties. Filter fabric shall not be stapled to existing trees.

E. Fasten wire mesh material support fence securely to upslope side of post fasteners. Extend wire into the trench a minimum of 4 inches, and not more than 30 inches above the ground surface.

F. Take precaution not to puncture filter fabric during installation. Repair or replace damaged area.

G. Remove support fence for filter fabric after upslope area has been permanently stabilized. Immediately dress sediment deposits remaining after the silt/sediment fence has been removed to conform to existing grade. Prepare and seed graded area.

3.11 TEMPORARY SOIL STOCKPILES

A. Cover with reinforced plastic covering, as directed in Article Reinforced Plastic Covering.

B. Protect perimeter of stockpile from erosion with sediment fence.

3.12 STRAW BALES

A. Embed minimum of 4 inches in flat-bottomed trench.

B. Place with ends tightly abutting or overlapped. Corner abutment is not acceptable.

C. Install so that bale bindings are oriented around the sides and not over the top and bottom of the bale.

D. Use two posts for each bale. Drive posts through the bale until top of post is flush with top of bale.

E. Wedge loose straws in any gaps between bales.

3.13 BIOFILTER BAGS

A. Place in locations shown in sufficient quantity to provide filtration and to prevent movement of bags. Provide means of stabilization if required.

3.14 CLEAN-UP

A. Sediment trapped in erosion control devices shall be removed from the site or regraded into the slopes on the site.

B. After site restoration is complete and when approved by the Contracting Officer, all temporary erosion control measures shall be completely removed.

C. Sediment fence, straw bales, reinforced plastic covering, and any other erosion control devices shall be disposed of to an offsite locations that are approved by federal, state, and local authorities.

END OF SECTION 01561

SECTION 01600

MATERIALS AND EQUIPMENT

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, along with Division - 1 General Requirements – Specification Sections, apply to the work of all sections.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project. Products listed by brand name are for informational purposes establishing a general standard of quality and the government is making no warranty of availability or fitness of the products for use.

B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."

C. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems", "structure," "finishes," "accessories," and similar terms. Such terms such are self-explanatory and have well recognized meanings in the construction industry.

B. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "materials," "equipment," "system," and terms of similar intent.

C. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.

D. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

E. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.4 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The name plate shall contain the following information and other essential operating data:

a. Name of product and manufacturer.

b. Model and serial number.

c. Capacity.

d. Speed.

e. Ratings.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

3. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, sorting, unpacking, protecting and installing.

4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.

5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

7. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

2.0 PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.

B. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

C. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

2.2 MANUFACTURERS

A. Manufacturers: Materials are specified by brand names to establish a standard quality, or by performance requirements and general description of product. The Contracting Officer will consider substitutions for brand names of products specified. The Contracting Officer reserves the right to reject any material which, in his opinion, will not produce the quality of work specified herein.

2.3 SUBSTITUTIONS

A. Contracting Officer will consider request for substitutions only 30 days after date of Notice to Proceed.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. Substitutions will not be accepted when they are indicated or implied on shop drawings or product data submittals of Form AF-66. A separate written request must be made.

D. Substitutions will not be accepted when the substitution will require revisions to Contract Documents.

E. A substitution request represents that the Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty for the substitution as the product specified.

3. Will coordinate installation and make changes to other work which may be required for the work to be completed with no additional cost to Government.

4. Waives claims for additional cost or time extension which may subsequently become apparent.

F. Contracting Officer will notify Contractor in writing of decision to accept or reject request.

3.0 EXECUTION

4.0 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

SECTION 01650

STARTING OF SYSTEMS

1.0 GENERAL

1.1 SECTION INCLUDES

A. Starting systems.

B. Demonstration and instructions.

C. Testing, adjusting, and balancing.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Manufacturers' field reports.

B. Section 01700 - Contract Closeout: System operation and maintenance data and extra materials.

C. Reference Section 18113 for LEED requirements and Section 19113 for Commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Contracting Officer seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Government's personnel two weeks prior to date of Pre-Final Inspection.

B. Demonstrate Project equipment and instruct in a classroom environment located at Government's site and instructed by a manufacturers' representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Governments' personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

1.5 TESTING, ADJUSTING, AND BALANCING

A. Contractor to perform testing, adjusting and balancing.

2.0 PRODUCTS NOT USED

3.0 EXECUTION NOT USED

END OF SECTION 01650

SECTION 01700

CONTRACT CLOSEOUT

1.0 GENERAL

1.1 SECTION INCLUDES

A. Substantial Completion.

B. Final Acceptance.

C. Closeout Submittals.

D. Final Cleaning.

1.2 RELATED SECTIONS

A. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section. The requirements of Division 1, General Requirements, apply to the Work of all Sections.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.3 SUMMARY

A. This section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.

2. Project record document submittal.

3. Operating and maintenance manual submittal.

4. Submittal of warranties.

5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Division -1 through –16.

1.4 SUBSTANTIAL COMPLETION

A. Preliminary Procedures

1. Before requesting inspection for certification of Substantial Completion, complete following and list known exceptions in request.

2. In Application for Payment that coincides with, or first follows, date Substantial Completion is claimed, show 100% completion for portion of the Work claimed as substantially complete. Include supporting documentation for completion as required and statement showing accounting of changes to the Contract Sum. If 100% completion cannot be shown, include list of incomplete construction, and reasons the Work is not complete.

3. Advise Government of pending insurance change-over requirements.

4. Submit specific guarantees, warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

5. Obtain and submit releases enabling the Government unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

6. Deliver tools, spare parts, extra stock, and similar items.

7. Make final change-over of permanent locks and transmit keys to the Government. Advise Government's personnel of change-over in security provisions.

8. Complete start-up testing of systems, and instruction of Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the Site, along with construction tools, mock-ups, and similar elements.

9. Complete final cleaning. Touch-up and otherwise repair and restore marred exposed finishes.

10. Submit record drawings, maintenance manuals, damage or settlement survey, and similar final record information.

B. Inspection Procedure

1. On receipt of request for inspection, Contracting Officer will either proceed with inspection or advise Contractor of unfulfilled requirements. Contracting Officer will prepare Certificate of Substantial Completion following inspection, or advise Contractor of construction that must be completed or corrected before certificate will be issued.

2. Contracting Officer will repeat inspection when requested and assured that the Work has been substantially completed.

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

1.5 FINAL ACCEPTANCE

A. Preliminary Procedures

1. Before requesting final inspection for certification of final acceptance and final payment, complete following and list known exceptions in request.

2. Submit final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

3. Submit updated final statement, accounting for final additional changes to the Contract Sum.

4. Submit certified copy of Contracting Officer final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by Contracting Officer.

5. Submit final meter readings for utilities, measured record of stored fuel, and similar data as of Date of Substantial Completion or when the Government took possession of and responsibility for corresponding elements of the Work.

6. Submit consent of surety to final payment.

7. Submit final liquidated damages statement.

8. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure

1. Contracting Officer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to Contracting Officer.

2. Upon completion of re-inspection, Contracting Officer will prepare certificate of final inspection, or advise Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

3. If necessary, re-inspection will be repeated.

1.6 SUBMITTALS

A. Comply with Section 01300, Submittals. Submit all prints of drawings organized into manageable sets, bound with durable paper cover sheets, with suitable titles, dates and other identification on cover of each set. Submit all other documents catalogued, indexed, and bound in loose leaf notebook form.

B. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Contracting Officer for the government's records.

C. Operating and Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Provide five (5) Sets of Operating and Maintenance Manuals data. Include the following types of information:

1. Subcontractor list, suppliers, point of contact, phone numbers, e-mail address, and mailing address.
2. Emergency instruction.
3. Spare parts list.
4. Copies of warranties.
5. Wiring diagrams.
6. Recommended "turn around" cycles.
7. Inspection procedures.
8. Shop Drawings and Product Data.
9. Fixture lamping schedule.

D. Real Property Capitalization Form and Construction Cost Data Sheet: Provide, in joint effort with the Contracting Officer, the information requested on the form. The Contractor shall provide all quantities and cost data required by the form and completely assist the Government in completing the entire form.

2.0 PRODUCTS Not Used

3.0 EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Contracting Officer's review.

B. Provide submittals to Contracting Officer that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

3.2 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

2. Remove labels that are not permanent labels.

3. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

4. Clean exposed exterior and interior hard-surfaced finishes to a dust free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

5. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

6. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved or planted, to a smooth even-textured surface.

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

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Government's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Government's property, arrange for disposition of these materials as directed.

3.3 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revision to the Work:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications to the Contract.

5. Reviewed Shop Drawings, Product Data, and Samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Contracting Officer.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:

1. Measured depths in relation to datum.

2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal appurtenances concealed in construction, referenced to visible and accessible features of the Work.

4. Field changes of dimension and detail.

5. Details not on original Contract Drawings.

G. Submit documents to Contracting Officer with claim for final Application for Payment.

H. Operation and Maintenance Data and Manuals: Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment supplier shall prepare an Operation and Maintenance Manual for each type of equipment. Parts lists and operating and maintenance instructions shall be furnished for all equipment.

1. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Government's personnel to provide instruction in proper operation maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

a. Maintenance manuals.

b. Record documents.

c. Spare parts and materials.

d. Tools.

e. Lubricants.

f. Fuels.

g. Identification systems.

h. Control sequences.

i. Hazards.

j. Cleaning.

k. Warranties and bonds.

l. Maintenance agreements and similar continuing commitments.

2. As part of instruction for operating equipment, demonstrate the following procedures:

a. Start-up.

b. Shutdown.

c. Emergency operations.

d. Noise and vibration adjustments.

e. Safety procedures.

f. Economy and efficiency adjustments.

g. Effective energy utilization.

3.4 WARRANTIES

A. Provide duplicated notarized copies.

B. Execute and assemble transferrable warranty documents from Subcontractors, suppliers and manufacturers.

C. Provide Table of Contents and assemble in 3-ring binder with durable plastic cover.

D. Submit prior to final Application for payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

END OF SECTION 01700

SECTION 01730

OPERATION AND MAINTENANCE DATA

1.0 GENERAL

1.1 SUMMARY

A. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.2 REFERENCES

A. The publication listed below forms a part of this specification to the extent referenced. The publication is referred to in the text by the basic designation only.

DEFENSE LOGISTICS AGENCY (DLA)

DLA H4/H8 Federal Cataloging Handbook Commercial and Government Entity (CHEE), Sections A and B, United States and Canada, Sections C and D, NATO, Supply Code for Manufacturers

1.3 SUBMISSION OF OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance (O&M) data which is specifically applicable to this contract and a complete and concise depiction of the provided equipment or product. Data containing extraneous information to be sorted through to find applicable instructions will not be accepted. Present information in sufficient detail to clearly explain user O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with Section 01300, "Submittals."

B. Quantity

1. Submit five copies of the manufacturers' information specified herein for the components, assemblies, subassemblies, attachments, and accessories. The items for which O&M data is required are listed in the technical sections which specify that particular item.

C. Package Content

1. For each product, system, or piece of equipment requiring submission of O&M data, submit the package required in the individual technical section.

D. Delivery

E. 1. Submit O&M data to the Contracting Officer for review and acceptance; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

F. Changes to Submittals

1. Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.4 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

A. Operating Instructions

1. Include specific instructions, procedures, and illustrations for the following phases of operation:

a. Safety Precautions: List personnel hazards and equipment or product safety precautions for all operating conditions.

b. Operator Prestart: Include requirements to set up and prepare each system for use.

c. Startup, Shutdown, and Post shutdown Procedures: Include a control sequence for each of these operations.

d. Normal Operations: Include control diagrams with data to explain operation and control of systems and specific equipment.

e. Emergency Operations: Include emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.

f. Operator Service Requirements: Include instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.

g. Environmental Conditions: Include a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited

for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

B. Preventive Maintenance

1. Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

a. Lubrication Data: Include lubrication data, other than instructions for lubrication in accordance with paragraph entitled "Operator Service Requirements":

1) A table showing recommended lubricants for specific temperature ranges and applications;

2) Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and

3) A lubrication schedule showing service interval frequency.

2. Preventive Maintenance Plan and Schedule: Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

C. Corrective Maintenance: Include manufacturer's recommendations on procedures and instructions for correcting problems and making repairs.

1. Troubleshooting Guides and Diagnostic Techniques: Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

2. Wiring Diagrams and Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation numbering.

3. Maintenance and Repair Procedures: Include instructions and list tools required to restore product or equipment to proper condition or operating standards.

4. Removal and Replacement Instructions: Include step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

5. Spare Parts and Supply Lists: Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.

6. Corrective Maintenance Man-Hours: Include manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

D. Appendices: Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

   a. Manufacturer's standard commercial practice: The parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice.

   b. Other than manufacturer's standard commercial practice: End item manufacturer may add a cross-reference to implement components'

assemblies and parts requirements when implementation in manual form varies significantly from the style, format, and method of manufacturer's standard commercial practice. Use the format in the following example:

- End Item Actual
- Manufacturer Manufacturer's Name Actual Manufacturer
- Alphanumeric Sequence and FSCM Part No.
- 100001 John Doe & Co. 00000 2000002
- List FSCM in accordance with DLA H4/H8.

2. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

3. Personnel Training Requirements: Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

4. Testing Equipment and Special Tool Information: Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

5. Contractor Information: Provide a list that includes the name, address, and telephone number of the General Contractor and each subcontractor installing the product or equipment. Include local representatives and service organizations most convenient to the project site. Provide the name, address, and telephone number of the product or equipment manufacturers.

2.0 PRODUCTS Not Used

3.0 EXECUTION Not Used

END OF SECTION 01730

SECTION 01734

INDOOR AIR QUALITY

1.0 GENERAL

1.1 SUMMARY

A. Section includes:

1. Construction procedures to promote adequate indoor air quality after construction.

2. Building flush-out after construction and before occupancy.

3. Testing indoor air quality after completion of construction

B. Related Sections:

1. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.2 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.

1. Cleaning of ductwork is not contemplated under this Contract.

2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.

1. Furnish products meeting the specifications.

2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.3 REFERENCES

A. SMACNA (OCC): IAQ Guideline for Occupied Building Under Construction: 1995.

1.4 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.5 SUBMITTALS

A. See Section 01300 – ADMINISTRATIVE REQUIREMENTS, for submittal procedure.

B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA IAQ Guidelines for Occupied Buildings Under Construction as a guide.

1. Contractor to submit plan within 60 calendar days after receipt of Notice to Proceed.

2. Identify potential sources of odor and dust.

3. Identify construction activities likely to produce odor or dust.

4. Identify areas of project potentially affected, especially occupied areas.

5. Evaluate potential problems by severity and describe methods of controls.

6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, type of filters and schedule for replacement of filters.

7. Describe cleaning and dust control procedures.

8. Describe coordination with commissioning procedures.

C. Interior Finished Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Air Contaminant Test Plan: Identify:

1. Testing agency qualifications.

2. Location and scheduling of air sampling.

3. Test procedure, in detail.

4. Test instrument and apparatus.

5. Sampling methods.

E. Air Contaminant Test Reports: Show:

1. Location where each sample was taken, and time.

2. Test values for each air sample; average the values of each set of 3.

3. HVAC operating conditions.

4. Certification of test equipment calibration.

5. Other conditions or discrepancies that might have influenced results.

1.6 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years' experience in performing the types of testing specified.

2.0 PRODUCTS

2.1 MATERIALS

A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

3.0 EXECUTION

3.1 CONSTRUCTION PROCEDURES

A. Prevent absorption of moisture and humidity by adsorptive materials by:

1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.

2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.

3. Provide sufficient ventilation of drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. HAVC equipment and supply air ductwork may be used for ventilation during construction:

1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.

2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.

3. Do not use return air ductwork for ventilation.

4. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways.

E. Do not store construction materials or waste in mechanical or electrical rooms.

F. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.

1. Inspect duct intakes, return air grilles, and terminal units for dust.

2. Clean plenum spaces, including top sides of lay-in ceiling, outsides of ducts, tops of pipes and conduit.

3. Clean tops of doors and frames.

4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.

5. Clean return plenums of air handling units.

6. Remove intake filters last, after cleaning is complete.

G. Do not perform dust or dirty work after starting use of return air ducts without intake filters.

H. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Building Under Construction for avoiding unnecessary contamination due to construction procedures.

3.2 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:

1. All construction is complete.

2. HVAC systems have been tested, adjusted, and balanced for proper operation.

3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.

4. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at noral flow rates with 100 percent outside air until a total air volume of 4500 cubic meters per square meter (14,000 cubic feet per square foot) of floor area has been supplied.

1. Obtain Contracting Officer's concurrence that construction is complete enough before beginning flush-out.

2. Maintain interior temperature of at least 15 degrees C (60 degrees F) and interior relative humidity no higher than 60 percent.

3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.

4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 per cent of the total air volume prior to daily occupancy.

a. Begin ventilation at least three hours prior to daily occupancy.

b. Continue ventilation during all occupied periods.

c. Provide minimum outside air volume of 0.0015 cu m/s/sq m (0.3 cfm per square foot) or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion fo flush-out and before occupancy or further testing.

3.3 AIR CONTAMINANT TESTING

A. Contractors Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before occupancy.

C. Do not start air contaminant testing until:

1. All construction is complete, including interior finishes.

2. HVAC systems have been tested, adjusted, and balanced for proper operation.

3. New HVAC filtration media have been installed.

D. Indoor Air Samples: Collect from spaces representative of occupied areas:

1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.

2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 2300 square meters (25,000 square feet); take samples from areas having the least ventilation and those having the greatest presumed source strength.

3. Collect samples from height from 915 mm (36 inches) to 1830 mm (72 inches) above floor.

4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 2 samples.

5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.

6. When retesting the same building areas, take samples from at least the same locations as in first test.

E. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

F. Analyze air samples and submit report.

G. Air Contaminant Concentration Determination and Limits:

1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.

2. Carbon Dioxide: Measure ppm, in relation to outdoor air; not more than 700 ppm higher than outdoor air.

3. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.

4. Formaldehyde: Not more than 50 parts per billion.

5. Total Volatile Organic Compounds (TVOC): Not more than 500 micrograms per cubic meter.

6. 4-Phenylcyclohexene (4-PCH): Not more than 6.5 micrograms per cubic meter.

7. Particulates (PM10): Not more than 50 micrograms per cubic meter.

8. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

H. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Contracting Officer, or conduct full building flush-out specified above.

END OF SECTION 01734

SECTION 01740

WARRANTIES

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, along with Division -1 General Requirements – Specification Sections, apply to the work of all sections.

1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2. General closeout requirements are included in Section "Project Closeout".

3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Division-2 through - 16.

4. Certifications and other commitments and agreements for continuing services to Government are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

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

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

1.4 WARRANTY REQUIREMENTS

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

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

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

D. Government's Recourse: Written warranties made to the Government are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Government can enforce such other duties, obligations, rights, or remedies.

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

E. The Government reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

A. Submit written warranties to the Contracting Officer prior to the date certified for Substantial Completion. If the Contracting Officer Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Contracting Officer.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Contracting Officer for approval prior to final execution.

1. Refer to individual Sections of Division 1 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

C. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

2. Identify each binder on the front and the spine with the typed or printed title "Warranties and Bonds," the Project title or name, and the name of the Contractor.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

2.0 PRODUCTS Not Used

3.0 EXECUTION Not Used

END OF SECTION 01740

SECTION 01820

DEMONSTRATION AND TRAINING

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, along with Division 1 General Requirements – Specification Sections, apply to work of all sections.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Government's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.

2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections include the following:

1. Divisions 2 through 16. See sections for specific requirements for demonstration and training for products specific to those individual Sections.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Coordinate instruction schedule with Government's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals.

2.0 PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors, including overhead coiling doors.

2. Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.

3. Conveying systems, including elevators.

4. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.

5. HVAC instrumentation and controls.

6. Electrical service and distribution, including transformers, panelboards and motor controls.

7. Lighting equipment and controls.

3.0 EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Government's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

END OF SECTION 01820

DIVISION 2 - SITE CONSTRUCTION

SECTION 02190

AGGREGATES

1.0 GENERAL

1.1 SUMMARY

A. This section includes the preparation and stockpiling of aggregates for portland cement concrete, bases, recycled concrete aggregated for base course, bituminous pavements and surface treatments, cover coats, bed courses, drains, pervious backfill and riprap.

B. This section is a material specification only and is subsidiary to other sections which address placement of the materials prepared under same.

1.2 RELATED WORK

A. Section 02231, Aggregate Sub-base and Base Courses.

B. Section 02512, Plant Mix Pavements.

C. Section 03304, Portland Cement Concrete.

D. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder

1.3 QUALITY ASSURANCE

A. AASHTO M 6: Fine Aggregate for Portland Cement Concrete.

B. AASHTO M 80: Course Aggregate for Portland Cement Concrete.

C. AASHTO M 92: Wire-cloth Sieve for Testing Purposes.

D. AASHTO T 2: Sampling Aggregates.

E. AASHTO T 27: Wyoming Modified Sieve Analysis of Fine and Course Aggregates.

F. AASHTO T 96: Resistance to Abrasion of Small Size Course Aggregate by Use of the Los Angeles Machine.

G. AASHTO T 104: Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate.

H. ASTM C 33: Concrete Aggregates.

I. ASTM C 127: Specific Gravity and Moisture Absorption of Coarse Aggregate.

J. ASTM C 136: Sieve or Screen Analysis of Fine and Coarse Aggregate.

1.4 SUBMITTALS

A. Sampling and testing of aggregates for flexible pavements shall be in accordance with the following standard methods of the American Society for Testing and Materials.

1. Sampling	ASTM D 75
2. Percentage of Wear	ASTM C 131
3. Sodium Sulfate Soundness	ASTM C 88
4. Specific Gravity and Absorption for Fine and Course Aggregate	ASTM C 127, 128
5. Sieve Analysis (for Materials finer than 200 sieve)	ASTM C 117

B. Sampling and testing of aggregates for portland cement concrete shall be in accordance with the following standard methods of the American Society for Testing and Materials.

1. Fine Aggregate	ASTM C 33
2. Course Aggregate	ASTM C 33
3. Sieve Analysis	ASTM C 136
4. Percentage of Wear	ASTM C 131
5. Sodium Sulfate Soundness	ASTM C 88
6. Reactivity of Aggregates	ASTM C 1260

1.5 DEFINITIONS

A. Coarse aggregate shall mean materials retained on a #4 sieve.

B. Fine aggregate shall mean materials passing a #4 sieve.

C. Sub-base shall be crushed sub-base unless otherwise specified.

D. Base shall be crushed base unless otherwise specified.

E. Gradation requirements, as listed herein, shall be the percentage of material by weight passing laboratory sieves having square openings. Sieve sizes or designations will be in accordance with AASHTO M 92 and ASTM C 33.

2.0 PRODUCTS

2.1 MATERIALS

A. When crushed aggregate for sub-base, bases, surfacing or bituminous pavements is specified, all boulders in the pit up 6" (150 mm) in diameter shall be crushed to meet the required specifications and shall be uniformly distributed in the remainder of the material, unless otherwise specified.

B. Before production of any of the following materials, all vegetation and stripping material shall be removed from the pit. Only designated portions of the pit will be used. The composite materials shall be free from clay balls, vegetable matter, and other deleterious substances, and shall not contain an excess of thin or elongated pieces.

C. When concrete pavements are utilized for sub-base and base materials the concrete shall be crushed to meet the required specification gradation.

2.2 AGGREGATE FOR PORTLAND CEMENT CONCRETE

A. Fine Aggregate

1. Fine aggregate for concrete shall conform to the requirements of AASHTO M 6 with the following exceptions:

	Max. % by Weight
Clay Lumps	1.0
Coal, Lignite, or Shale	1.0
Material Passing No. 200 Sieve	4.0

The sum of the above materials and other deleterious substances such as shale, alkali, mica, coated grains, or soft and flaky particles shall not exceed 4% by weight.

2. Fine aggregate shall be well graded from coarse to fine and shall conform to the following gradation requirements:

SIEVE DESIGNATION	PERCENTAGE PASSING
3/8-Inch (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 16 (1.18 mm)	45 to 80
No. 50 (.300 mm)	10 to 30
No. 100 (.150 mm)	2 to 10

B. COARSE AGGREGATE

1. Coarse aggregates shall consist of crushed stone, gravel, or other approved inert materials of similar characteristics, or combinations thereof, having strong and durable pieces. The aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films of clay, or other matter that would prevent thorough bonding in accordance with Paragraph 2.

2. Coarse aggregate shall conform the requirements of AASHTO M 80 with the following exceptions:

   a. The amount of deleterious substances shall not exceed the following limits:

	Max. % by Weight
Clay Lumps	0.5
Coal, Lignite, or Shale	1.0
Material Passing #200 Sieve (0.075mm)	4.0
Other deleterious substances such as friable, thin, elongated or laminated pieces	3.0

   The sum of the above material and other deleterious substances shall not exceed 5% by weight.

   b. Coarse aggregates shall have a percentage of wear of not more than 40 when tested in accordance with AASHTO T 96 or show a sodium sulfate loss not to exceed 12% when tested in accordance with AASHTO T 104. The wear and soundness requirements may be waived, or modified, by the Contracting Officer provided that the coarse aggregate has a proven service record for similar conditions.

   c. Coarse aggregate shall meet the following gradation limits for the concrete class specified. Other sizes or combinations of sizes may be

used when otherwise specified. If not specified, Type No. 57 shall be the gradation used.

SIEVE DESIGNATION	TYPE NO. 57	TYPE NO. 67
1 ½ -Inch (37.5 mm)	100	-----
1-Inch (25.4 mm)	95-100	100
3/4-Inch (19 mm)	-----	90 to 100
½ -Inch (12.5 mm)	25 - 60	-----
3/8-inch (9.5 mm)	-----	20 to 55
* No. 4 (4.75 mm)	2 to 10	0 to 10
* Not more than 5 percent shall pass the No. 8 sieve (2.36 mm).		

2.3 AGGREGATE FOR UNTREATED SUB-BASE AND BASE

A. The composite materials shall be free from clay balls, vegetable matter, and other deleterious substances, and shall not contain an excess of thin or elongated pieces.

B. Crushed sub-base and crushed base shall be crushed stone or crushed gravel and an approved soil binder or natural filler, where required, conforming to the following requirements, unless otherwise designated in the Contract Documents.

1. Coarse aggregate shall consist of hard, durable particles or fragments of stone or gravel. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used. Unless otherwise specified, the coarse aggregate shall have a percentage of wear of not more than 50.

2. Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. The fraction passing the #200 (0.075 mm) sieve shall not be greater than two-thirds of the fraction passing the #40 sieve. The fraction passing the #40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6 except that, when the plasticity index is non-plastic (NP), the liquid limit shall not be more than 30.

3. Crushed base and crushed sub-base shall meet one of the following gradation requirements as specified in the Contract Documents:

SIEVE DESIGNATION	GRADING D	GRADING G	GRADING H	GRADING J	GRADING K	GRADING W
2-Inch (50 mm)	100	100	-----	100	-----	-----
1 ½ -Inch (37.5 mm)	90 to 100	90 to 100	-----	90 to 100	100	100
1-Inch (25.0 mm)	-----	-----	100	-----	90 to 100	90 to 100

3/4-Inch (19.0 mm)	-----	-----	90 to 100	-----	-----	-----
No. 4 (4.75 mm)	50 to 85	-----	45 to 65	35 to 75	40 to 65	45 to 65
No. 8 (2.36 mm)	40 to 70	-----	33 to 53	-----	30 to 55	33 to 53
No. 200 (0.075 mm)	2 to 15	0 to 15	3 to 12	0 to 15	3 to 15	3 to 12

C. Crusher run sub-base and crusher run base shall be crusher run material of the maximum size as called for in the Contract Documents, not to exceed 3" (76 mm).

D. Pit run or screened sub-base and base shall be pit run or screened material of the maximum size called for in the Contract Documents, not to exceed 3" (76 mm).

E. Placement of sub-base materials with aggregates greater than 3" shall not be allowed unless otherwise specified by the Contracting Officer in the Special Provisions.

F. Recycled Concrete Aggregate for Base. Recycled Concrete Aggregate for Base Course shall be utilized by crushing the existing concrete pavement removed at the project site. The aggregate shall be crushed to meet Grading W. Coordinate on site crushing operations with the Base Civil Engineer. Perform test and analysis of aggregate material and accordance with ASTM C 136, Sieve Analysis. Additional laboratory test to be completed include ASTM C131, Los Angeles Abrasion Percent Wear not to exceed 40% maximum. ASTM C88, Magnesium Sulfate Soundness percent loss not to exceed 18% maximum. Stock Materials on site at location designated by the Base Civil Engineer. Direct surface water away from stockpile so as to prevent erosion and deterioration of materials. Surround the base of stockpiled material with temporary sediment barrier. Remove stockpile, leave area in clean and neat conditions. Grade site surface to prevent freestanding surface water. Leave unused materials in neat, compact stockpile. Coordinate unused materials stockpile location with Base Civil Engineer.

2.4 AGGREGATE FOR PLANT MIX BITUMINOUS BASE

A. General: Aggregate shall be composed of coarse and fine aggregates combined in the proper proportions to meet the grading requirements for Grading W of Subsection 2.03 herein, Aggregate For Untreated Sub-Base And Base, unless otherwise noted in the Contract Documents. Aggregates shall be composed of clean, tough, durable fragments free from an excess of flat, elongated, soft, or disintegrated pieces and free from fragments coated with dirt or other objectionable matter.

B. Coarse Aggregate: Coarse aggregate shall be crushed stone, crushed gravel, or natural gravel. Unless otherwise shown noted in the Contract Documents, the material shall have a percentage of wear of not more than 50 when tested in

accordance with AASHTO T 96. The sodium sulfate soundness loss shall not exceed 12% in accordance with AASHTO T 104.

C. Fine Aggregate: Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. The fraction passing the #200 (0.075 mm) sieve shall not be greater than two-thirds of the fraction passing the #40 sieve. The fraction passing the #40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 3, except that when the plasticity index is non-plastic (NP), the liquid limit shall be not more than 30.

2.5 AGGREGATE FOR ROAD MIX BITUMINOUS BASE

A. Aggregates for road mix bituminous base shall meet the requirements for Crushed Base of Subsection 2.03 herein, Aggregate For Untreated Sub-Base And Base and unless otherwise specified by the Contracting Officer in the Special Provisions, the combined aggregate and natural filler, where required, shall meet the gradation requirements for Grading W.

2.6 AGGREGATE FOR FLEXIBLE PAVEMENTS

A. General: Aggregates shall be of uniform quality, crushed to size as necessary, and shall be composed of sound, tough, durable pebbles or fragments with or without natural or mineral fillers, as required. The aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films of clay or other matter that would prevent thorough coating with bituminous material and shall be free of an excess of flat or elongated pieces. The crushed aggregate shall have a percentage of wear of not more than 40, show a sodium sulfate loss of not more than 12%, and the plasticity index shall not exceed 3 unless otherwise provided for in the Contract Documents or as approved by the Contracting Officer.

B. Coarse Aggregate: Coarse aggregate shall be crushed stone or crushed gravel with eighty-five (85) percent having one or more fractured faces and eight (80) percent having two (2) or more fractured faces. Coarse aggregate shall be crushed stone or crushed gravel of such gradation that when combined with other required aggregate fractions and fillers in proper proportion, the resultant mixture shall meet the gradation requirements under the composition of mixture for the specific material type. Only one kind shall be used on the Project except as approved by the Contracting Officer.

C. Fine Aggregate: Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. Fine aggregate angularity shall be a minimum or forty-five (45) percent. Fine aggregate shall be of such gradation that when combined with other required aggregate fractions in proper proportion, the resultant mixture shall meet the gradation requirements under the composition of mixture for the specific material type. Only one kind shall be used on the Project except as approved by the Contracting Officer.

2.7 AGGREGATE FOR HOT PLANT MIX BITUMINOUS PAVEMENT

A. Type I Pavement aggregate shall be composed of coarse and fine aggregates combined as shown and in conformance with Subsection 2.4 herein, Aggregate for Plant Mix Bituminous Base.

B. Type II Pavement aggregate material, prior to crushing, (one hundred (100) percent crushed) shall be of such size that not less than ninety-five (95) percent shall be retained on a sieve with square openings 1/4" larger than the maximum size mineral aggregate being produced, unless otherwise specified by the Contracting Officer in the Special Provisions.

C. Type III Pavement aggregate shall have not less than fifty(50) percent of the materials by weight retained on the #4 sieve with at least one fractured face, unless a different percentage of fractured faces is otherwise provided for in the Contract Documents.

D. The aggregate fractions for the mixture shall be sized, graded, and combined in such proportions that the resulting composite blend meets one of the grading requirements in the following table as specified in the Contract Documents. If not specified, Contractor shall use the 3/4" maximum material grading specification.

GRADATION REQUIREMENTS
(% by Weight Passing)

SIEVE SIZES	**1 " MAX**	**3/4" MAX**		**1/2" MAX**		**3/8" MAX**
	Grading E	**Grading A**	**Grading B**	**Grading C**	**Grading D**	**Grading G**
1-1/4"	100					
1"	90 – 100	100	100			
3/4"	70 – 90	90 – 100	90 – 100	100	100	
1/2"	55 – 80	60 – 85		90 – 100	90 – 100	100
3/8"			60 – 85	60 – 85		90 – 100
# 4	35 – 55	40 – 60	40 – 65	40 – 60	50 – 70	45 – 85
# 8	20 – 40	25 – 45	25 – 55	25 – 45	25 – 55	30 – 65
# 30	10 – 25	10 – 30	10 – 30	10 – 30	10 – 30	10 – 40
# 200	2 – 7	2 – 7	2 – 10	2 – 7	2 – 11	2 – 7

2.8 AGGREGATE FOR PLANT MIX WEARING COURSE

A. The aggregate for plant mix wearing course shall be crushed stone or gravel composed of hard, durable pebbles or fragments and a filler of finely crushed stone, gravel, or sand, where required, to provide a composition of aggregates meeting the following requirements for the type specified:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING	
	Type A	Type B
½ -Inch (12.5 mm)	100	100
3/8-Inch (9.5 mm)	97 to 100	97 to 100
No. 4 (4.75 mm)	25 to 45	20 to 40
No. 8 (2.36 mm)	10 to 25	10 to 20
No. 20 (0.850 mm)	2 to 7	2 to 7

B. The aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films of clay, or other matter that would prevent thorough coating with bituminous material. Unless otherwise shown on the plans, at least 75% of the material by weight retained on the #4 (4.75 mm) sieve shall be particles having at least one fractured face and shall have a percentage of wear of not more than 35.

C. When either Type A or Type B wearing course is specified, the aggregate material, prior to crushing, shall be of such size that not less than 95% shall be retained on a sieve with square openings of 3/8" (9.5 mm).

2.9 AGGREGATE FOR ROAD MIX BITUMINOUS PAVEMENT

A. Aggregates shall be composed of clean, tough, durable fragments of crushed stone, or crushed or natural gravel free from an excess of flat, elongated, soft, or disintegrated pieces. The aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films or other matter that would prevent thorough coating with bituminous material.

B. Unless otherwise specified, the coarse aggregate shall have a percentage of wear of not more than 50. The sodium sulfate soundness loss shall not exceed 12% and the plasticity index shall not exceed 3. The combined coarse and fine aggregate shall meet the following gradation requirements:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING
1-Inch (25.0 mm)	100
3/4-Inch (19.0 mm)	95 to 100
No. 4 (4.75 mm)	45 to 65
No. 8 (2.36 mm)	33 to 53
No. 200 (0.075 mm)	3 to 12

2.10 AGGREGATE FOR COVER COAT

A. Only one type of aggregate shall be used on the project unless alternate types are approved.

B. Cover aggregate for seal coats shall be crushed stone, crushed ledge rock, crushed or natural gravel, or sand.

C. Cover aggregate material for bituminous surface treatment shall consist of clean, tough, durable fragments free from an excess of flat, elongated, soft or disintegrated pieces and free from coatings of dirt or other objectionable matter. The aggregate shall have neither a percentage of wear of more than 40 nor a plasticity index in excess of 3. The aggregate material shall be well graded from coarse to fine within the following limits:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING
3/4-Inch (19.0 mm)	100
2-Inch (12.5 mm)	95 to 100
No. 4 (4.75 mm)	50 to 70
No. 8 (2.36 mm)	33 to 63
No. 200 (0.075 mm)	3 to 10

D. Type A, B, C, D, E and S aggregate material produced shall be well graded from coarse to fine within the following limits:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING					
	TYPE A	TYPE B	TYPE C	TYPE D	TYPE E	TYPE S
1-Inch (25.0 mm)	100	-----	-----	-----	-----	-----
3/4-Inch (19.0 mm)	95 to 100	100	-----	100	100	-----
2-Inch (12.5 mm)	30 to 60	95 to 100	100	95 to 100	95 to 100	100
3/8-Inch (9.5 mm)	-----	-----	95 to 100	-----	-----	95 to 100
No. 4 (4.75 mm)	0 to 15	0 to 15	0 to 20	0 to 15	35 to 70	85 to 100
No. 8 (2.36 mm)	0 to 7	0 to 7	0 to 12	0 to 7	-----	-----
No. 200 (0.075 mm)	0 to 2	0 to 2	0 to 2	0 to 2	0 to 10	0 to 5

E. Material used for the production of Type A, B, or C cover aggregate shall be stone, ledge rock, or boulders of such size that prior to crushing not more than 5% will pass a 3/4" (19 mm) screen for Type A or a 2" (12.5 mm) screen for Type B and Type C.

F. Type D cover aggregate shall be crushed stone, crushed gravel, or clean pea gravel.

G. Types A, B, C, or D shall have a percentage of wear of not more than 35, unless a different percentage of wear is specified by the Contracting Officer in the Special Provisions.

H. Type E cover aggregate shall be crushed sand-gravel. Type S cover aggregate shall be screened or pit-run sand. The plasticity index of either Type E or Type S shall not exceed 3.

2.11 AGGREGATE FOR BLOTTER

A. Blotter material shall be either sand or screenings, free from vegetable matter, clay, or other deleterious matter. The material shall be of such size that 100% of the material will pass through a 3/8" (9.5 mm) sieve, the fraction passing the #4 (4.75 mm) sieve shall be from 85% to 100% and the fraction passing the #200 (0.075 mm) sieve shall not be greater than 20%. The plastic index shall not exceed 6.

2.12 AGGREGATE FOR FILLER

A. Filler shall consist of clean, hard, durable grains of naturally occurring granular material taken either from locations shown on the Drawings or from approved sources as otherwise specified in the Contract Documents.

2.13 AGGREGATE FOR BED COURSE MATERIAL

A. Bed course material for sidewalks and curbing shall consist of graded gravel, crushed stone, or other approved material of such that all particles will pass through a sieve having ½”(12.5 mm) square openings.

2.14 AGGREGATE FOR DRAINS

A. Gravel for drains shall be crushed or natural sand and gravel or other approved free-draining material. The material shall be uniformly graded from coarse to fine within the following gradation requirements for the material type indicated in the Contract Documents. When the grading is not indicated in the Contract Documents, Grading B shall be used.

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING		
	GRADING A	GRADING B	GRADING C
2-Inch (50.0 mm)	100	-----	-----
1½-Inch (37.5 mm)	95 to 100	100	-----
1-Inch (25.0 mm)	-----	95 to 100	-----
3/4-Inch (19.0 mm)	35 to 70	-----	100
3/8-Inch (9.5 mm)	10 to 30	-----	95 to 100
No. 4 (4.75 mm)	0 to 5	0 to 10	-----
No. 8 (2.36 mm)	-----	-----	45 to 95
No. 16 (1.18 mm)	-----	-----	5 to 45
No. 100 (0.150 mm)	-----	-----	0 to 10

2.15 AGGREGATE FOR MAINTENANCE STOCKPILES

A. Type A aggregate shall consist of clean, hard, durable particles of crushed gravel or stone free from soft, thin, elongated, or laminated pieces or organic material, and shall show a percentage of wear of not more than 50. The fraction passing the #40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 3, except that, when the plasticity index is non-plastic (NP), the liquid limit shall not be more than 30. The material placed in the stockpile shall meet the following gradation requirements for the maximum size specified:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING	
	1/2-Inch (12.5 mm) Maximum	3/8-Inch (9.5 mm) Minimum
3/4-Inch (19.0 mm)	100	-----
2-Inch (12.5 mm)	95 to 100	100
3/8-Inch (9.5 mm)	-----	95 to 100
No. 4 (4.75 mm)	45 to 65	50 to 70
No. 8 (2.36 mm)	37 to 57	33 to 63
No. 200 (0.075 mm)	3 to 12	3 to 12

B. Type B aggregate shall consist of clean, hard, durable particles of crusher-run gravel or stone free from soft, thin, elongated, or laminated pieces or organic material. Material shall be obtained from designated portions of the pit. The plasticity index shall not be greater than 6. The material placed in the

stockpile shall meet the following gradation requirements for the maximum size specified:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING
Maximum Designated	95 to 100
No. 4 (4.75 mm)	0 to 75
No. 200 (0.075 mm)	0 to 15

C. Type C aggregate shall consist of crusher-run scoria. Not less than 95% of the material placed in the stockpile shall pass a 1/2" (12.5 mm) sieve.

D. Type D aggregate shall consist of clean, hard, durable particles of screened sand free from soft, thin, elongated or laminated pieces, or organic material. The plasticity index shall not be greater than 6. The material placed in the stockpile shall meet the following gradation requirements:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING
2-Inch (12.5 mm)	100
3/8-Inch (9.5 mm)	95 to 100
No. 4 (4.75 mm)	85 to 100
No. 200 (0.075 mm)	3 to 12

2.16 AGGREGATE FOR PERVIOUS BACKFILL MATERIAL

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING
2-Inch (50.0 mm)	100
No. 4 (4.75 mm)	0 to 50
No. 40 (0.425 mm)	0 to 30
No. 100 (0.150 mm)	0 to 10
No. 200 (0.075 mm)	0 to 4

A. Pervious Backfill Material shall consist of gravel, crushed gravel, crushed rock, natural sands, manufactured sands, or combinations thereof, and shall meet the following gradation requirements:

B. In addition, the fraction passing the #40 sieve shall be non-plastic (NP) and shall have a liquid limit not greater than 30.

2.17 AGGREGATE FOR RIPRAP

A. Aggregate for riprap shall be hard, durable, crushed, quarried, or natural stone, or broken concrete having an apparent specific gravity of 2.4 or greater. The absorption shall not exceed 4 % unless otherwise approved by the Contracting Officer in the Special Provisions. The stone shall be free of weak laminations and cleavages, and shall be of a quality that will not disintegrate on exposure to water or weathering. The aggregate for the various types of riprap shall meet the following additional requirements:

1. Class l Riprap aggregate shall consist of two sizes of stone.

   a. Primary stones shall be not less than 3" (75.0 mm) thick and shall weigh not less than 50 pounds. At least 60 percent of the stones shall weigh more than 80 pounds each.

   b. Choke stones shall be fragments or spalls of the proper size to satisfactorily wedge between the primary stones as placed.

2. Class 2 Riprap aggregate shall be graded with a sufficient amount of smaller stones uniformly distributed throughout. At least 60 percent of the stones shall weigh more than 80 pounds each.

3. Grouted Riprap aggregate shall conform to the specifications for Class 1 or Class 2 Riprap. If not specified, Class 1 Riprap shall be used.

4. Wire Enclosed Riprap aggregate shall be round or angular stones. Not less than 95% of the stone shall be retained on a screen or wire having 2" square openings.

5. Sacked Concrete Riprap aggregate shall consist of either a sandy or gravelly pit-run material. This material shall be clean and free from roots, vegetable matter, or other deleterious substances. The aggregate shall meet the following gradation requirements:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING
2-Inch (50.0 mm)	80 to 100
No. 200 (0.075 mm)	0 to 4

2.18 AGGREGATE FOR RIPRAP FILTER

A. Filter aggregates for riprap shall be hard, durable particles or fragments of crushed stone or natural gravel, screened or crushed to meet the following gradation requirements:

SIEVE DESIGNATION	PERCENT BY WEIGHT PASSING
3-Inch (75.0 mm)	100
No. 4 (4.75 mm)	20 to 50
No. 200 (0.075 mm)	0 to 10

3.0 EXECUTION

3.1 STOCKPILED AGGREGATE

A. This work shall consist of storing aggregate material which will be used in construction projects in accordance with these specifications at locations shown on the Drawings, noted in the Contract Documents, or as otherwise designated by the Contracting Officer.

B. The aggregates shall meet applicable parts of this section for the type of material required.

C. Sites for aggregate stockpiles shall be grubbed and cleaned prior to storing aggregates, and the site shall be firm and smooth and well drained. A bed of aggregate suitable to avoid the inclusion of soil or foreign material shall be maintained.

D. The stockpiles shall be built in layers not exceeding four feet in height, and each layer shall be completely in place before the next layer is started so as to prevent segregation. The material shall be deposited in such manner as to prevent coning, except in the case of fine aggregate composed of material approximately 90% finer than a #4 (4.75 mm) sieve.

E. Dumping, casting, or pushing over sides of stockpiles is prohibited except in the case of fine aggregate materials.

F. Stockpiles of different types or sizes of aggregates shall be spaced far enough apart or separated by suitable walls or partitions to prevent the mixing of the aggregates.

G. Any stockpiling of materials derived by wet pit or dredging operations, other than those stockpiles previously mentioned, are subject to prior approval of the Contracting Officer and must be specified and submitted in the Contractor's plan of operations.

H. When it is necessary to operate trucks or other equipment on the stockpile in the process of building that stockpile, it should be done in a manner approved by the Contracting Officer. Any method of stockpiling aggregate which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate will not be permitted. Excessive

degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has operated. Failure of such samples to meet all grading requirements for the aggregate shall be considered cause for discontinuance of such stockpiling procedures.

I. The aggregate shall be transferred from the stockpiles in such a way as to obtain a material having a uniform grading.

3.2 PROTECTION FOR AGGREGATE

A. The equipment and methods utilized in the production, storage, transportation and final placement of aggregate materials shall be such as to provide in-place materials meeting all requirements as specified.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 METHOD OF MEASUREMENT

A. Unless otherwise noted in the Special Provisions, no separate measurement will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

4.2 BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be lump sum.

END OF SECTION 02190

SECTION 02220

TRENCH EXCAVATION

1.0 GENERAL

1.1 SUMMARY

A. This section consists of excavation and trenching for pipelines, handling and storage of materials and preparation of subgrade, pumping and dewatering as necessary, and dressing and surface restoration cleanup of the site.

2.0 PRODUCTS Not used.

3.0 EXECUTION

3.1 CONSTRUCTION

A. During excavation, materials suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated material shall be piled on one side of the trench only, to permit ready access to existing fire alarm boxes, fire hydrants, valves, manholes and other appurtenances. Surface drainage of adjoining areas shall be unobstructed.

B. All excavated materials not required or suitable for backfill shall be removed from the site as directed by the Contracting Officer.

C. Grading shall be done as may be necessary to prevent surface water from flowing into excavations, and any other water accumulating therein shall be promptly removed. Under no circumstances shall water be permitted to rise in unbackfilled trenches until after the pipe has been placed, tested and covered with backfill. Any pipe having its alignment or grade changed as a result of a flooded trench shall be relayed at no additional cost to the Contracting Officer.

D. Adequate provisions shall be made for maintaining the flow of sewers, drains and water courses encountered during construction. Culverts, ditches, fences, crosswalks and structures which are disturbed by this construction shall be satisfactorily restored to their original condition upon completion of the work.

3.2 SITE CONDITIONS

A. Contractor's Safety Responsibilities

1. Whether utilizing Type 1 or Type 2 trench excavation, the Contractor shall be responsible for enforcing safety and maintaining safe working

conditions in all trenching, shoring, and blasting operations to conform to OSHA regulations.

2. The Contractor shall employ qualified, properly trained personnel to design shoring, perform safety inspections of the trenches, and supervise the handling of explosives and other operations involving safety procedures, as prescribed by OSHA.

3.3 TRAFFIC CONTROL AND WARNING DEVICES

A. The Contractor shall plan and construct the project in such a manner as to minimize the interruption of the use of roads, highways, streets and sidewalks involved and shall provide for emergency access to adjacent property and fire hydrant access at all times.

B. The Contractor is responsible for providing and maintaining adequate barricades of high visibility design, flares, lanterns, signs, flaggers and pre-warning devices to alert the public, motorists and pedestrians of hazardous conditions in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways published by the U.S. Department of Transportation.

3.4 STRUCTURES

A. The Contractor shall exercise every precaution to prevent damage to existing buildings or structures in the vicinity of his work. In the event of such damages, he shall repair them to the satisfaction of the Contracting Officer of the damaged structure and at no cost to the Contracting Officer.

3.5 OVERHEAD UTILITIES

A. The Contractor shall use extreme caution to avoid a conflict, contact or damage to overhead utilities, such as power lines, street lights, telephone lines, television lines, poles or other appurtenances during the course of construction of this Project.

3.6 SURVEY MARKERS AND MONUMENTS

A. The Contractor shall use every care and precaution to protect and not disturb any survey marker or monuments, such as those that might be located at lot or block corners, property pins, intersection of street monuments or addition line demarcation. Such protection shall include marking with flagged high lath and close supervision. No monuments shall be disturbed without prior approval of the Contracting Officer. Any survey marker or monument that is disturbed or destroyed by the Contractor without approval during the construction of this Project shall be replaced at no cost to the Contracting Officer by a licensed land surveyor.

3.7 CLEANUP

A. As work progresses, that portion of the work completed shall be cleared of debris and brought to the finished grade. Upon completion of the work, the entire site shall be cleared of all debris and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. All rocks brought to the ground surface by excavation or backfilling operations shall be removed.

B. At all times during construction, the Contractor shall be responsible for dust control as directed by the Contracting Officer.

3.8 TYPE 1 TRENCH EXCAVATION

A. Excavation performed as Type 1 will not be shored or sheathed. The sides of all trenches shall be sloped back to preclude collapse in accordance with OSHA Regulations (29 CFR Part 1926.650 through 1926.652) Subpart P.

3.9 TYPE 2 TRENCH EXCAVATION

A. Excavation performed as Type 2 shall be adequately shored and sheathed in accordance with the minimum requirements of OSHA Regulations (29 CFR Part 1926.650 through 1926.652) Subpart P.

B. Portable trench boxes or sliding trench shields may be used for performing Type 2 excavation in lieu of a shoring system provided they are designed, constructed, and maintained in a manner which will provide protection equal to or greater than the sheathing or shoring required for the trench.

3.10 PREPARATION

A. Protection Of Existing Properties

1. Prior to beginning construction, the Contractor must fulfill and meet the requirements of Wyoming Statutes 37-12-301 through 37-12-304 relating to public utilities; providing definitions; providing that notice of intended excavation be given to public utilities with underground facilities located in the area of proposed excavation; and providing for exceptions. See attached copy of Title 37, Public Utilities.

2. Existing utilities which will intersect with the new pipelines or structures will be relocated by the Contracting Officer or by the Contractor when the relocation is authorized in writing. In the event the Contractor is authorized to relocate the utilities, payment will be made in accordance with the General Conditions.

3. Existing water or sewer services from the mains to private property which interfere with trenching operations may be cut and replaced at the

Contractor's option and expense. The use of such services shall in no case be interrupted for more than four (4) hours, unless specifically permitted in writing by the user.

4. Existing water mains and water services shall be protected at all times during construction operations.

3.11 PRIVATELY OWNED UTILITIES

A. Gas mains, underground electrical and telephone cables, telephone poles, light poles, etc., required to be moved to make way for new construction will be moved by others. The Contractor shall assure that all necessary arrangements are made with the appropriate utility entities prior to beginning work in the affected area, and he shall assure that all required work is coordinated with the appropriate utility entities as work progresses.

3.12 EXPLORATORY EXCAVATION

A. Location of buried utilities that might interfere with alignment or grade shall be verified by exploratory excavation prior to construction. If any existing utility interferes with the work in either alignment or grade and has to be moved, such work shall be done by the Contractor and adjustment in payment will be made at a price agreed upon before the work is started.

3.13 SHORING, SHEETING AND BRACING

A. The Contractor shall do all shoring, bracing and tight sheeting required to prevent caving and to protect his workmen, in accordance with Occupational Safety and Health Regulation Requirements, and to protect adjacent property and structures. No extra payment shall be made for these items.

3.14 DEWATERING

A. Where ground water is encountered in excavation, it shall be removed to avoid interfering with pipe laying and other construction operations. If groundwater is encountered in the excavation, work shall stop until the Base ascertains that the water is not TCE or diesel fuel contaminated. If it is not contaminated, dewatering can proceed. If it is contaminated, the water will have to be containerized and disposed of accordingly via a separate negotiated agreement.

The cost of dewatering operations will not be paid for as a separate item, but shall be merged with and considered a part of the excavation cost.

B. Discharge from dewatering operations shall be directed to approved natural drainages or storm sewers as appropriate, in the opinion of the Contracting Officer, and as approved by the Contracting Officer.

3.15 GENERAL EXCAVATION OPERATIONS

A. The Contractor shall excavate as necessary at the locations shown on the drawings, staked in the field or otherwise specified for the installation of pipelines. Excavations shall be made at each location by one of the two methods specified herein--either Type 1 or as Type 2 trench excavation. Areas of Type 1 and Type 2 trench excavation are designated on the plans or described in the Special Provisions of these specifications. However, the Contractor shall have the option of performing the opposite type excavation in any area, providing this option results in equal or less cost to the Contracting Officer.

B. Whether trench excavation is by Type 1 or Type 2, the Contractor shall take precautions and protect all adjoining private and public property and facilities, including underground and overhead utilities, curbs, sidewalks, driveways, structures, and fences. Any disturbed or damaged facilities will be suitably restored or replaced at no cost to the Contracting Officer.

C. Crossings under sidewalks or curbs may be made by tunneling only if approved by the Contracting Officer. If the Contractor elects to remove a portion of the sidewalk or curb, he must use a concrete saw for making neat joints corresponding to existing joints, compact the backfill as specified, and pour a new concrete sidewalk or curb section.

D. Excavation For Appurtenances: Excavations for manholes, hydrants, structures and other appurtenances shall be sufficient to leave clearance adequate for proper compactive effort on all sides. The depth, provisions for removing water, and other applicable portions of these specifications shall apply to excavation for appurtenances.

3.16 TRENCH DIMENSIONS

A. Trench dimensions shall be as specified below:

1. Trench width FROM the trench bottom to a point one foot above the top of the pipe shall be no less than the outside diameter of the pipe plus eight (8) inches, but not more than twenty-four (24) inches plus the pipe outside diameter. The width of the trench from the bottom of the trench to the existing ground surface shall be adequate to allow proper compactive effort along both sides of the pipe.

   a. Depth of Trench. Trench depth shall be as required for the invert grade or pipe bury shown on the plans. Care shall be taken not to excavate below the required depth.

   b. When soft or unstable material or rock is encountered at the subgrade which will not uniformly support the pipe, such material shall be excavated to an additional depth as directed by the Contracting Officer and backfilled with Type 2 Bedding Material.

2. TRENCH BOTTOM

a. The bottom of the trenches shall be accurately graded to the line and grade shown on the drawings. Bedding material shall provide uniform bearing and support for each section of the pipe at every point along its entire length. Bell holes and depressions for joints shall be dug after the trench bedding has been graded, and shall be only of such length, depth and width as required for properly making the particular type joint. Unauthorized overdepths shall be backfilled with bedding material at the Contractor's expense.

3.17 TIME OF OPEN TRENCHES

A. The Contractor will be required to conduct his work so that trenches will remain open a minimum possible time.

B. No trench excavating shall begin until approved compaction equipment is at the site where the excavating is to take place. All backfill and compacting shall be completed in all trenching and structural excavations within a maximum distance of 500 feet behind the end of newly installed pipe and the maximum distance between the newly installed pipe and the excavator shall be 200 feet. For each work group consisting of trench excavator, a pipelaying crew, and a backfilling and compacting crew, the maximum allowable open ditch at any time will be 700 feet. The maximum distance behind the end of the new pipe shall be 1,500 feet for gravel replacement or for base placement or pavement replacement.

C. Certain conditions, as provided in the Special Provisions of these specifications, may necessitate the closing of certain sections of trench prior to daily, weekend or holiday shutdown.

3.18 EQUIPMENT

A. The use of trench digging machinery will be permitted except in places where its operation will cause damage to existing structures or features, in which case hand methods shall be employed.

B. Any equipment on tracks, which is to be used on pavement, shall be equipped with suitable pads to prevent damage to the pavement. All pavement damaged during construction by the Contractor's equipment shall be restored to its original condition by the Contractor. No compensation will be allowed for pavement replacement other than as specified elsewhere.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 METHOD OF MEASUREMENT

A. Full compensation for all trenching, utility support and protective work operations required to accommodate or safeguard public traffic, and all other incidental work and material required to construct the trench system shall be considered as included in the prices paid for the various contract items of trenching and/or excavation work, and no additional compensation will be allowed therefore.

B. Trench excavation for pipelines shall include all quantities used and called for in this section including right-of-way excavation and trenching. Trench excavation shall be measured as the actual length from end to end of pipe buried at the specified depth ranges. Measurements will not include excavation made for purposes other than installation of pipeline nor for trenching done for the Contractor's convenience.

4.2 BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

4.3 WYOMING STATE STATUTES

5.0 Regarding damage to underground public utility facilities.

6.0 The following is a copy of Article 3- Damage to underground public facilities.

(COPY)

ARTICLE 3. DAMAGE TO UNDERGROUND PUBLIC

UTILITY FACILITIES

37-12-301 DEFINITIONS

A. As used in this act:

1. "Business day" means any day other than Saturday, Sunday or legal holiday;

2. "Excavation" means any operation in which earth, rock or other material on or below the ground is moved or otherwise displaced by means of power tools, power equipment or explosives, and includes grading, trenching, digging, ditching, drilling, auguring, tunneling, scraping and cable or pipe blowing and driving, except tilling of soil and gardening or agricultural purposes;

3. "Person" means an individual, partnership, municipality, state, county, political subdivision, utility, joint venture or corporation, and includes the employer of an individual; and

4. "Underground facility" means any item of personal property buried or placed below ground for use in connection with the storage or conveyance of water, sewage, electronic, telephonic or telegraphic communications, electric energy, oil, gas or other substances and including but not limited to pipes, sewers, conduits, cables, valves, lines, wires, manholes, attachments and those parts of poles below ground;

5. "This act" means W.S. 37-12-301 through 37-12-304. (Laws 1978, ch. 46, para. 1.)

37-12-302 Public utilities to file names and addresses of owners of underground facilities with county clerk; notice of excavation by excavator; public utilities to supply information upon notice; exceptions.

A. Every person having the right to bury underground facilities shall file with the county clerk in each county where underground facilities are located a general description of the area served together with the name, address and telephone number of the person in that county from whom necessary information may be obtained concerning the location of underground facilities within that county.

In counties where an association pursuant to W.S. 37-12-304 is established, the name, address and telephone number of the association shall be filed with the county clerk on behalf of all participating members.

B. Architects, engineers, or other persons designing or requiring excavation shall obtain information from persons with underground facilities, as to the nature and location of underground facilities and then make such information and location a part of the plan by which the contractors operate.

C. Except as hereafter provided, no person shall make or begin excavation without first notifying any person having underground facilities in the area of the proposed excavation except an employee with respect to his employer's facility. Notice shall be given by telephone or in person. If an association exists within the county pursuant to W.S. 37-12-304, notice to the association is notice to each member thereof in the county.

D. A person shall, upon receipt of the notice provided for in subsection (c) of this section, advise the excavator of the location and size of underground facilities in the proposed excavation area by marking the location of the facilities with stakes, paint or by other clearly identifiable marking within eighteen (18) inches horizontally from the exterior sides of the underground facilities, and the depth of the underground facility, if known. The person providing information shall respond no later than two (2) full business days after receipt of the notice.

E. Emergency excavations are exempt from the provisions of subsections (c) and (d) of this section.

F. If information requested pursuant to subsections (c) and (d) of this section is not provided within the time specified therein, or if the information provided fails to identify the location of the underground facilities in accordance with subsection (d) of this section, then any person damaging or injuring underground facilities shall not be liable for such damage or injury except on proof of negligence.

G. Compliance with this section does not excuse a person from acting in a careful and prudent manner, nor does compliance with this section excuse a person from liability for damage or injury for failure to so act. (Laws 1978, ch. 46, para. 1.)

37-12-303 Notice to public utilities of damages to underground facilities.

A person who, in the course of excavation, contacts or damages an underground facility shall immediately notify the person owning the facility. (Laws 1978, ch. 46, para. 1.)

37-12-304 Association of public utilities; formation; duties.

A. Two (2) or more public utilities, municipalities or other persons having underground facilities may form an association providing for mutual receipt of notification of excavation activities in a specified area. In areas where an association is formed, public utilities, municipalities or other persons with underground facilities in the area shall become members of the association,

receive the service furnished by the association and pay their share of the cost for the service provided.

B. The association shall:

1. File with the county clerk a description of the geographical area served by the association;

2. List the name, address and telephone number of every member and submit the list to the county clerk; and

3. Maintain adequate records documenting compliance with the requirements of this act. (Laws 1978, ch. 46, para. 1.)

Effective date - Section 2, ch. 46, Laws 1978, makes the act effective May 27, 1978.

END OF SECTION 02220

SECTION 02225

TRENCH BACKFILL

1.0 GENERAL

1.1 SUMMARY

A. This section consists of handling and storage of materials to be used for fill and backfill; backfill; and final grading.

2.0 PRODUCTS

2.1 MATERIALS

A. Pipe Bedding Material

1. Type 1 Bedding material around the pipe from six (6) inches under the pipe to six (6) inches (150 mm) over the pipe shall consist of select course grained soils (over 50% retained on a no. 200 Sieve (0.075 mm)) such as gravel, sand, or silty sand meeting unified soil classification requirements for type GW, GP, GM, GC, SW, SP, SM & SC, or as specifically approved by the Contracting Officer. Bedding material shall not consist of fine soil (less than 50% retained on a No. 200 sieve (0.075 mm)) such as silt, clay & organic soils meeting requirements for soil types ML, CH, & PT. Bedding material shall be free from clods, frozen material, or stones larger than 3/4 inch (19 mm) in their maximum dimension. Where wet or otherwise unstable conditions exist, the material in this zone shall be free draining, non-plastic material. Where suitable material is available in the material excavated from the trench, the Contractor may procure the select material by screening, sifting or manually sorting the material removed from the trench in a manner approved by the Contracting Officer.

2. Type 2 Pipe Bedding required for foundation in over-excavated trenches shall consist of the bedding material from six (6) inches (150 mm) under the pipe and down. The bedding material shall consist of sand, sandy gravel, compacted rock or gravel having a maximum size of ½ inches (38 mm), uniformly graded and having a maximum plasticity of six (6) as determined by AASHTO Methods T-89 and T-90.

B. Cement Treated Fill

Cement treated fill, when required, shall meet the following criteria:

INGREDIENTS	
CEMENT (1.0 SACK)	94-100 lbs/cy
WATER	50-52 gals
AGGREGATE	3000 lbs/cy
SIEVE SIZE ¾“	100% passing
SIEVE SIZE #200	0-12% passing

The maximum desired 28 day strength is 150 psi.

3.0 EXECUTION

3.1 CONSTRUCTION

A. Common And Select Backfill

1. All trenches shall be backfilled immediately after grade, alignment and jointing of the pipe has been inspected and approved by the Contracting Officer. Leakage tests, pressure tests or tests for alignment and grade shall be performed after backfill. If any test fails, the Contractor shall be responsible for work required to correct the defects at no additional cost to the Contracting Officer.

2. After the select pipe bedding material has been placed and compacted as specified above, the remainder of the trench backfilling shall be done. All backfill material shall be free from cinders, ashes, refuse, organic and frozen material, boulders, or other materials that are unsuitable. From one (1) foot (300 mm) above the top of the pipe to six (6) inches (150 mm) below the ground surface, or to the subgrade elevation for streets or paved surfaces, material containing stones up to eight (8) inches (200 mm) in the greatest dimension may be used.

3. Trench backfill from the top of the pipe bedding material to ground surface or to the subgrade of street surfacing is separated into two classifications. Type A trench backfill refers to compacted backfill in streets, paved areas, or alleys. Type B backfill is designated for fields, borrow pits, unimproved streets or other unsurfaced areas where special compaction of the trench backfill is not required. Locations of the types of backfill required shall be as shown on the plans or as designated in the Special Provisions.

4. Where shown on the plans, the Contractor shall provide embankment over the pipe above the original ground surface to a height which will satisfy the minimum depth of cover requirements. Such embankment shall be constructed to the cross section shown on the plans. No

additional compensation will be paid for embankment unless shown as a specific item on the proposal.

B. Type A Trench Backfill

1. Materials used for bedding and backfill shall be carefully deposited in layers suitable to the equipment used for compaction, wetted to 3% below to 2% above optimum moisture content, and compacted to at least 96% of maximum density as determined by AASHTO T-99 (Standard Proctor).

2. Compaction by flooding will not be permitted.

3. The Contractor shall provide excavation equipment to dig compaction test holes through each layer of backfill (not to be less than one (1) per 300 foot (90 m) intervals) where the layers exceed one (1) foot (300 mm) in depth. Should the tests fail, the deficiencies shall be corrected by the Contractor at his expense.

4. For **graveled streets** and **alleys** the backfill shall be completed by blading the stripped gravel back over the trench.

5. Any trench backfill or pipe bursting insert repairs within a street or drive must be cement-treated fill as described in Part 2.01 B.

C. Type B Trench Backfill

1. Materials used for Type B Trench Backfill shall not require special compaction. However, the material shall be placed in layers to achieve a density approximately equal to the density of the existing soil.

2. The Contractor may be required to mound excess earth over the top of the trench so that a depression will not be formed after the trench settles. In cultivated areas, the stripped topsoil shall be placed uniformly over the backfilled trench. The topsoil shall not be compacted but shall be graded to provide a smooth surface conforming to the adjoining ground surfaces.

3.2 COMPACTION

A. Bedding material under and around the pipe to six (6) inches (150 mm) above the top of the pipe shall be distributed by hand in maximum layers of six (6) inches (150 mm) and thoroughly compacted by tamping. Special care shall be taken to assure complete compaction under the haunches of the pipe.

B. Backfill material shall be placed in the trench for its full width on each side simultaneously. Compaction of pipe bedding shall be in accordance with the pipe manufacturer's recommendations.

C. Cement treated fill may be used at the option of the contractor. Provided it meets or exceeds the requirements set forth, no specific compaction will be required.

3.3 TESTING

A. Field density testing of compacted fill will be run at all levels. These tests will be performed by a reputable testing firm at the discretion of the Contracting Officer and hired and approved by the Contracting Officer. The contractor shall provide necessary equipment to dig test holes. The contractor shall be responsible for correction of any areas failing compaction tests, and the expense of such correction shall be borne by the contractor. The Contracting Officer shall deduct from payment to Contractor the cost of failed compaction tests.

B. The Contractor and testing firm shall follow the requirements as stated in Section 01040, Project Coordination. The Contractor shall pay for all required testing.

C. Compaction tests shall be performed every one hundred (100) linear feet of trench and for each sixteen (16) inch level of material placed and compacted. Each appurtenance shall be tested within two (2) feet of the appurtenance and for each sixteen (16) inches of material placed and compacted.

D. It shall be the responsibility of the Contractor to schedule and obtain compaction tests by an independent construction laboratory. The Contractor shall be responsible for providing copies of all tests results to the Contracting Officer.

E. The road bed shall be tested for soft spots by proof rolling. The proof roll test shall be done after passing the in-place compaction tests. Copies of the passing compaction tests, including the proctor, shall be provided to the Contracting Officers representative prior to the proof roll. Each succeeding pass of the proof roller over the road bed shall be offset by no greater than four (4) tire widths. The proof roller shall be uniformly loaded.

1. The Contracting Officer's representative shall initial the permit after the successful completion of the proof roll test. A copy of the completed permit with the approved inspections shall be submitted with the "As-Built" plans and specifications when the written notification for acceptance is requested.

2. The proof roller shall be the weight of a fully loaded ten (10) yard dump truck (approx. 50,000 lbs or more on ten (10) wheels).

3. Areas which exhibit movement, cracking, or deflection of the material shall be removed, replaced, and retested to ensure proper compaction.

4. A string line test shall be done after a passing proof roll test. The Contractor shall place blue tops at centerline of the road every fifty (50) feet and at all grade breaks and crown transitions. If the roadway is greater than forty (40) feet from face of gutter to centerline, then the Contractor shall also place quarter blue tops. The blue tops shall be placed using a generally accepted industry standard as approved by the Contracting Officer. String line tests shall be performed for all sections of the road profile complete (i.e.: subgrade, subbase, and base). Tolerances for string line shall be one-tenth (0.10) of a foot for subgrade, three-quarter (¾) inch for subbase, and one-half (½) inch for base materials. If a string line test fails, the Contractor shall rework the area to compliance. Passing string line and proof roll tests are required prior to any placement of pavement.

F. No additional compensation shall be paid to the Contractor for the required tests.

G. Scheduling for the proof roll and string line tests shall be done a minimum of two (2) working days in advance with the Contracting Officer.

3.4 TRENCH GUARANTEE

A. The Contractor shall, for a period of one (1) year after completion and final acceptance of the work, repair any trench settlement which may occur and shall make suitable repairs to any pavement, sidewalks or other structures which may become damaged as a result of backfill settlement.

B. If the Contractor elects to perform such repairs by subcontract with the Contracting Officer or with others, he shall furnish the Contracting Officer a copy of such subcontract or authorization as evidence of his faithful intention to perform the work.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02225

SECTION 02226

BACKFILLING FOR APPURTENANCES

1.0 GENERAL

1.1 SUMMARY

A. This section consists of backfilling for appurtenances.

2.0 PRODUCTS Not used.

3.0 EXECUTION

3.3 CONSTRUCTION

A. Backfill around appurtenances shall be deposited in such a manner as not to disturb the appurtenance from its proper alignment, and compacted to the finished grade. Backfill material, compaction and backfill procedures shall conform to the requirements of the related Type A or Type B backfill as specified for trenches.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02226

SECTION 02227

BACKFILLING FOR PAVEMENT

1.0 GENERAL

1.1 SUMMARY

A. This section consists of backfilling and compacting operation for construction or reconstruction of roadways, embankments, streets, parking lots and other paved surface areas.

2.0 PRODUCTS Not used.

3.0 EXECUTION

3.1 CONSTRUCTION

A. Surfaces for trenches in gravel streets or alleys shall be restored to their original shape and the surfacing material shall be of equal quality and equal thickness to that of the original surface. Gravel surfacing material shall be approved by the Contracting Officer. Care shall be taken to not contaminate existing gravel surfaces outside the trench area.

B. Subgrade for trench resurfacing shall be restored to that existing prior to the excavation and shall be placed in a manner that will permit the restoration of the surface to condition equivalent to that in which it was prior to excavation.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02227

SECTION 02231

AGGREGATE SUB-BASE AND BASE COURSES

1.0 GENERAL

1.1 SUMMARY

A. This work shall consist of furnishing and placing one or more courses of aggregate and additives, if required, on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by the Contracting Officer.

1.2 RELATED WORK

A. Section 02190, Aggregates.

B. Section 02227, Backfilling for Pavement.

C. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder

1.3 REFERENCES

A. ASTM C 911: Quick Lime, Hydrated Lime and Limestone for Chemical Uses.

B. AASHTO M 85: Portland Cement.

C. AASHTO T 180: Moisture Density Relations of Soils using a 10 lb (4.54 kg) Rammer and an 18 in (457mm) Drop.

D. AASHTO T 191: Wyoming Modified. Density of Soil in Place (Sand Cone Method).

E. AASHTO T 99: Moisture Density Relations of Soils using a 5 lb (2.27 kg) Rammer and an 18 in (457 mm) Drop.

1.4 SUBMITTALS

A. When the stationary plant method is used, the aggregate will be accepted immediately before mixing and prior to the addition of water based on periodic samples taken from the pugmill input.

B. When a road mix method is used, the aggregate will be accepted after necessary blending and before laying, based on samples taken from the

combined windrow for each lift.

2.0 MATERIALS

2.1 MATERIALS

A. The aggregates shall meet the requirements of Section 02190, Aggregates.

B. Stockpiled materials shall meet the requirements of Section 02190, Subsection 3.01, Stockpiled Aggregate.

C. Commercial additives, when required, shall meet the following requirements:

1. Hydrated Lime: Hydrated lime shall conform to the requirements of ASTM C 415.

2. Portland Cement: Portland Cement shall conform to the requirements of AASHTO M 85. Unless otherwise designated or permitted, Types I or II shall be used.

3. Fly Ash: Fly ash shall conform to the requirements of ASTM C 311 and ASTM C 618 (including Table 1A) for either Class C or Class F, as specified in the Contract Documents. Aggregates determined to be reactive shall require the use of ASTM C 618, Table 2A, Supplementary Optional Physical Requirements.

D. Unless otherwise permitted by the Contracting Officer, the product of only one mill for any one brand and type of portland cement shall be used on the project.

E. Contractor shall provide suitable means for storing and protecting the additives against dampness and other forms of damage. Cement additives which, for any reason, have become partially set or which contain lumps of caked cement shall be rejected. Cement additives may not be salvaged from discarded or used bags.

F. Other additives, when specified, shall meet the requirements set forth in the Special Provisions.

3.0 EXECUTION

3.1 PREPARATION

A. All sub base or base course material shall not be placed or any subgrade until the subgrade meets the specifications in this section.

B. Contractor shall mix the aggregate, water, and commercial additive by the Stationary Plant Method unless otherwise provided for in the Contract Documents or as approved by the Engineer.

1. The Stationary Plant Method shall meet the following requirements when adding a commercial additive.

2. The aggregate and water shall be mixed in an approved pugmill mixer. Water shall be added during the mixing operation in the amount necessary to maintain the required moisture content for compacting.

C. The mixer shall be capable of uniformly distributing the aggregate, additives, and water throughout the mixture without evidence of over wet or dry pockets of material when the equipment is operated at Contractor's desired capacity.

D. Each layer shall be compacted to a density of a minimum of ninety – five (95) percent of maximum dry density as determined in accordance with ASTM D698. Tests shall be performed be using ASTM D 2922, D 1556, or D 5195. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture and surface is produced and the aggregates firmly keyed. Water shall be uniformly applied over the materials during compaction in the amount necessary for proper consolidation.

E. The minimum number of tests taken shall be one (1) compaction test per two hundred-fifty (250) linear feet per every twelve (12) inches or material change per driving lane.

F. It shall be the responsibility of the Contractor to schedule and obtain compaction tests by an independent testing laboratory. The Contractor shall be responsible for providing copies of all tests results to the Contracting Officer. All tests shall be paid for by the Contractor.

G. The base course under pavement sections shall be tested for soft spots by proof rolling. The proof roll test shall be done after passing the in- place compaction tests. Copies of the passing compaction tests, including the proctor, shall be provided to the Contracting Officer prior to the proof roll. Each succeeding pass of the proof roller over the road bed shall be offset by no greater than four (4) tire widths. The proof roller shall be uniformly loaded.

1. The Contracting Officer’s Representative shall initial the permit after the successful completion of the proof roll test. A copy of the completed permit with the approved inspections shall be submitted with the “As-Built” plans and specifications when the notification for acceptance is requested.

2. The proof roller shall be the weight of a fully loaded ten (10) yard dump truck (approx. 50,000 lbs or more on ten (10) wheels).

3. Areas which exhibit movement, cracking, or deflection of the material shall be removed, replaced, and retested to ensure proper compaction.

H. A string line test shall be done after a passing proof roll test. The Contractor shall place blue tops at centerline of the road every fifty (50) feet and at all grade breaks and crown transitions. If the roadway is greater than forty (40) feet from face of gutter to centerline, then the Contractor shall also place quarter blue tops. The blue tops shall be placed using a generally accepted industry standard as approved by the Contracting Officer. String line tests shall be performed for all sections of the road profile complete (i.e.: subgrade, subbase, and base). Tolerances for string line shall be one- tenth (0.10) of a foot for subgrade, three-quarter (¾) inch for subbase, and one-half (½) inch for base materials. If a string line test fails, the Contractor shall rework the area to compliance. Passing string line and proof roll tests are required prior to any placement of pavement.

I. No additional compensation shall be paid to the Contractor for the required tests.

J. Scheduling for the proof roll and string line tests shall be done a minimum of twenty-four (24) hours in advance with the Contracting Officer.

K. If the required compacted depth of subbase course exceeds six (6) inches, the course shall be constructed in two (2) or more layers. The maximum compacted thickness of any one (1) layer shall not exceed six (6) inches. When vibrating or other approved types of special compacting equipment are used, the depth of a single layer of the course may be increased upon approval by Contracting Officer.

3.2 APPLICATION

A. Stationary Plant Method - Materials mixed by the stationary plant method shall be transported to the job site while it contains the proper moisture content, and shall be placed on the roadbed by means of an approved method.

B. Travel Plant Method - After the material for each layer has been placed through an aggregate spreader, windrow sizing device or aggregate hopper, the material shall be uniformly mixed by a travelling mixing plant. During mixing, water shall be added in an amount sufficient to maintain the required moisture content for compacting.

C. Road Mix Method - After material for each layer of the course has been placed, the materials shall be mixed while in the range of plus 2% or minus 4% of optimum moisture content, by means of motor graders or other approved equipment until the mixture is uniform throughout.

D. Stockpile Method - Commercial additives, if required, will be introduced into the aggregate during stockpiling operations. Water will be introduced by prewetting the stockpile of aggregate and additive. Additional water may have to be introduced during the placing of the aggregate courses.

3.3 SHAPING AND COMPACTION

A. The moisture content of the material at the time of compaction shall be within plus two or minus four percentage points of optimum.

B. If the required compacted depth of sub-base course exceeds 6"(150 mm), the course shall be constructed in 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6"(150 mm). When vibrating or other approved types of special compacting equipment are used, the depth of a single layer of the course may be increased upon approval by the Contracting Officer.

C. Each layer shall be compacted to a density of not less than 95% of maximum density as determined in accordance with AASHTO T 180, unless otherwise noted in the Special Provisions. Compactions or in place field densities will be determined by AASHTO T 191 (Wyoming Modified), or by other approved methods. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture and surface is produced and the aggregates firmly keyed. Water shall be uniformly applied over the materials during compaction in the amount necessary for proper consolidation.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02231

SECTION 02280

TOPSOIL

1.0 GENERAL

1.1 SUMMARY

A. This work shall consist of excavating and depositing topsoil in accordance with the specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross- section shown on the plans or established. Removing and stockpiling topsoil prior to grading operations shall be classified as "Unclassified Excavation."

B. "Unclassified Excavation" shall consist of the excavation and disposal of all materials encountered in the work, including excavation obtained from borrow sources, not classified under other items of the contract.

C. The item, "Topsoil Borrow", will apply only to borrow material obtained from borrow areas and placed directly in its final location. When topsoil is obtained from borrow areas and stockpiled for later use in the work the Contractor shall mark the stockpile as “Topsoil” and obtain approval of the stockpile location from the Contracting Officer.

D. Placing weed barrier and rock mulch as indicated on the Drawings.

2.0 PRODUCTS

2.1 TOPSOIL

A. Topsoil shall consist of any soil suitable for the growth of grass or other cover crops reasonably free from hard dirt, clay, rocks, or other materials with would inhibit the germination of seeds or the growth of the cover crop. Classification of soils suitable for topsoil will be at the discretion of the Contracting Officer.

2.2 ROCK MULCH

A. Rock Mulch shall be as indicated on the drawings. Types of Rock Mulch shall be in accordance with Section 02955, Landscape.

2.3 WEED BARRIER

A. Weed Barrier shall be “DeWitt Weed Barrier” manufactured by DeWitt Company, Inc. Polypropylene Division, Sikeston, Missouri (800-325-0950); or “Typar” as manufactured by Reemay, Indianapolis, Indiana (800-352-6776), or approved equal.

3.0 EXECUTION

3.1 STRIPPING AND STORING TOPSOIL

A. Prior to stripping topsoil from the designated areas, brush, grass, agricultural crops, or other suitable material shall be conserved as mulch and incorporated into the topsoil. The material shall be chopped through a brush chopper, shredded by means of a commercial- sized rotary blade mower, or reduced by other approved methods.

B. Unless it can be placed directly on the prepared slopes, topsoil shall be stockpiled for later incorporation into the work. Stockpiles shall be placed at the location and to the dimensions designated by the Contracting Officer.

3.2 PREPARATION OF AREAS

A. The embankment or cut slope areas to be covered with topsoil shall be completed to the designated lines and grades. Areas that have become crusted or hard packed shall be scarified to a depth of approximately three inches (76 mm), prior to placement of the topsoil.

3.3 PLACING TOPSOIL

A. Topsoil shall be placed in a uniform manner to a depth commensurate with the quantity of topsoil available and the area to be covered.

B. After the topsoil has been spread, large stiff clods, stones, or other foreign material that would seriously affect the effectiveness or appearance of the topsoil, shall be raked up and removed from the area. Topsoil shall be keyed to the underlying material by scarifying.

C. Water shall be applied to the topsoil at the locations and in the amounts designated. Water shall be applied in a fine spray by nozzles or spray bars in such a manner that it will not wash or erode the topsoil areas.

3.4 PLACING ROCK MULCH

A. Place rock mulch to the thickness indicated over weed barrier fabric in the areas indicated on the Plan.

3.5 WEED BARRIER

A. Place weed barrier on a properly prepared and leveled surface according to manufacturer’s recommendations as to overlap and other considerations.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02280

SECTION 02290

WATERING

1.0 GENERAL

1.1 SUMMARY

A. This item shall consist of furnishing and applying water required in the compaction of embankments, subgrades, base courses and surface course, or for the control of dust for the safety and convenience of the public, for the reduction of the dust nuisance with adjacent property, or for other purpose as directed by the Contracting Officer, in accordance with the requirements of these specifications.

2.0 MATERIALS

2.1 WATER SOURCE

A. Water required for compaction of embankments, subgrade and gravel courses may be obtained from the City Water Department, or from other sources as designated or approved by the Contracting Officer.

3.0 EXECUTION

3.1 WATER ADDED

A. Deficiencies in moisture content of embankment materials, aggregate sub-base, base, or surfacing courses shall be corrected by the addition of water by approved water distribution equipment. Water for dust control, finishing operations, and seeding shall be applied by approved distributor equipment.

1. Grading Operations. Prewetting does not guarantee that additional water will not be required. Water added to embankment material during grading operations shall be distributed in a manner that will avoid ponding or overwetting materials for the full width of each layer of material placed.

2. Aggregate Courses. Water added to aggregate courses shall be applied to the material immediately prior to mixing and placing the material.

3. Finishing Operations. Water added during finishing operations shall be uniformly applied in a fine spray across the full width of the course by means of controllable pressures and spray bars or nozzles.

4. Seeding. Water added to seeded areas shall be applied in a spray that will not wash or erode the seeded area.

5. Dust Control. Water ordered for dust control measures for the protection and safety of traffic, for abatement of air pollution, or for other purposes, shall be applied in a manner that will best accomplish the elimination of dust.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02290

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.

B. Related Sections include the following:
1. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
2. Division 3 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Contracting Officer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices, changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Contracting Officer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Contracting Officer's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 2 inches (51 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

F. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection,

detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR UTILITY TRENCHES IN BUILDING

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 SUBGRADE INSPECTION

A. Notify Contracting Officer when excavations have reached required subgrade.

B. If Contracting Officer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Contracting Officer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Contracting Officer, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Contracting Officer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Contracting Officer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, perimeter insulation.
2. Testing and inspecting underground utilities.

3. Removing concrete formwork.
4. Removing trash and debris.
5. Removing temporary shoring and bracing, and sheeting.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL IN BUILDING

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete".

D. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
1. Under building slabs, use engineered fill.
2. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. After the building area has been stripped and the existing fill removed, the top 12-inches of the exposed ground surface shall be scarified, moisture conditioned, and recompacted to 95% of the maximum dry unit weight before any new fill or foundation is placed.

2. Under footings compact existing subgrade and each layer of backfill or fill soil material, where required, to 98% of maximum dry unit weight.

3. Under building slabs-on-grade compact existing subgrade and each layer of backfill or fusion material to 98% of the maximum dry unit weight.

4. For general backfill in non-structural areas of building compact existing subgrade and each layer of backfill or fill soil material to 95% of the maximum dry weight unit weight.
5. For utility trenches, compact each layer of initial and final backfill soil material at 85%.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.16 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
   2. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
   3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95% of maximum dry unit weight according to ASTM D 698.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency who is acceptable to the Contracting Officer to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Contracting Officer.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

   1. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. (186 sq. m) or less of building slab, but in no case fewer than 3 tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet (30 m) or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet (46 m) or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Contracting Officer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Government's property.

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Government's property. Stockpile or spread soil as directed by Contracting Officer.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Government's property.

END OF SECTION 02300

SECTION 02512

PLANT MIX PAVEMENTS

1.0 GENERAL

1.1 SUMMARY

A. These specifications include general requirements that are applicable to all types of bituminous pavements of the plant mix type irrespective of gradation of aggregate, kind, and amount of bituminous material or pavement use. Deviations from these general requirements will be indicated in the specific requirements for each type.

B. This work shall consist of one or more courses of bituminous mixture constructed on the prepared foundation in accordance with these specifications and the specific requirements of the type under contract, and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Contracting Officer.

1.2 RELATED WORK

A. Section 02190, Aggregates.

B. Section 02545, Bituminous Materials.

1.3 REFERENCES

A. ASTM C 150: Portland Cement.

B. AASHTO M 303: Hydrated Lime for Asphalt Mixtures.

C. AASHTO T 230: Density of Bituminous Aggregate Mixtures.

1.4 SUBMITTALS

A. Contractor shall submit for the Contracting Officer's approval a job mix formula for each mixture to be supplied for the project fourteen (14) days prior to the use in the work. The job mix formula with the allowable tolerances shall be within the master range specified. The job mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size and a single mixing temperature. Should a change in sources of material be made, a new job mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, the Contracting Officer may establish a new job mix formula.

B. Mixing plant scales shall be checked as often as deemed necessary to assure their continued accuracy. Contractor shall have on hand not less than ten 50 pound (23 kg) weights for checking of the scales.

C. Mix designs shall be submitted for review to the Contracting Officer a minimum of fourteen (14) days prior to anticipated use in the work.

D. During production for parking lots, roadways with five hundred (500) tons or greater daily, the following shall be submitted to the Contracting Officers Representative on a daily basis:

1. Copy of asphalt heat chart.

2. Copy of total day's production quantities for the mix.

3. Records of tank stabs and asphaltic concrete manifests throughout production period for approved job mix.

4. Lime weights and manifests shall be provided.

5. Manifests for liquid anti-strip shall be provided.

1.5 DEFINITIONS

A. Plant mix pavement is considered a surface course in all cases.

B. Plant mix bituminous base is considered a sub-surface course.

2.0 PRODUCTS

2.1 MATERIALS

A. Bituminous Materials

1. The percentage of bituminous material to be added to the job-mix formula will be designated by the Contracting Officer and specified in the Contract Documents.

2. The type and grade of bituminous material will be specified in the Contract Documents. The grade may be changed one step by the Contracting Officer during construction at no change in unit price.

3. The bituminous material shall meet the applicable requirements of Section 02545, Bituminous Materials.

B. Aggregate Materials

1. Aggregates shall meet the applicable requirements of Section 02190, Aggregates.

2. During crushing operations, the coarse and fine aggregates shall be stockpiled in separate piles in such manner that they can later be combined to meet the required specifications.

3. Stockpiled material shall meet the requirements of Section 02190, Aggregates, Subsection 3.01.

4. Natural filler, when required, shall be stockpiled separately. The plans may limit or prohibit the use of crusher rejects or material from the same source as the aggregate material.

C. Commercial Additives

1. The type of commercial additive to be used will either be designated on the plans, or when no specific type is designated, any of the Commercial Additives conforming to either of the following requirements may be used:

a. Portland Cement: Portland cement shall conform to the requirements of ASTM C 150.

(1) Unless otherwise permitted by the Contracting Officer, the product of only one mill of any one brand and type of Portland cement shall be used on the project.

(2) Contractor shall provide suitable means for storing and protecting the cement against dampness. Cement which, for any reason, has become partially set or which contains lumps of caked cement shall be rejected. Cement salvaged from discarded or used bags shall not be used.

b. Hydrated Lime: Hydrated lime shall conform to the requirements of AASHTO M 303, except that not less than 93% of the hydrated lime shall consist of calcium and magnesium oxides.

D. COMPOSITION OF MIXTURES

1. The bituminous plant mix shall be composed of a mixture of aggregate, natural filler or commercial additive, if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resultant composite blend meets the job mix formula.

2. Do not furnish mix with virgin aggregate fractions that exceed the wide band limits or the tolerance ranges from the target JMF, in accordance with the following table:

Passing #4 (4.75 mm) and Larger Sieves	± 5 %
Passing #8 (2.36 mm)	± 4%
Passing #30 Sieve (0.600 mm)	± 3 %
Passing #200 Sieve (0.075 mm)	± 2%
Bituminous Material	± 0.25%
Mixing Temperature	±20°F

a. The physical properties of the mix design and plant mix product during production shall meet or fall within the following mixture properties:

Voids, Total Mix	3-5%
Voids in Mineral Aggregate	13% - 16%
Stability (lbs)	2000 Minimum (50 Blows) 2500 Minimum (75 Blows)
Flow, (0.01in.)	8-18
Tensile Strength Retained	75% minimum w/ (AASHTO T283) Lime Additive 80% Minimum w/Liquid Anti-Strip Agent
Film Thickness	8-10 Microns

b. Asphalt binder content will be determined on five hundred (500) tons or more by determining asphalt binder used as a percentage of plant mix produced. The binder's weight (mass) will be determined from delivery invoices and the quantity of material remaining in the storage tank at the end of a day's production. The calculation to determine content will include all material used during the day's production of plant mix, including asphalt binder and plant mix not incorporated into the project.

c. If the oil content is between ± 0.25% and ± 0.5%, of the approved mix design, the plant will be shut down and plant will be recalibrated before production is resumed. A letter will be sent to project engineer explaining correction. If the oil content exceeds ± 0.5% based on tank stabs on production tons of five hundred (500) tons or more, asphalt paving will be removed and replaced.

3. When a recycled plant mix is specified, use RAP for at least ten (10) percent of the total aggregate. The amount RAP may be increased or decreased up to ten (10) percent (by weight of total aggregate) from the amount specified. Adjustment of the percent of RAP may result in an adjustment of the virgin aggregate gradation.

4. In general, the point of acceptance for the aggregate will be after the material has passed through the gradation unit and prior to the addition of bituminous material. If this point of acceptance proves unsatisfactory, an alternate point of acceptance may be selected by the Contracting Officer.

3.0 EXECUTION

3.1 PREPARATION

A. Conditioning Of Existing Surface

1. Irregular surfaces of existing pavements or bases shall be brought to uniform grade and cross section as directed.

2. When specified in the Contract Documents, all longitudinal and transverse joints and all cracks shall be sealed by the application of an approved joint sealing compound before the mixture is spread upon a pavement surface. All excessive bituminous material shall be removed from joints and cracks prior to placement of the mixture.

B. Preparation Of Bituminous Material

1. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature at all times. Charts showing specified temperature range for each source of supply are available from the Headquarters Laboratory of the Wyoming Department of Transportation.

C. Preparation Of Aggregate

1. The aggregates for the mixture shall be dried and heated to the required temperature. Flames used for drying and heating shall be properly adjusted to avoid damage to the aggregate or coating the aggregate with soot, oil, or other contaminants. Burner fuels may be specified by the Contracting Officer in the Special Provisions.

2. The aggregates, immediately after heating and drying, shall be screened into two or more fractions and conveyed into separate compartments ready for batching and mixing with bituminous materials. Screening shall be at such rate and in such manner that the coarse aggregate bin or

bins shall contain less than 10% of minus #4 sieve (4.75 mm) material and the fine bin shall contain less than 10% of plus #4 (4.75 mm) sieve material.

D. Mixing

1. The dried aggregate shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job-mix formula.

2. After the required amounts of aggregate and bituminous material have been introduced into the mixer, unless otherwise specified, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate is secured.

3. For hot mix bituminous pavement, the mixture shall be produced at the lowest possible temperature that will produce a workable mix within the application temperatures specified under Section 02545, BITUMINOUS MATERIALS, Subsection 3.02. The bituminous material and aggregate shall be introduced into the mixer within the specified temperature range and shall be within 25EF of each other.

E. Bituminous Mixing Plant - General

1. Sufficient storage space shall be provided for each size of aggregate, and the different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the drier.

2. Plants used for preparation of bituminous mixtures shall conform to all requirements under Subsection 3.01(F) below, except that scale requirements shall apply only where weight proportioning is used. In addition, batch mixing plants shall conform to the requirements under Subsection 3.01(G) herein, continuous mixing plants shall conform to the requirements under Subsection 3.01(H) herein, and dryer-drum mixers shall conform to the requirements under Subsection 3.01(I) herein.

3. Mixing plants shall be of sufficient capacity and coordinated to adequately handle the proposed bituminous construction.

F. Requirements For All Plants

1. Plant Scales: Scales shall be accurate to 0.5% of the maximum load that may be required. Poises shall be designed to be secured in any position to prevent inadvertent change of position. Contractor may provide an approved automatic printer system which will print the weights of the

material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weigh ticket for each load.

2. Equipment for Preparation of Bituminous Material: Tanks for the storage of bituminous material shall be equipped to heat and hold the material at the required temperatures. The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the tank. The circulating system for the bituminous material shall be designed to assure proper and continuous circulation during the operating period. Provision shall be made for measuring and sampling storage tanks.

3. Feeder for Drier: The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and uniform temperature will be obtained.

4. Drier: The plant shall include a drier or driers which continuously agitate the aggregate during the heating and drying process. For cold-type bituminous mix, equipment for mechanical cooling of the dried aggregate to the temperature prescribed for cold mixtures shall be provided and shall be capable of supplying prepared material for the mixer to operate at full capacity.

5. Screens: Plant screens, capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.

6. Bins: The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. Separate dry storage shall be provided for commercial additives when used, and the plant shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes of such size and at such location as to prevent backing up of material into other compartments or bins. Each compartment shall be provided with its individual outlet gate, constructed so that when closed, there shall be no leakage. The gates shall cut off quickly and completely. Bins shall be so constructed that samples can be readily obtained. Bins shall be equipped with adequate telltale devices to indicate the position of the aggregates in the bins at the lower quarter points.

7. Sampling Facilities: The plant shall be equipped with suitable sampling devices or facilities to insure representative samples. If the Contracting Officer is unable to obtain samples which represent the material being accepted for incorporation into the project, Contractor shall make necessary adjustments or revisions to the plant before any further mixing is done.

8. Bituminous Control Unit: Satisfactory means, either by weighing or metering, shall be provided to obtain the proper amount of bituminous material in the mix. The accuracy of bituminous content measured either by weighing or metering may be checked by computing the daily yield of total material being processed.

9. Thermometric Equipment

   a. An armored thermometer of adequate range in temperature reading shall be fixed in the bituminous feed line at a suitable location near the charging valve at the mixer unit.

   b. The plant shall also be equipped with an approved temperature recording device so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregates. The printed temperature recordings shall be furnished to the Contracting Officer after each day's run.

10. Dust Collector: The plant shall be equipped with a dust collector constructed to waste or return uniformly to the hot elevator all or any part of the material collected as directed.

11. Truck Scales: The bituminous mixture shall be weighed on approved scales. Such scales shall be inspected as often as the Contracting Officer deems necessary to assure their accuracy.

G. Requirements For Batching Plants

1. Weigh Box or Hopper: The equipment shall include a means for accurately weighing each size of aggregate in a weigh box or hopper suspended on scales and of ample size to hold a full batch without running over. The gate shall close tightly so that no material is allowed to leak into the mixer while a batch is being weighed.

2. Bituminous Control

   a. The equipment used to measure the bituminous material shall be accurate to plus or minus 0.5%.

   b. The bituminous material bucket shall be non-tilting type with a loose sheet metal cover. The capacity of the bituminous material bucket

shall be at least 15% in excess of the weight of bituminous material required in any batch. The length of the discharge opening or spray bar shall be not less than three-quarters of the length of the mixer, and it shall discharge directly into the mixer. The size and spacing of the spray bar openings shall provide a uniform application of bituminous material the full length of the mixer.

c. The bituminous material bucket, its discharge valve or valves, and spray bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained, and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous scales. The plant shall have an adequately heated quick-acting, non-drip, charging valve located directly over the bituminous material bucket.

d. The indicator dial shall have a capacity of at least 15% in excess of the quantity of bituminous material used in a batch. The controls shall be constructed so that they may be secured at any dial setting and will automatically reset to that reading after the addition of bituminous material to each batch. The dial shall be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled so that it will begin when the dry mixing period is over and all of the bituminous material required for one batch will be discharged in not more than 15 seconds after the flow has started.

3. Mixer

a. The batch mixer shall be an approved twin pugmill type capable of producing a uniform mixture within the job-mix tolerances. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust.

b. The clearance of blades from all fixed and moving parts shall not exceed 1" (25 mm).

c. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh box gate after the charging of the mixer until the closing of the mixer gate at the completion of the cycle. It shall lock the bituminous material bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the start of introduction of bituminous material. The wet mixing period is the interval of time between the start of introduction of bituminous material and the opening of the mixing gate.

d. The control of the timing shall be flexible and capable of being set at intervals of 5 seconds or less throughout a total cycle of up to 3 minutes.

e. The setting of time intervals shall be performed in the presence of the Contracting Officer, who shall then lock the case covering the timing device until such time as a change is to be made in the timing periods.

H. Requirements For Continuous Mixing Plants

1. Aggregate Proportioning

a. The plant shall include means for accurately proportioning each size of aggregate.

b. The plant shall have a feeder mounted under each compartment bin. Each compartment bin shall have an accurately controlled, individual gate to form an orifice for volumetrically measuring the material drawn from each compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means and secured against inadvertent movement.

c. Indicators shall be provided for each gate to show the respective opening in inches.

2. Weight Calibration of Aggregate Feed: The plant shall include a means for calibration of gate openings by weighing test samples. Provision shall be made so that materials fed out of individual orifices may be bypassed to individual test boxes. The plant shall be equipped to conveniently handle individual test samples weighing not less than 200 pounds (91 kg), and accurate scales shall be provided by Contractor to weigh such test samples.

3. Synchronization of Aggregate Feed and Bituminous Material Feed: Satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bituminous material from the meter or other proportioning device. This control shall be accomplished by interlocking mechanical means or by any other positive, satisfactory method.

4. Mixer

a. The plant shall include a continuous mixer of an approved twin pugmill type, adequately heated and capable of producing a uniform mixture within the job-mix tolerances.

b. It shall be equipped with a discharge hopper with dump gates which will permit rapid and complete discharge of the mixture. The paddles

shall be adjustable for angular position on the shafts and reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge. Charts shall be provided showing the rate of feed of aggregate per minute for the aggregate being used.

c. The clearance of blades from all fixed and moving parts shall not exceed 1" (25 mm).

I. Requirements For Dryer-Drum Mixer

1. The plant shall be equipped to control aggregate gradation as described for cold feed control. The total cold aggregate feed shall be weighed continuously by an approved belt scale. When tested for accuracy, the weighing system shall register within plus and minus 0.5%. Provisions shall be made for determining the moisture content of the cold feed and correcting the aggregate weight to a dry weight.

2. An automatic digital record of the dry aggregate and the asphalt shall be displayed, recorded and totaled in appropriate units of weight and time. A positive interlock shall be provided between the dry weight of the aggregate and the bituminous material. The flow of the bituminous material shall be adjusted to compensate for the changes in the dry weight of the aggregate.

3. The dryer-drum mixer shall be capable of drying and heating the aggregate to the moisture and temperature requirements. A uniform mixture of aggregates and bituminous material shall be produced. The plant shall have a temperature recording device at the discharge chute of the dryer.

3.2 APPLICATION

A. The temperature of the mixture prior to laydown shall not be more than 25EF less than the mixing temperature.

B. Plant mix wearing course shall be placed between the dates of June 1st and September 15th unless otherwise specified by the Contracting Officer in the Special Provisions.

C. Bituminous plant mix shall not be placed on any wet surface; when the atmospheric temperatures are less than those specified in the following table; or, when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixtures:

COMPACTED THICKNESS	*MINIMUM AMBIENT TEMPERATURE	
	SURFACE COURSE	SUBSURFACE COURSE
Less than 1 Inch (25 mm)	60	55
1 Inch (25 mm) to and Including 2 Inches (50 mm)	40	40
More than 2 Inches (50 mm)	40	35
* May 1 to October 15 or as specified in the Contract Documents.		

D. Spot leveling or the bottom lift of a leveling course may be placed at 50°F if additional courses are placed on the same contract.

E. Hauling Equipment

1. Trucks used for hauling bituminous mixtures shall have tight, clean, smooth, metal beds which have been thinly coated with a minimum amount of paraffin oil or other approved material to prevent the mixture from adhering to the beds. This material shall not be used in amounts which will contaminate the mixture. When required, each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather. When necessary, so that the mixture will be delivered on the road at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

2. Railroad cars used for transportation of cold-laid bituminous mixtures shall be in good condition and without pockets. All projecting spikes, nails, foreign material, and other obstructions likely to interfere with efficient unloading shall be removed from the cars. The bottoms of the cars shall be covered with a thin layer of clean sand or screenings, and the top of the load shall be protected from contamination by moisture or foreign materials, and from the loss of volatile material.

F. Spreading And Finishing

1. The mixture shall be laid upon an approved surface, spread, and struck off to the grade and elevation established. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.

2. When the total compacted thickness of the mat is to be in excess of 2" (50 mm), it shall be placed in two or more lifts. The compacted thickness of any one lift in multiple-lift construction shall not exceed 2" (50 mm).

3. Except on tapers, narrow median areas, shoulders, and other such areas of irregular shape, limited length or restrictive width, or such other areas as directed, the paver screed shall be controlled by the automatic screed control described under Subsection 3.02(G) herein.

4. The Contracting Officer will perform such engineering as may be required to establish controls for the work and will set references for line and grade controls at reasonable intervals along the work.

5. Contractor shall furnish, place, and maintain such materials, devices, and equipment as may be required to provide specified independent line and grade control references and other controls which may be required for proper execution of the work.

6. Line and grade control for use with automatic paver control systems shall be an independent control reference consisting of:

   a. A tightly stretched wire or string line offset and paralleling true line for pavement edge and established grade for pavement surface;

   b. A floating beam of not less than 20' (6 m) in length attached to the paver and riding on previously placed base or pavement material. The beam shall be equipped with a floating string or other device that will actuate the automatic screed control in reference to the base on which it is riding. Unless otherwise permitted by the Contracting Officer, the first ribbon of the first course of pavement material shall be controlled by the independent control wire. Subsequent ribbons may be controlled by the beam reference system.

7. The longitudinal joint in one layer shall offset that in the layer immediately below, by at least 6" (150 mm). Longitudinal joint locations may be otherwise specified in the Contract Documents.

8. Defects caused by trucks bumping into the laydown machine or by unnecessary stopping due to lack of coordination between mixing, hauling, and laydown shall be removed and replaced in accordance with Subsection 3.04.

9. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked and luted by hand tools. For such areas the mixture shall be dumped, spread, and screeded to give the required compacted thickness.

10. Plant mix surfacing ribbons shall be brought up approximately even at the end of each shift on those projects being constructed under traffic.

G. Bituminous Pavers

1. Bituminous pavers shall be self-contained, power-propelled units, provided with an activated screed or strikeoff assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thickness shown on the plans. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant mix material in widths shown on the plans.

2. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

3. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

4. Pavers shall be equipped with a paver control system which will automatically control the laying of the mixture to specified transverse slope and established longitudinal grade. The paver control system shall be automatically actuated from an independent line and grade control reference and through a system of mechanical sensors and sensor directed devices which shall maintain the paver screed at the proper transverse slope and at proper height to establish the top surface of the finally compacted mixture at specified slope and grade. In case of failure of the control system, the paver shall be operated by mechanical control only until the material under production at the time of breakdown is laid.

5. The paver shall be capable of being operated, when laying mixtures, at forward speeds consistent with satisfactory laying of the mixture.

6. A paving leveler shall be used when specified as shall be described in the Special Provisions.

H. Rollers

1. All rollers shall be in good condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment which results in excessive crushing of the aggregate will not be permitted.

2. The pneumatic-tired roller shall be self-propelled with a total weight, including ballast, not greater than 30 tons (27 Mg). The roller shall be constructed so contact pressure may be varied between 40 psi (275 kpa) and 90 psi (620 kpa).

3. Wobble wheel rollers are not permitted. Each roller shall be equipped with not less than 7 wheels with tires of equal size and ply and having a smooth tread design. The wheels shall be staggered on the front and rear axles to provide complete coverage, have a system for uniformly moistening each wheel without an excess of water, and have close-fitting scrapers for each wheel. The tire pressures shall not vary by more than 5 psi (35 kpa) between individual tires from the designated pressure.

I. Compaction

1. Immediately after the bituminous mixture has been spread and struck off and the surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. Rolling shall be continued while the mixture is in a workable condition until all roller marks are eliminated and, unless otherwise designated on the plans, until a minimum of the required density (see table) as established by test results as determined by an approved laboratory, has been obtained. Samples shall be taken in accordance with ASTM D 5361 or density will be determined by the use of properly calibrated Nuclear Density Gauge.

TABLE OF MINIMUM DENSITY REQUIREMENTS

New construction inside city right-of-way.	92% of theoretical maximum density as Established by ASTM D2041.
Construction outside the city right-of-way (patching, parking lots).	94% of maximum density as established by ASTM D1559.
Patching inside city right-of-way.	94% of maximum density as established by ASTM D1559.
Overlays	Density requirement shall be achieved when a determined number of passes of a steel wheel roller establishes the compaction of the mix no longer increases as determined by use of a nuclear density gauge.

2. The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction without undue displacement, cracking, or shoving. Pneumatic tires shall be inflated to obtain the contact area pressures designated by the Contracting Officer.

3. Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the road centerline, each trip overlapping one-half of the roller width. Roller shall move at a slow, uniform speed with the drive wheels or rolls nearest the paver except on steep grades.

4. When the pavement is placed by machines in echelon or abutted against a previously placed lane, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. On superelevated curves, the rolling shall begin at the low side and progress to the high side by overlapping of longitudinal trips parallel to the centerline.

5. Any displacement occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture when required. Care should be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture.

6. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with very small quantities of detergent or other approved material. Excess liquid will not be permitted.

7. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, a trench roller may be used, or cleated compression strips may be used under the roller to transmit compression to the depressed area.

8. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform with the surrounding area. Any area showing an excess or deficiency of bituminous material shall be removed and replaced.

J. Joints

1. Placing of the bituminous paving shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the Contracting Officer. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. When directed by the Contracting Officer, a brush of bituminous material shall be used on contact surfaces of transverse joints just before additional mixture is placed against the previously rolled material.

3.3 PROTECTION

A. During any delays or suspensions of work, as outlined in the Contract Documents, Contractor shall be responsible for maintaining the quality of all leveling courses until the placement of additional courses. Maintenance of leveling courses because of delays or suspension of work will be done at Contractors expense unless otherwise specified in the Contract Documents.

3.4 QUALITY CONTROL

A. The surface will be tested by the Contracting Officer using a 10' (3m) straightedge provided by the Contractor at selected locations. The variation of the surface from the testing edge of the straightedge between any two (2) contacts with the surface shall at no point exceed one-quarter (¼) inch. All humps or depressions exceeding the specified tolerance shall be corrected by removing defective work and replacing it with new material, or as directed.

B. Contractor shall perform gradation verification testing every one thousand (1,000) tons of material produced. Particle size analysis sample to be taken at the hot mix plant from the cold feed belt.

C. Minimum compaction of the mat shall be in accordance with the table indicated in this section as established by ASTM D 2041 or ASTM D 6926 and D 2726. Density shall be determined by coring in accordance with ASTM D 5361 and compaction verified by ASTM D 1188 or ASTM D 2726. The rate of testing shall be every five hundred (500) tons or every three hundred (300) linear feet of street. The use of a nuclear density gauge, per ASTM D 2950, is acceptable for quality control and acceptance. To use for quality control and acceptance, a nuclear density gauge must be correlated by coring and must be based on a minimum of seven (7) cores. Samples for determining maximum density shall be taken in accordance with ASTM D 979. Testing shall be paid by for the Contractor.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02512

SECTION 02516

MILLING & PROFILE MILLING EXISTING PAVEMENT

1.0 GENERAL

1.1 SUMMARY

A. This work shall consist of milling, removing, and disposing of milled pavement materials in accordance with this specification and details shown on the plans.

2.0 PRODUCTS

2.1 EQUIPMENT

For full roadway width milling, the cold-milling equipment shall be a power operated milling machine equipped to perform the following:

A. Remove a strip of material at least six (6') ft. wide and a minimum of two (2") inches in depth during a single pass.

B. Prevent the escape of dust from the operation into the atmosphere through devices such as conveyor belt covers and water sprayers.

C. Establish a profile grades by referencing from either the existing pavement or from an independent grade control, and with a positive means of controlling cross slope elevations.

D. For Profile Milling Plant Mix, the milling machine shall establish line and grade control by the use of an automatic control system with independent control reference consisting of:

1. A tightly stretched wire or string line offset and paralleling true line for establishing grade for the milled surface; or

2. A floating beam of not less than twenty (20) feet in length attached to the milling machine and riding on the curb or previously milled surface. The beam shall be equipped with a floating string or other device that will actuate the automatic grade control device in reference to the surface on which it is riding. Unless otherwise permitted by the Engineer, the first ribbon of milling shall be controlled by the independent control wire. Subsequent ribbons may be controlled by the beam reference system; or

3. Non-contact electronic sensors may be used.

E. Be capable of milling any concrete pavement or paving fabric encountered in the existing asphalt pavement section.

F. Be self propelled with sufficient power, traction and stability to maintain an accurate depth of cut.

The use of smaller, skid-steer type milling machines will be allowed for edge milling, in areas where access is limited, or as approved by the Contracting Officer.

The Engineer has the right to reject, and require removal from the job, of any milling equipment that does not meet the above requirements.

3.0 EXECUTION

3.1 CONSTRUCTION

A. The designated existing bituminous and concrete pavement shall be removed by cold-milling to the lines and limits shown on the plans or established by the Engineer. The pavement shall be removed without damage to the underlying base course or pavement surface. The resulting pavement surface shall be smooth and free of excessive scarification marks or other damage, as determined by the Engineer. Contractor shall correct vertical differences greater than 3/8" between adjacent peaks and valleys of the milled surface using cold milling or other operations, at no additional cost to the Government.

Milled pavement materials shall become the property of the contractor, unless otherwise specified.

B. The sequence for milling will be determined based on the Contractor's milling equipment, width of area to be milled, cross slope and thickness of pavement, and traffic control requirements of the project.

C. When Profile Milling is specified, milling depths will vary across the roadway's length, width, or both. Contractor is to mill the roadway across its full width to establish the cross-slope to the specified profile.

D. Work may include transition milling into structures, into project tie-ins, at box culverts, and at the beginning and end of project transitions. Contractor is responsible for providing adequate grades of transitions that allow for safe travel of vehicles at the posted work zone speed limits.

E. Traffic will be allowed to travel on milled surfaces prior to paving, unless otherwise specified or agreed to by the Contracting Officer. All temporary striping and traffic control required for running traffic on milled surfaces will be considered. Any damages to the existing pavement surfaces resulting from allowing traffic to run on milled surfaces will be repaired prior to paving at the expense of the Contractor.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 METHOD OF MEASUREMENT

A. Milling of existing pavement will not be measured separately for payment.

4.2 BASIS OF PAYMENT

A. Basis of Payment will be made on a percentage of completion, not for each element in the Bid Schedule. The bid Schedule will be lump sum.

END OF SECTION 02516

SECTION 02528

CONCRETE CURBS AND COMBINED CURBS AND GUTTERS

1.0 GENERAL

1.1 SUMMARY

A. Curbs or combined curbs and gutters shall consist of air-entrained Portland Cement Concrete constructed in accordance with these specifications. This work shall be in reasonably close conformity with the lines and grades, thicknesses, and typical cross sections shown on the plans or established by the Contracting Officer.

2.0 PRODUCTS

2.1 MATERIALS

A. Portland Cement Concrete: Air-entrained Portland Cement Concrete shall conform to the requirements of Section 03304, Subsection 2.08, Class 4000.

B. Reinforcing Steel: Reinforcing steel shall conform to the requirements of ASTM A 615 –Grade 60.

C. Preformed Expansion Joint Material: Joint material shall comply with the requirements of AASHTO M 2l3, ASTM D 994, ASTM D 1751, or ASTM D 1752.

3.0 EXECUTION

3.1 GENERAL

A. Curbs and curb and gutter shall be constructed at the locations shown on the plans and where directed by the Contracting Officer and shall be in accordance with these specifications and plans.

3.2 SUBGRADE AND BASE COURSE PREPARATION

A. The subgrade shall be excavated or filled with suitable material to the required grades and lines.

B. All soft, yielding, and otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted and extend a minimum of one foot (300 mm) outside the form lines.

C. The subgrade shall be 90% of maximum dry density as determined by AASHTO T 180 modified proctor density.

D. When required on the plans base course will be installed to the required grade in accordance with Section 02231, Subsection 3.03.

3.3 CONCRETE PLACEMENT

A. The concrete shall be placed either by an approved slipform/extrusion machine, by the formed method, or by a combination of these methods.

B. The slipform/extrusion machine approved shall be so designed as to place, spread, consolidate, screed, and finish the concrete in one complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section.

1. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed.

2. It shall be operated with as nearly a continuous forward movement as possible. All operations of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.

C. The formed method shall consist of setting forms, placing concrete and finishing.

1. Form material shall be straight and free from warp, having sufficient strength to resist the pressure of the concrete without displacement and sufficient tightness to prevent the leakage of mortar. Flexible or rigid forms of proper curvature may be used for curves having a radius of 100 feet (30 m) or less. Division plates shall be metal.

2. The front and back forms shall extend for the full depth of the concrete. All of the forms shall be braced and staked so that they remain in both horizontal and vertical alignment until their removal.

3. They shall be cleaned and coated with an approved form-release agent before concrete is placed against them.

4. The concrete shall be deposited into the forms without segregation and then it shall be tamped and spaded or mechanically vibrated for thorough consolidation.

5. Low roll or mountable curbs may be formed without the use of a face form by using a straightedge and template to form the curb face. When used, face forms shall be removed as soon as possible to permit finishing.

6. Front and back forms may be removed at such time as the concrete is sufficiently set that removal will not chip, spall or otherwise damage the

concrete. When forms are removed before the expiration of the curing period, the edges of the concrete shall be protected with curing compound.

3.4 FINISHING

A. The surface of the concrete shall be finished true to the lines and grades shown on the plans.

B. Concrete shall be worked until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. The surface shall then be floated with a wooden float to a smooth and uniform surface.

C. When the concrete has hardened sufficiently the surface shall be given a broom finish. The broom shall be an approved type. The stokes shall be square across the concrete from edge to edge with adjacent strokes overlapped. Strokes shall be made without tearing the concrete. The broomed finish shall produce regular corrugations not over one-eighth inch (3 mm) in depth.

D. Concrete that is adjacent to forms and formed joints shall be edged with a suitable edging tool to the dimensions shown on the plans.

3.5 JOINTING

A. Contraction Joints: Transverse weakened-plane contraction joints shall be constructed at right angles to the curb line at intervals not exceeding 15 feet (4.5 m). Joint depth shall average at least l/4 of the cross section of the concrete.

1. Contraction joints may be sawed, handformed, or made by l/8-inch (3 mm) thick division plates in the formwork.

2. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking.

3. The joints may be handformed either by (1) using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete, or (2) inserting 1/8-inch (3 mm) thick steel strips into the plastic concrete temporarily. Steel strips shall be withdrawn before final finishing of the concrete.

4. Where division plates are used to make contraction joints, the plates shall be removed after the concrete has set and while the forms are still in place.

B. Expansion Joints: Expansion joints shall be constructed at right angles to the curb line at immovable structures and at points of curvature for short-radius curves.

1. Filler material for expansion joints shall be furnished in a single 3/4-inch thick piece for the full depth and width of the joint.

2. Expansion joints in a slipformed curb or curb and gutter shall be constructed with an appropriate hand tool by raking or sawing through partially set concrete for the full depth and width of the section. The cut shall be only wide enough to permit a snug fit for the joint filler. After the filler is placed, open areas adjacent to the filler shall be filled with concrete and then troweled and edged.

3. Alternately, an expansion joint may be installed by removing a short section of freshly extruded curb and gutter immediately, installing temporary holding forms, placing the expansion joint filler, and replacing and reconsolidating the concrete that was removed. Contaminated concrete shall be discarded.

C. Construction joints may be either butt or expansion type joints.

D. Curbs or combined curbs and gutters constructed adjacent to existing concrete shall have the same type of joints as in the existing concrete, with similar spacing; however, contraction joint spacing shall not exceed 15 feet (4.5 m).

3.6 PROTECTION

A. The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slipform construction, materials such as wood planks or forms to protect the edges shall also be required.

B. When concrete is being placed in cold weather and the temperature may be expected to drop below 35EF., suitable protection shall be provided to keep the concrete from freezing until it is at least 72 hours old. Concrete injured by frost action shall be removed and replaced at the Contractor's expense.

3.7 CURING

A. Curing shall be in accordance with Section 03370, Concrete Curing.

3.8 BACKFILLING

A. After the concrete has set sufficiently, the spaces in front and back of curbs shall be backfilled with original material or as shown on the drawings to the required elevations.

B. The backfill material shall be thoroughly compacted to a density equal to that of adjacent materials.

3.9 TOLERANCES

A. The work shall be performed in a manner which results in a curb and gutter constructed to specified line and grade, uniform in appearance and structurally sound.

B. Curb and gutter found with unsightly bulges, ridges, low spots in the gutter or other defects shall be removed and replaced at the Contractor's expense if the Contracting Officer considers them to be irreparable.

C. When checked with a ten foot (3 m) straightedge, grade shall not deviate more than 1/4 inch (6 mm), and alignment shall not vary more than 2 inch (12.5 mm).

D. Final elevation shall not depart from plan elevation by more than 2 inch (12.5 mm).

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02528

SECTION 02545

BITUMINOUS MATERIALS

1.0 GENERAL

1.1 SUMMARY

A. These specifications include general requirements applicable to all types of bases or pavements that require the application of bituminous materials by spray or mix. Deviations from these general requirements will be indicated in the specific requirements for each type.

1.2 RELATED WORK

A. Section 02512, Plant Mix Pavements.

1.3 REFERENCES

A. AASHTO M 81: Cut-Back Asphalt (Rapid Curing Type).

B. AASHTO M 82: Cut-Back Asphalt (Medium Curing Type).

C. AASHTO M 140: Emulsified Asphalt.

D. AASHTO M 141: -70 Slow Curing Liquid Road Material.

E. AASHTO M 208: Cationic Emulsified Asphalt.

F. AASHTO M 226: Table 1, Viscosity Graded Asphalt Cement.

G. AASHTO T 40: Sampling Bituminous Materials.

1.4 SUBMITTALS

A. Bituminous material may be conditionally accepted at the source based on test reports furnished by Contractor for each 40 tons (36 Mg) or 10,000 (40 m3) gallons loaded.

B. A sample of each load of Asphaltic Materials is to be obtained at the time of conveyance loading, and the Certificate of Compliance, together with this sample, shall be surrendered to the Contracting Officer on the project. Sampling shall be accomplished using methods described and outlined in AASHTO T 40.

C. Tank trucks delivering bituminous material to the project shall be equipped with a sampling cock on the discharge pipe.

D. Bituminous materials used on the project which do not meet the specification requirements for the type and grade specified may, at the direction of Contracting Officer:

1. Be rejected and Contractor required to remove and replace all materials affected by the out-of-specification material at his expense;

2. Be accepted and left inplace and the contract price of the bituminous material deducted, or be accepted at a reduced unit price as directed by the Contracting Officer.

2.0 PRODUCTS

2.1 MATERIALS

A. Bituminous materials shall meet all applicable requirements. No materials or products other than those designated in this Section will be added to bituminous material without the express permission of Contracting Officer.

2.2 ASPHALT CEMENTS

A. The grades shown on the plans shall conform to the specifications of AASHTO M 226, Table 1, with the following modifications:

TEST	PG 64-28	PG 64-22
Penetration, 77°F (25°C) 100g, 5 sec (min.)	60	35

B. The spot test shall be negative for all grades when tested with naphtha xylene solvent using 15% xylene.

2.3 LIQUID CUTBACK ASPHALTS

A. Liquid cutback asphalts shall conform to the requirements of AASHTO M 81, AASHTO M 82, and AASHTO M 141. The spot test shall be negative for all grades when tested with naphtha xylene solvent using 15% xylene. The Saybolt-Furol viscosity alternate will not apply.

2.4 EMULSIFIED ASPHALTS

A. Emulsified asphalts shall conform to the following requirements:

1. Emulsified Asphalt (Anionic) AASHTO M 140

2. Emulsified Asphalt (Cationic) AASHTO M 208

B. The designation "h" added to any grade of Emulsified Asphalt requires the residue from distillation to have a penetration from 40 to 90.

C. The following exceptions apply to grade CMS-2 only:

1. Viscosity: Seconds Saybolt-Furol at 122°F 50 Min.-500 Max.

2. Distillation: % Residue 60 Min.

3. Distillation: Oil Distillate, by volume of emulsion - to be determined by independent laboratory from produced materials, not to exceed 20%.

D. The letter "F" following the bituminous material type designation shall require a satisfactory antistripping agent be added to the material at the refinery.

E. The presence of antistripping agents will be determined in accordance with the Wyoming Quick Bottle Test or other approved means.

3.0 EXECUTION

3.1 PREPARATION

A. The water used for the dilution shall be free of sediment and other deleterious matter.

3.2 APPLICATION

A. The rate of emulsified asphalt used for fog seal or tack shown in the Contract Documents is the rate of Emulsified Asphalt as received from the refinery.

B. The emulsified asphalt used for tack may be diluted in the field at a rate of 50% emulsified asphalt and 50% additional water.

C. The emulsified asphalt used for fog seal may be diluted in the field at a rate of 33% emulsified asphalt and 67% additional water.

D. Both the dilution water and the emulsion shall be heated to approximately 110°F prior to mixing, and this approximate temperature shall be maintained during the application. Dilution shall be made by introducing the water into the emulsified asphalt.

E. Bituminous materials for the various types of applications shall be loaded and applied within the temperatures indicated in the following table:

TYPE AND GRADE OF MATERIAL	APPLICATION - SPRAY EF	MIXING TEMPERATURE FE
RT 1, 2 and 3	60 to 130	60 to 130
RT 5 and 6	85 to 150	85 to 150
RT 7, 8 and 9	150 to 225	150 to 225
RT 10, 11 and 12	175 to 250	175 to 250
RC 70	100 to 180	90 to 140
250	160 to 220	140 to 175
800	175 to 250	170 to 210
3000	220 to 275	200 to 240
MC 30	90 to 180	60 to 120
70	120 to 200	95 to 140
250	160 to 220	140 to 200
800	175 to 250	175 to 240
3000	200 to 290	200 to 250
SC 70	120 to 200	95 to 140
250	160 to 220	140 to 200
800	175 to 250	175 to 210
3000	200 to 290	200 to 250

F. The maximum loading temperature for asphalt cements shall be 350°F.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of Payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02545

SECTION 02581 - UNDERGROUND DUCTS AND MANHOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic conduit.
   2. Underground duct markers.

B. Related Sections:
   1. Section 02315 - Excavation and Fill: Product and execution requirements for excavation and backfill required by this section.
   2. Section 02320 - Backfill: Requirements for backfill to be placed by this section.
   3. Section 02324 - Trenching: Execution requirements for trenching required by this section.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE C2 - National Electrical Safety Code.

B. National Electrical Manufacturers Association:
   1. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   2. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

C. Underwriters Laboratories Inc.:
   1. UL 651A - Type A Rigid PVC Conduit.

1.3 SYSTEM DESCRIPTION

A. Interconnected system of conduits, to distribute, low-voltage power and telephone , data communications.

B. Conduit routing and manhole locations are shown in approximate locations unless dimensions are indicated. Route and locate to complete duct bank system.

C. Low-voltage: Use rigid plastic conduit.

D. Telephone: Use rigid plastic conduit.

E. Data communication: Use rigid plastic conduit.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 01351 - Sustainable Project Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
   1. Materials Resources Certificates:
      a. Certify source and origin for salvaged and reused products.
      b. Certify recycled material content for recycled content products.
      c. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
   1. Provide cost data for the following products:
      a. Salvaged, refurbished, and reused products.
      b. Products with recycled material content.
      c. Regional products.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual routing and elevations of underground conduit.

1.6 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.8 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with existing underground utilities and structures.

PART 2 PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 01351 - Sustainable Project Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:
   1. Recycled Content Materials: Furnish materials with maximum available recycled content.
   2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site

2.2 PLASTIC CONDUIT

A. Manufacturers:
   1. Harvel Plastics, Inc.
   2. Oxford Plastics Inc.
   3. Substitutions: Section 01600 - Product Requirements. Permitted.

B. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.

2.3 UNDERGROUND DUCT MARKERS

A. Manufacturers:
   1. Kolbi Pipe Marker Co.
   2. Marking Service Inc.
   3. Pipemaker.com.
   4. Rhino Marking and Protection.
   5. Seton Identification Products.
   6. Substitutions: Section 01600 - Product Requirements. Permitted.

B. Underground Warning Tape: 4 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

3.2 EXISTING WORK

A. Maintain access to existing duct bank and other installations remaining active and requiring access.

B. Extend existing duct bank installations using materials and methods compatible with existing electrical installations.

C. Clean and repair existing duct bank.

3.3 INSTALLATION - DUCT BANK

A. Install duct to locate top of ducts at depths as indicated on Drawings.

B. Install conduit with minimum slope of 4 inches per 100 feet (0.33 percent). Slope conduit and duct toward manholes and away from building entrances.

C. Cut conduit and duct square using saw or pipe cutter; de-burr cut ends.

D. Insert conduit and duct to shoulder of fittings; fasten securely.

E. Join nonmetallic conduit using adhesive as recommended by manufacturer.

F. Wipe nonmetallic conduit and duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

G. Install no more than equivalent of three 90-degree bends between pull points.

H. Install fittings to accommodate expansion and deflection.

I. Terminate conduit and duct at manhole entries using end bell.

J. Connect to existing concrete encasement using dowels.

K. Connect to manhole wall using dowels.

L. Provide suitable pull string in each empty duct except sleeves and nipples.

M. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

N. Backfill trenches in accordance with Section 02324.

O. Interface installation of underground duct markers with backfilling specified in Section 02324. Install 6 inches below finished surface.

END OF SECTION

SECTION 02590 - SITE GROUNDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Exothermic connections.
   3. Mechanical connectors.
   4. Wire.
   5. Grounding well components.

B. Related Sections:
   1. Section 03300 - Cast-in-Place Concrete: Product and execution requirements for concrete used in concrete wells.
   2. Section 13100 - Lightning Protection.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 80 - Guide for Safety in AC Substation Grounding.
   2. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
   3. IEEE C2 - National Electrical Safety Code.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SYSTEM DESCRIPTION

A. Multiple rod electrodes buried in straight line pattern around perimeter of building foundation in configuration as indicated on Drawings.

1.4 PERFORMANCE REQUIREMENTS

A. Overall Resistance to Ground: 3 ohms.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate layout and installation details of grounding components.

C. Product Data: Submit data for grounding electrodes and connectors.

D. Test Reports: Indicate overall resistance to ground.

1.6 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of electrodes and connections.

1.7 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

B. Conform to IEEE 142.

C. Substation Grounding: Conform to IEEE 80.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
   1. Erico International Corporation.
   2. Harger Lightning and Ground.
   3. Substitutions: Section 01 60 00 - Product Requirements. Permitted.

B. Product Description: Copper ground rods.

C. Diameter: 3/4 inch.

D. Length: 8 feet.

2.2 EXOTHERMIC CONNECTIONS

A. Manufacturers:
   1. Brundy.
   2. Erico.
   3. Galvan Industries.
   4. Harger Lightning and Ground.
   5. Ilsco.
   6. Substitutions: Section 01600 - Product Requirements. Permitted.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.3 MECHANICAL CONNECTORS

A. Manufacturers:
   1. Brundy.
   2. Erico.
   3. Harger Lightning and Ground.
   4. Substitutions: Section 01600 - Product Requirements. Permitted.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.4 WIRE

A. Material: Stranded copper.

B. Horizontal Electrodes: 2/0 AWG, minimum size.

C. Connections to Electrodes: 2/0 AWG, minimum size.

D. Bonding Other Objects: 2/0 AWG, minimum size.

E. Mechanical Connector: Bronze.

F. Grounding Boxes: Bronze.

2.5 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inch diameter by 24 inch long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

C. Treatment Well Liner: 8 inch diameter concrete perforated pipe.

2.6 ACCESSORIES

A. Treatment Chemicals: Use magnesium sulfate (Epsom salts), copper sulfate (blue vitriol), calcium chloride or suitable ion-producing, non-corrosive and non-toxic treating chemicals.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

C. Verify trenching is completed before installing horizontal electrodes.

3.2 INSTALLATION

A. Install rod electrodes in vertical position with bottom at least 4.5 feet below frost line.

B. Install interconnecting wire minimum 2.6 feet below finished grade level.

C. Install grounding wells and grounding boxes as indicated on Drawings.

D. Construct concrete well in accordance with Section 03300.

E. Provide chemical treatment at each vertical electrode site.
   1. Saturate treatment chemicals with water following application.
   2. Fill each electrode well to 12 inches below grade with treatment material.

3.3 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements, 01700 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13. Make final grounding system measurements three or four days after chemical treatment.

3.4 DEMONSTRATION

A. Section 01700 - Execution Requirements: Requirements for demonstration and training.

B. Demonstrate location of each accessible grounding connection and each chemical treatment well.

END OF SECTION

SECTION 02645

FIRE HYDRANTS

1.0 GENERAL

1.1 SUMMARY

A. This selection consists of installation of fire hydrants together with related appurtenances, complete.

1.2 REFERENCES

A. AWWA C-502: Standard For Dry Barrel Fire Hydrants

2.0 PRODUCTS

2.1 MATERIALS

A. **DRY-BARREL FIRE HYDRANTS**

1. Fire hydrants shall conform to standard for dry barrel fire hydrants, AWWA C-502, and modifications herein specified.

2. Fire hydrants shall have a 6" gate valve at the main connected with a swivel-tee. The fire hydrant will have a 6" mechanical joint inlet, with a 5 ¼" valve opening; the operating nut and caps will have a 1½" pentagon 1½" high; the fire hydrant shall open to the right (clockwise) with arrow cast into the top of the hydrant. The hydrant itself will be a bury depth of 6 foot to finished grade. (Refer to drawing #2645-01)

3. Type of fire hydrant - Meuller Super Centurion 250, or a Clow Medallion, complying with AWWA C502, with a working pressure of 200 PSI or greater.

4. Size of fire hydrant - 6' bury depth, 2 each - 2½" I.D. nozzles and 1 each - 4½" I.D. nozzle.

5. Threads - National standard threads

6. Color - Fire Hydrant red.

7. Extensions: they are only to be used when the BOPU approves them, they will be Mueller extensions for Mueller hydrants and Clow extensions for Clow hydrant, with a maximum extension length of 18". The contractor will supply the extensions and will be responsible for the installation of the extension.

8. Hydrants shall be of the "Compression" type with safety flange and safety stem coupling above the ground line so that they can be repaired without shutting off the water. Hydrants shall be of the dry top design with two or more "O"+ rings sealing the water from the operating mechanism. The portion of the hydrants above the ground line shall be painted red. Hydrants shall be furnished for six-foot cover unless specified otherwise in the Special Provisions.

9. Fire hydrant barrel bolts and nuts, and shoe bolts and nuts, shall be type 304 stainless steel. The mechanical joint fitting bolts and nuts shall be ASTM A 307 Grade B.

3.0 EXECUTION

3.1 INSTALLATION

A. All hydrants shall stand plumb (within 1/32 inch per five feet) with the pumper nozzle facing the street. Hydrant shall be set with the bury line set at finished grade. All parts of the fire hydrant that is below ground shall be double wrapped with polyethylene encasement.

B. Drainage shall be provided at the base of the hydrant by placing clean gravel under and around the base of the hydrant. Sufficient gravel shall be used to provide a minimum of one foot on all sides from the base of the hydrant to the point at least 6" above the drain opening. Hydrant shall be braced against unexcavated earth at the end of the trench with concrete thrust block. The hydrant shall have a kicker block 33 inches by 39 inches with a minimum length of 30" inches. Hydrant installation shall be in accordance with BOPU standard drawing. The hydrant shall be supported at the base by a concrete pad of 18"x18"x6" dimension.

4.0 METHOD OF MEASUREMENT AND PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02645

SECTION 02665

WATER DISTRIBUTION AND TRANSMISSION SYSTEMS

1.0 GENERAL

1.1 SUMMARY

A. This section consists of construction of Water Mains, including fittings, water valves, water services, water service piping, tapping the main, corporation stops, curb stops, and other appurtenances normally used for water supply and distribution systems, including furnishing and installing pipe, water valves, and fittings, construction of thrust blocking, testing, cleaning and disinfection of mains and other related work.

1.2 REFERENCES

A. AWWA C-104; Cement Mortar Lining for Ductile Iron Water Pipe and Fittings.

B. ANSI/AWWA C-105/A21.5; Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

C. AWWA C-110 and AWWA C-153; Standard for Ductile-Iron and Gray-Iron Fittings, 3" through 48", for Water and Other Liquids.

D. AWWA C-111; Rubber gasket joints for ductile iron pressure pipe and fittings.

E. AWWA C-151; Ductile Iron Pipe, Centrifugally Case, for Water and Other Liquids.

F. AWWA C-500; Gate Valves for Water and Sewerage Systems.

G. AWWA C-504; Rubber-Seated Butterfly Valves.

H. AWWA C-509; Resilient-Seated Gate Valves for Water and Sewerage Systems.

I. AWWA C-550; Protective Interior Coatings for Valves and Hydrants.

J. AWWA C-600; Installation of Ductile Iron Water Mains and Their Appurtenances.

K. AWWA C-651; Disinfecting Water Mains.

L. AWWA C-900; PVC Pressure Pipe, 4" Through 12", for Water.

1.3 QUALITY ASSURANCE

A. The Contractor shall be required to furnish certification by the manufacturer of the pipe to be furnished on this project, certifying that the pipe and fittings comply with applicable specifications. **Required Certification Shall Accompany Each Delivery Of Material.**

B. All pipe shall be clearly marked with type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

C. he contractor shall provide the Contracting Officer with two complete sets of submittals for all materials incorporated into the work. No materials shall be incorporated into the work until the Contracting Officer or its designee has provided written approval within 10 calendar days of receipt of the related submittal.

2.0 PRODUCTS

2.1 MATERIALS

A. All materials furnished and used shall be new and shall be less than two (2) years old since date of manufacture. No used material shall be allowed. All material used in water systems must be NSF approved.

B. Pipe

1. Pipe used in water main construction shall be in accordance with the following specifications:

C. Ductile Iron Pipe

1. Ductile iron pipe shall be no less than Class 52 and shall conform to the provisions of AWWA Specifications C-151.

2. Pipe joints shall be mechanical joint or APush-On@ joints conforming to AWWA Specification C-111.

3. The interior of the pipe shall have a cement mortar lining conforming to the requirements of AWWA Specification C-104. The outside surface of pipe designed for underground service shall receive a bituminous coating approximately one (1) mil thick.

4. All ductile iron pipe installed shall be double wrapped with polyethylene encased and shall meet the requirements of AWWA Specification C-105/A21.5-88. Fire hydrants fittings, valves and valve boxes, shall be double wrapped.

D. Polyvinyl Chloride (Pvc) Pressure Pipe

1. PVC pipe for the water mains shall meet the requirements of AWWA Specification C-900, “Polyvinyl Chloride Pressure Pipe”, made to ductile iron O.Ds for “Push-On” joints.

2. PVC pressure pipe shall meet all requirements and specifications as set forth in Attachment A, Standards and Specifications for PVC Pressure Pipe, as the same may be hereafter amended, attached hereto and incorporated by this reference as though fully set forth herein.

E. Casing Pipe

1. The casing pipe used for either water lines, sanitary sewer lines, or storm sewer lines shall be C-900 PVC DR-25 Water Pipe for 12" and Smaller and C-905 DR-41 Water Pipe for 12" and Larger, with a minimum inside diameter to accommodate the carrier pipe. Casing chalks shall be used on the carrier pipe, spaced according to manufacturer=s recommendations and the ends of the casing pipe properly sealed. (Refer to drawing 02665-01A).

F. Fittings And Couplings

1. Fittings used for water mains shall be ductile iron Class 250 conforming to AWWA C-110 or AWWA C-153, Gray-iron and Ductile Irons Fittings for Water and Other Liquids. Joints for ductile iron and PVC pipe shall be mechanical joint or Push-On joints conforming to AWWA C-111. The interior of the fitting shall have a cement mortar lining conforming to AWWA C-104. The outside surface of the fitting shall have a bituminous coating approximately one (1) mil thick. Couplings for making connections to existing pipelines shall be ductile iron solid sleeves.

2. ASTM A 307 Grade B, bolts and nuts shall be used for all fittings installed.

3. EBAA Iron Mega Lug Series 1100, 1100SD for 12" and Smaller on DIP, and Series 2000 PV, 2000SV for 12" and Smaller on C-900 PVC are acceptable.

G. Air Relief Valves, Blow Offs, Flushing Hydrants

1. These shall be of the same material as shown on the plans and shall meet pressure and flow requirements equal to or exceeding the main installation or as required by the manufacturer, and shall be pre-approved by the BOPU.

H. Butterfly Valves

1. Butterfly valves for use in the water distribution system shall be Class 150 rubber seated, tight closing butterfly valves conforming to AWWA C-504. Butterfly valves shall be furnished with mechanical joint ends and lubricated screw type operators designed for underground service. ASTM A 307 Grade B, bolts and nuts shall be used for valve installation.

2. Rubber valves seats shall be replaceable without disassembling the valve and shall not be interrupted by the shafting. Rubber seats may be retained on the disc edge by stainless steel clamping in lieu of bonding to the valve body. Shaft packing shall be of the self-adjusting permanent type.

3. Operators for underground service shall be permanently lubricated screw-type operators, totally enclosed and of watertight construction. Overload protection shall be incorporated into the operator allowing the application of 450 foot-pounds input torque at full-open and full-closed positions without damage to the operator or valve. A two- (2) inch square wrench nut and valve box shall be provided for operating the valve. Valves shall open clockwise and shall have an arrow imprinted into the operating nut showing the direction for opening the valve.

4. Certification of performance, leakage and hydrostatic tests as described in Section 13 of AWWA C-504 shall be furnished when the shipment arrives. Valves shall be the product of a manufacturer having a minimum of five (5) years' experience in the manufacture of water works and distribution valves. Butterfly valves shall be a Clow, M&H, Pratt, or Mueller.

5. Butterfly valves shall be used for applications 12" and larger.

I. Resilient Seated Gate Valves

1. All gate valves supplied for the Cheyenne system shall be Resilient Seated Gate Valves and shall be ductile iron body with non-rising stems with design, construction, and pressure rating conforming to AWWA C-509, standard for Resilient Seated Gate Valves with modifications specified herein.

2. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or sealing.

3. Stem seals shall be double "O" ring seals designed so that the seal above the stem collar can be replaced with the valve under pressure in full open position.

4. Resilient Seated Gate Valves for underground installation shall have two- (2) inch square wrench nut for key operation. All valves shall open

clockwise and shall have an arrow imprinted into the operating nut showing the direction for opening the valve.

5. The resilient seated gate valves' interior parts and surfaces shall be coated in accordance with AWWA C-550.

6. All gate valves supplies for use in the Cheyenne system (for sizes 3" through 10") shall be manufactured by Clow, Mueller, M&H, or American Flow Control Model AFC-2500. ASTM A 307 Grade B, bolts and nuts shall be supplied and used for the installation.

7. The resilient seated gate valves shall have resilient seated wedges and shall have a working pressure rating of no less than 200 psi.

8. Bonnet, stuffing box and wrench nut, bolts and nuts shall be Type 304 Stainless Steel.

J. Valve Boxes

1. Valve boxes shall be cast iron, 5¼" diameter I.D., slip type (telescoping) adjustable valve boxes. Valve boxes shall be of the slip type and of sufficient length for the pipe bury. The cast iron cover of the valve box shall have the word "Water" stamped thereon. All valve boxes shall be as manufactured by Tyler 7000 series or D&L Products Model 8042, Starr 666-S, or an approved equal.

2. All other valves such as, but not limited to, PRV's air relief, check valves and backflow preventers shall be approved by the BOPU prior to their use and shall be as shown on the plans.

K. Water Service Lines

1. Pipe used in water services line construction (2" in diameter or less) shall be copper, and shall conform to the following specifications:

   - Copper Service Pipe shall be Type K soft, conforming to Federal Specification WW-T-799 or ASST, B88-62.

2. The service line shall be continuous piece (no splices) from the corporation stop to the curb stop, or as otherwise approved by the Contracting Officer.

L. Corporation Stops

1. Corporation stops shall be brass with CC threads and a flared fitting and shall be equal in quality to A.Y. McDonald 4701B or Mueller B-25000, or Ford F-B600. All corporation stops installed on ductile iron water mains shall be installed with an insulator coupling.

M. Service Unions

1. Meuller, A.Y. McDonald, & Ford flared and compression connections may be used for repairs to service lines, and for the construction of service lines exceeding the length of a standard roll of copper.

N. Service Line Tapping Saddles

1. Service Saddles For Ductile Iron Pipe

   - Tapping saddles for 1½" and 2" service shall have double strap, brass/bronze saddle or epoxy coated ductile iron saddle, neoprene gasket with CC corporation threads:

     1) (Ford style 202B)

     2) (Mueller style DE2S)

     3) (A.Y. McDonald style 2825)

     4) (Smith Blair Style 313)

2. Service Saddles for C-900 PVC Pipe

   - Tapping saddles for ¾" to 2" service shall have doubled stainless steel straps, epoxy coated saddle, neoprene gasket with CC corporation threads.

     1) (Ford style FC202)

     2) (Mueller style DR25)

     3) (Smith Blair style 317)

O. Curb Stops

1. Curb stops shall be 3 turn bronze ball-valve type as manufactured by A.Y. McDonald, or Mueller or Ford. Curb stops shall be set on a concrete support block and shall be located one (1) foot outside of the property line. The curb stop shall have flared fitting. Adequate and appropriate stop boxes such as McDonald 5601 or approved equal, shall be installed with the curb stop.

P. Meters And Pits (See Standard Drawings)

1. All water meters shall be provided by the Cheyenne Board of Public Utilities.

2. It is preferred that meters one (1)" inch and smaller be installed inside the building.

3. All meters that are two (2) inch or larger shall be placed in pits as approved by the Cheyenne BOPU.

4. When meter pits are used, the pit shall be 24" X 48" with an aluminum double lid cover for meters one (1) "inch and smaller. Meter yokes shall be Ford L-Bar with drain. If the meter is two (2)" inch and larger, the pit shall be a concrete vault with a #24" monitor cover and the exact type and size of the vault must be pre-approved by the Cheyenne BOPU.

5. In areas subject to vehicular traffic, the meter pit lid must be a traffic rated lid as approved by the Contracting Officer.

Q. Backflow Preventers

1. All water services having high risk potential for backflow contamination will have backflow preventers installed as required by the Uniform Plumbing Code and the Cheyenne BOPU Rules & Regulations for backflow prevention. (Ref. Manual of Cross Connections and Control, 9th edition, University of Southern California.)

2. When required, backflow preventers for residents will be installed inside the building to provide for proper operation of the device.

3. For ¾" and 1" meter size, a Wilkens double-check valve 950L (or equivalent) will be installed.

4. A properly sized expansion tank, as specified by the manufacturer, will be installed with the backflow preventer to provide a safety factor for expansion within the customers water system caused by heated water in a confined system.

5. For services larger than ¾ inch diameter, the specified backflow prevention device will be installed as required by the Cheyenne BOPU Rules and Regulations, and the Uniform Plumbing Code for backflow prevention.

6. All exterior hose bibs, including exterior yard hydrants will have a self-draining vacuum breaker installed to protect the customer and the Cheyenne BOPU distribution system.

7. The Hose Bib Vacuum Breaker will be the Arrowhead Model 59ABP (or equivalent). This backflow preventing device is designed specifically for use on frost-proof wall hydrants and buried yard hydrants, and provides freeze protection and health protection from potentially contaminated water. Designed with a break-a-way set screw to prevent vandalism.

Rough brass finish. Meets ASSA Standards 1019 and 1011 and is listed with IAPMO individually boxed. Made in the USA.

3.0 EXECUTION

3.1 CONSTRUCTION

A. General

1. Pipe shall be installed in accordance with these specifications for installing the type of pipe used. The Contractor shall provide all tools and equipment including any special tools designed for installing each particular type of pipe used.

2. Service pipe shall be of the size or sizes designated in the plans.

B. Dewatering Of Trench

1. Where free standing water is encountered in the trench, it shall be completely dewatered during pipe laying operations to keep the trench bottom dry at all times and so maintained until the ends of the pipe are sealed and the trench is completely backfilled and all other necessary provisions are made to prevent floating of the pipe.

C. Responsibility For Material

1. The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged. This shall include the furnishing of all materials and labor required for the placement of installed material discovered damaged or defective prior to the final acceptance of the work, or during the guarantee period.

2. The Contractor shall be responsible for the safe and proper storage of material furnished by him or to him and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.

D. Handling Of Pipe

1. All pipe furnished by the Contractor shall be delivered and distributed at the site by the Contractor. Pipe, fittings, specials, valves and accessories shall be loaded and unloaded by lifting with hoists to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe shall not be skidded or rolled against pipe already on the ground.

2. Pipe shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Contracting Officer, or the material will be rejected for use.

E. Laying Of Pipe

1. Before installation, the pipe and pipe coating shall be inspected for defects. Any damage to pipe coatings shall be repaired **As Recommended By The Pipe Manufacturer** before laying the pipe. If a satisfactory repair cannot be found, the pipe will be marked and removed from the site.

2. All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations. All water mains shall be buried no less than 5.5 feet and no more than 7.0 feet below final finished grade.

3. Grade and alignment on ungraded streets will be given from hubs set parallel to the line of the pipe, and on graded streets, the grade and alignment shall be taken from established points on the existing curbs or sidewalks, when directed by the Engineer. Trenches for the pipe shall be opened in accordance with the lines and grades given or to the standard depth of cover provided on the drawings. The survey staking shall consist of line and grade stakes adequate to keep the pipeline to the plan lines and grade. Contractor shall transfer lines and grades to the pipe from marks set by a professional surveyor or from existing concrete curbs or sidewalks as an incidental part of his work. Streets, alleys, and/or easements shall be cut to final subgrade elevation before the construction of the water or sewer is to begin.

4. Wherever obstructions not shown on the plans are encountered, during the progress of the work and interfere to such an extent that an alteration in the plan is required, Engineer shall be contacted to change the plans and order and deviation from the line and grade or arrange with the owners of the structures for the removal, relocation, and reconstruction of the obstructions. The BOPU shall approve all such changes before they are made.

5. Water mains shall be installed along the north and west sides of the street, at least ten (10) feet away from the sewer main, or at a different location if preapproved by the Cheyenne BOPU.

6. All pipe, fittings, and valves shall be carefully lowered into the trench piece by piece by means of a derrick, slings or other suitable tools or equipment, in such a manner as to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.

7. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug.

8. Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints. If the pipe is shown curved on the plans and no special fittings are shown, Contractor can assume that the curves can be made by deflection of the joints with standard lengths of pipe. If shorter lengths are required, the plan will indicate maximum lengths that can be used.

9. Where field conditions require deflection or curves not anticipated by the plans, Engineer (with pre-approval from the Cheyenne BOPU) will determine the methods to be used.

10. Maximum deflections at pipe joints for various types of pipe shall not exceed the applicable material and joint specifications of AWWA nor shall they exceed the recommendations of the pipe manufacturer. When rubber gasketed pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be made wide on curves for this purpose. Refer to Attachment "A", Standards and Specifications for PVC Pressure Pipe for additional requirements.

11. Reaction or thrust blocking shall be applied at all tees, plugs, caps and at bends deflecting 11 ¼ degrees or more, or movement shall be prevented by attaching suitable metal rods or straps as approved by Engineer and the Cheyenne BOPU. Reaction blocking shall be concrete having a compressive strength of not less than 4,000 pounds per square inch at 28 days. Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground shall be as shown on Standard Drawing 02665-03. The blocking shall be so placed that the pipe and fitting joints will be accessible for repair. Minimum of 8 mil. Polywrap shall be used between the concrete and the pipe or fitting.

12. Thrust blocks shall not be placed under stress until they have cured for a minimum of five (5) days. If pre-approved, fast curing additives are added, the minimum curing time will be three (3) days. The thrust block shall be prevented from freezing during curing.

13. The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or coating and so as to leave a smooth end at right angles to the axis of the pipe. The flame cutting of pipe by means of an oxyacetylene torch shall not be allowed.

14. A #10 THHN blue plastic coated solid copper wire shall be run continuously from iron fitting to iron fitting. The #10 THHN copper wire shall be fastened securely to the iron fitting by bolting it to the fitting with an approved connecting device. The #10 THHN copper wire shall be securely fastened to the top of the pipe at least once every ten (10) feet by use of a vinyl plastic electrical tape 7 mil. The #10 THHN copper wire shall run from fire hydrant to fire hydrant with at least twelve (12) inches of wire extending above final grade.

15. Dewatering

    - ❖ Where ground water is encountered in excavation, it shall be removed to avoid interfering with pipe laying and other construction operations.

    - ❖ Discharge from dewatering operations shall be directed to approved natural drainages or storm sewers as appropriate.

16. Trench Dimensions

    - ❖ Trench dimensions shall be as specified below:

        1) Trench width **From** the trench bottom to a point one (1) foot above the top of the pipe shall be no less than the outside diameter of the pipe plus twelve (12) inches, and not more than twenty-four (24) inches plus the pipe outside diameter. The width of the trench from the bottom of the trench of the existing ground surface shall be adequate to allow proper compactive effort along both sides of the pipe.

            a) Depth of Trench. Trench depth shall be as required for the invert grade or pipe bury shown on the plans. In all cases the depth of the water main shall be between 5.5 and 7.0 feet. Care shall be taken not to excavate below the required depths.

            b) When soft or unstable material or rock is encountered at

the subgrade which will not uniformly support the pipe, such material will not uniformly support the pipe, such material shall be excavated to additional depth as necessary and backfilled with Type 2 B bedding material.

2) Trench Bottom.

a) The bottom of the trenches shall be accurately graded to the line and grade shown on the drawings. Bedding material shall provide uniform bearing and support for each additional section of the pipe at every point along its entire length. Bell holes and depressions for joints shall be dug after the trench has been graded, and shall be only of such length, depth, and width as required for properly making the particular type joint. Over excavation shall be backfilled and compacted with bedding material at the Contractor's expense.

17. Time Of Open Trenches

- The Contractor will be required to conduct his work so that trenches will remain open a minimum possible time. Trenches shall not be left open during times of freezing weather.

- No trench excavations shall begin until approved compaction equipment is at the site where the excavation is to take place. All backfilling and compacting shall be completed in all trenching and structural excavations within a maximum distance of 200 feet behind the end of newly installed pipe and the excavator shall be 200 feet. For each work group consisting of trench excavator, a pipe laying crew, and a backfilling and compacting crew, the maximum allowable open ditch at any time will be 400 feet.

- Certain conditions may necessitate the closing of certain sections of trench prior to daily, weekend or holiday shutdown.

F. Separation Of Water Mains And Sewers

1. Parallel Installation

- Normal Conditions: Water mains shall be laid at least Ten (10) feet horizontally from any sanitary sewer, storm sewer, or manhole, whenever possible. The distance shall be measured as the clear or edge-to-edge distance.

- ❖ Unusual Conditions: When local conditions prevent a horizontal separation of Ten (10) feet, a water main may be laid closer to a sanitary sewer, storm sewer, or manhole, provided that:

    1) The bottom of the water main is at least Eighteen (18) inches above the top of the sanitary or storm sewer; or

    2) Where **Eighteen (18) Inches** vertical separation **As Noted Above** cannot be obtained, the sewer shall be:

        a) Constructed of materials and with joints that are equivalent to water main standards of construction and tested for water tightness or

        b) Either the water main or the sewer main shall be placed in a separate casing pipe. The casing pipe shall be C-900 PVC-DR-25 water pipe for 12" and smaller and C-905 DR-41 water pipe for 12" and larger.

2. Crossing

- ❖ Normal Conditions: Water mains crossing sanitary sewers, sanitary sewer service lines, or storm sewer shall be laid above to provide a vertical separation of at least eighteen (18) inches whenever possible. The distance shall be measured from the top of the sewer pipe to the bottom of the water pipe.

- ❖ Unusual Conditions: When local conditions prevent a vertical separation of at least **Eighteen (18) Inches As Noted Above,** the following construction shall be used:

    1) Definitions:

        a) Modern water main materials - DIP, C-900 water pipe with rubber gaskets.

        b) Non-modern water main materials - lead joint cast iron pipe.

        c) Modern sewer main materials - PVC rubber gasket pipe, glued pipe is not acceptable.

        d) Non-modern sewer main materials - VCP grouted pipe, concrete grouted pipe.

        e) Flow fill - see section 02225 for construction standards for mixes.

2) Fire hydrants must be at least ten (10) feet away from storm drains, storm drain inlets, sanitary sewers & sanitary sewer appurtenances at all times.

3) Water mains and sanitary sewer main crossings:

a) When constructing a modern water main and it crosses over an existing modern sewer main and the pipes are less than 18 vertical inches of each other:

(1) Center a full joint of water main over sewer main.

(2) Flow fill the water main a distance of nine (9) feet each side of the sewer main.

b) When constructing a modern water main that crosses under a modern sewer main or when constructing a modern sewer main that crosses over a modern water main:

(1) When constructing a modern water main; flow fill the water main that goes under the sewer main nine (9) feet each side of the sewer main, also encasing the modern sewer main where it crosses the excavation for the new water line.

(2) When constructing a modern sewer main; flow fill the sewer main that goes over the water main nine (9) feet each side of the water main.

(3) If a modern sewer main joint is directly over the water main then flow fill both mains nine (9) feet in all directions.

c) When constructing a modern water main that crosses over a non-modern sewer main (VCP, Concrete) and has less than 18 vertical inches of separation between mains:

(1) Center a full joint of water main over sewer main.

(2) Flow fill the modern water main a distance of nine (9) feet each side of the non-modern sewer main.

d) When constructing a modern water main that crosses under a non-modern sewer main (VCP, Concrete):

(1) Replace the non-modern sewer main with water grade pipe (DR-25 C-900 or greater, encasing the couplers in concrete) nine (9) feet each side of the water main.

(2) Encase the water main pipe nine (9) feet each side of the sewer with a water grade, casing pipe (using skids, boots, etc.).

4) Water mains and storm sewer main crossings:

a) When constructing a water main that crosses under a storm sewer lateral or collection box the main is flow filled nine (9) feet each side of the box or storm sewer lateral.

b) When constructing a storm sewer lateral or collection box over a water main, the lateral or collection box is encased with flow fill nine (9) feet side of the water main.

c) When constructing a water main that crosses under a 48 inch or larger storm sewer; encase the water main using skids, boots, and appropriate water grade casing pipe.

d) When constructing a water main that crosses under a 47 inch and smaller storm sewer; flow fill the water main nine (9) feet each side of the 47 inch or smaller storm sewer pipe up to the haunch of the storm sewer, maintaining a minimum 18 inch separation.

e) When constructing a 47 inch and smaller storm sewer that crosses over an existing water main; flow fill the storm sewer nine (9) feet each side of the water main, maintaining a minimum 18 inch separation:

(1) If separation between the mains is less than 18 inches, then 2 inches of rigid styrene insulation must be placed between the two pipes in addition to the flow fill.

3.2 SETTING VALVES AND VALVE BOXES

A. All valves and valves boxes shall be double wrapped with an 8 mil polywrap.

B. Gate valves shall be set and jointed to the pipe in the manner specified for pipe laying and jointing. Valves shall be set with operating nut vertical. Valve boxes shall be centered and plumb over the operating nut and shall be set so that no shock or stress will be transmitted to the valve.

C. Special care needs to be taken when installing butterfly valves onto pressure Class 200 PVC water pipe (ANSI-AWWA C- 900). It is advisable to take the following precautionary steps to assure proper valve performance:

1. Cut the pipe that is to connect to the valve in a clean, straight and square manner, preventing spurs and ridges that might interfere with the operation of the valve.

2. It is prudent on Class 200 PVC water pipe to bevel the inside edge slightly (removing approximately ¼ inch of the insider corner).

3. Tighten all bolts on the follower ring and restraining gland uniformly to prevent egging.

4. Test the valve operation after installation to assure proper operation before backfilling.

D. Valve boxes shall be centered and plumb over the operating nut of the valve. Tops of valve boxes shall be set flush with the ground surface or street surfacing unless otherwise approved by the Contracting Officer. The valve box shall have a 24-inch square concrete collar at the top. During construction of the water main and prior to the work to pave the street, the valve boxes shall be set to a grade that is three (3) inches below the top of the final base elevation. The valve boxes shall be raised to the top of asphalt immediately after the asphalt paving is placed.

3.3 SERVICE CONNECTIONS

A. General

1. Once the required top permits are obtained from the BOPU, the contractor shall provide all work materials and materials for the complete service line installation, including trench excavations and backfill; making sure the water main taps for taps one (1)" inch and smaller; finishing and installing the corporation stop with insulator coupler, curb stop and box, service clamp where necessary, and service line with fittings as required to make the connection to the stops. The service line adjacent to the water main shall be bent slightly into a figure “S” to avoid a rigid connection. All services shall have a minimum of five (5) feet of cover. The service line shall be installed at right angles to the main, unless otherwise approved by the Contracting Officer.

2. Contractor shall furnish and install the service pipe from the main to the property line with a curb stop and extension service box installed at the property line.

3. Installation of water service lines shall be in accordance with the Standard Drawing.

B. Separations Between Water And Sewer Services

1. The service connection shall be installed such that a minimum horizontal separation, measured center to center, of ten (10) feet is maintained, or as specified under the ASeparation of water mains and sewer@ as stated above.

C. Tapping

1. Actual tapping of the water mains for ¾" and one (1) inch" sizes shall be made by the Contractor. The Contractor shall be licensed by the City of Cheyenne and shall have been certified by Cheyenne BOPU. Certification is subject to renewal every 24 months. The certified person must be on the job site during all tapping operations. Taps 1½" and larger will be installed by the Cheyenne BOPU after all required tap permits are obtained. All taps must be inspected before backfill.

2. Water taps must be no less than 24 inches apart and they must be staggered.

3. Tapping directly into the barrel of PVC and AC pipe will be done using a service saddle. Refer to Appendix 'A' Standards and Specification for PVC pressure pipe and additional requirements.

4. Tap permits must be obtained from the Cheyenne BOPU before any taps can be installed.

5. Tapping Procedures (¾" and one (1)" inch sizes):

- To perform the preferred method of tapping polyethylene encased ductile iron pipe, wrap two or three layers of polyethylene-compatible adhesive tape completely around the pipe to cover the area where the tapping machine and chain will be mounted.

- Mount the tapping machine on the pipe area covered by the polyethylene tape. Then mare the tape and install the corporation stop directly through the tape and polyethylene.

- After making the direct service connection, inspect the entire circumferential area for damage and make any necessary repairs to the pipe or poly wrap.

3.4 VALVE THRUST BLOCKS

A. Valves requiring thrust blocks shall be installed in accordance with and as detailed on the standard drawings.

3.5 PIPE JOINTING

A. Rubber Gasket "Push-On" Joints

1. Jointing of pipe and fittings with a rubber gasket Apush-on@ joint shall be as recommended by the manufacturer. The rubber gasket and gasket seat inside the bell shall be wiped clean with a cloth. A thin film of lubricant (NSF approved for drinking water), furnished with the pipe, shall be applied to the inside surface of the gasket. The plain end of the adjoining pipe shall be wiped clean and inserted into the bell a sufficient distance to make contact with the gasket. The plain end shall then be forced "home" by the use of a crow bar, fork tool, or jack assembly.

B. Mechanical Joints

1. The inside of the bell and the outside of the spigot of the mechanical joint fittings shall be brushed thoroughly with a wire brush to remove all loose rust or other foreign material just prior to assembly. The cleaned surfaces shall be brushed with an NSF approved lubricant just prior to slipping the gasket over the spigot end and into the bell.

2. The spigot end of the pipe or fitting shall be accurately centered in the bell before jointing is begun. After the gasket is in place, the gland shall be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Bolts shall be partially tightened alternately around the socket maintaining approximately equal tension until the final tension is reached.

3. The normal range of bolt torques to be applied to the cast iron bolts in the joints shall be as follows:

Bolt Size (inch)	Range of Torque (ft. lb)
$^{5}/_{8}$	40 - 60
¾	60 - 90
1	70 - 100
1 - 1¼	90 - 120

❖ The type of bolts shall be Cor-Ten.

The above torque loads may be applied with torque measuring or indicating wrenches, or they may be applied using regular socket wrenches, and checked to torque wrenches.

4. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after through cleaning. Over stressing of bolts to compensate for poor installation practice will not be permitted.

C. Connections To Water Mains

1. All ¾ and one (1)" inch connections to water mains in use shall be made by Contractor, once tap permits are obtained. Contractor shall furnish all materials required. He shall make all necessary excavations and he shall perform all necessary backfilling.

2. Where the connection of new work to old requires interruption of service, Contractor shall give 24 hours advance notice to the customers affected. The Cheyenne BOPU, Engineer, Contracting Officer and Contractor shall mutually agree upon a date for connections which will allow ample time to assemble labor and materials, and to notify all customers affected. When service is interrupted for more than four (4) hours, the contractor will have to provide temporary service.

3. Once the Owner/Contractor obtains all tap permits, the Cheyenne BOPU will make all taps which are 1½" and larger. The Contractor shall make all necessary excavations, perform all backfill and perform any other necessary work.

3.6 CHANGES TO APPROVED PLANS

A. The design Engineer is required to obtain DEQ and Cheyenne BOPU approval for all field changes to the approved construction plans prior to the field change being made. Except for minor field changes, which require Contracting Officer and BOPU approval only. The Engineer inspector shall make the decision as to what constitutes a minor field change.

3.7 INSPECTION SCHEDULING

A. Water And Sewer Taps

1. The Contractor shall make appointments with the Cheyenne BOPU utility inspectors twenty-four (24) hours in advance for the inspection of water and sewer taps.

B. General Inspections

1. The Contractor shall make appointments with the Cheyenne BOPU utility inspectors in advance for general inspections such as, but not limited to, thrust blocks, fire hydrants, valves, and bedding.

C. Preconstruction Meetings And System Testing

1. The Contractor shall make arrangements with the Cheyenne BOPU utility inspectors twenty-four (24) hours in advance for preconstruction meetings and system testing.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02665

SECTION 02670

HYDROSTATIC TESTING

1.0 GENERAL

1.1 SUMMARY

A. This section consists of testing of water main and related appurtenances.

2.0 PRODUCTS (Not Used)

3.0 EXECUTION

A. All hydrostatic testing of all water mains shall be under the full-time observation of and shall meet the approval of the Contracting Officer and Cheyenne BOPU.

3.2 HYDROSTATIC TESTING OF WATER MAINS

A. PVC, ductile and cast iron pipe (Refer to Appendix A Standards and Specifications for PVC Pressure Pipe for additional information).

1. Pressure Test

All newly laid pipe or any valved section hereof shall be subjected to a hydrostatic pressure of 200 psi. Hydrostatic testing shall include all service line connections from the point of connection to the curb stop. All necessary labor, tools, materials and equipment shall be provided by the Contractor as approved by the Cheyenne BOPU.

a. Test Pressure Restrictions - Test pressures shall:

1) Not be less than 1.25 times the working pressure at the highest point along the test section.

2) Not exceed pipe or thrust restraint design pressures.

3) Be of at least two (2) hour duration.

4) Not vary by more than five (5) psi.

5) Not exceed the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.

b. Pressurization

1) Each valved section of pipe shall be filled with water at a rate not exceeding a water velocity of one (1) foot per second. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Contracting Officer and Cheyenne BOPU.

c. Air Removal

1) Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation stops at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation stops shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation stops shall be removed and plugged, or left in place at the discretion of the Contracting Officer and Cheyenne BOPU.

d. Examination

1) All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the Contracting Officer and Cheyenne BOPU.

2. Leakage Test

A leakage test will be conducted concurrently with the pressure test.

a. Leakage Defined

1) Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

b. Allowable Leakage

1) Pipe installation will not be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

in which L is the allowable leakage, in gallons per hour; S is

the length of pipeline tested, in feet D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

NOTE: Refer to Attachment "A" Standards and Specifications for PVC Pipe, for testing criteria.

3. Leakage Test Failure

   a. When the leakage test fails to pass the allowable limits, the Contractor shall make all necessary system repairs and schedule a retest.

3.3 DEQ DISCHARGE PERMIT

A. As required by DEQ Regulations, the Government/Contractor must file a NOI (Notice of Intent) and obtain a permit before discharging super chlorinated water or water from hydrostatic testing.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02670

SECTION 02675

DISINFECTION

1.0 GENERAL

1.1 SUMMARY

A. This section consists of essential procedures for disinfecting new and repaired water mains.

2.0 PRODUCTS (Not Used)

3.0 EXECUTION

3.1 All disinfection methods, processes, applications, and testing shall be performed under the observation of and with the approval of the Contracting Officer and Cheyenne BOPU.

3.2 DISINFECTING WATER MAINS

A. Basic Procedure

The basic procedure comprises:

1. Preventing contaminating materials from entering the water mains during construction or repair and removing by flushing materials that may have entered the water main.

2. Disinfecting any residual contamination that may remain.

3. Determining the bacteriologic quality by laboratory test after disinfection.

B. Preventative Measures During Construction

1. Keeping Pipe Clean And Dry

a. Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipe laying is not in progress, as for example, at the close of the day's work, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

Note: Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the less the potential for contamination.

b. If dirt, that in the opinion of the Owners engineer or job superintendent, will not be removed by the flushing operation (Item D, Preliminary Flushing) enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary, with a five percent (5%) hypochlorite disinfecting solution.

2. Packing Material And Joints

a. No contaminated material or any material capable of supporting prolific growth of micro-organisms shall be used for sealing joints. Packing material shall be handled in such a manner as to avoid contamination.

b. The lubricant used in the installation of sealing gaskets shall be NFS approved for use in potable water. It shall be delivered to the job in enclosed containers and shall be kept clean.

C. Preliminary Flushing

The main shall be flushed prior to disinfection, except when the tablet method is used (Item F, Methods Of Chlorine Application, Paragraph (3)). The sites and velocities of flushing shall be as specified in the supplemental specifications.

Note 1: The flushing velocity shall not be less than 2.5 ft. sec. The rate of flow required to produce this velocity in various diameters is shown in Table 2. No site for flushing should be chosen unless it has been determined that drainage is adequate at that site and at all points downstream. The Contractor will be liable for downstream damages.

Note 2: Flushing is no substitute for preventive measures taken before and during pipelaying (Item C, Preventive Measures During Construction). Certain contaminants, especially in caked deposits, resist flushing at any velocity. Furthermore, with diameters of 16 inches or more, even the minimum flushing velocity of 2.5 ft/sec is sometimes difficult to achieve.

TABLE 2

Required Openings to Flush Pipelines*
(40 psi Residual Pressure)
Hydrant Outlet Nozzles

Pipe Size Inches	Flow Required to Produce 2.5 fps Velocity gpm	Orifice Size Inches	Number	Size Inches
4	100	$^{15}/_{16}$	1	2”
6	220	1	1	2”
8	390	1	1	2”
10	610	$2\ ^{5}/_{16}$	1	2”
12	880	$2\ ^{13}/_{16}$	1	2”

*With 40 psi residual pressure, a 2” hydrant outlet nozzle will discharge approximately 1,000 gpm and a 4-2@ hydrant nozzle will discharge approximately 2,500 gpm.

D. Form Of Chlorine For Disinfection

1. The most common forms of chlorine used in the disinfecting solutions are liquid chlorine (gas at atmospheric pressure), calcium hypochlorite granules, sodium hypochlorite solutions, and calcium hypochlorite tablets. (Hot tub tablets are not allowed.)

2. Hypochlorite

a. Calcium Hypochlorite

1) Calcium hypochlorite contains 65 percent (65%) available chlorine by weight. It is either granular or tabular in form. The tablets, 6-8 to the ounce, are designed to dissolve slowly in water (Item E, Methods Of Chlorine Application, Para. (3). Calcium hypochlorite is packaged in containers of various types and sizes ranging from small plastic bottles to 100-pound drums.

2) A chlorine-water solution is prepared by dissolving the granules in water in the proportion requisite for the desired concentration.

b. Application

The hypochlorite solutions shall be applied to the water main with a gasoline or electrically-powered chemical feed pump designed for feeding chlorine solutions. For small applications the solutions may be fed with a hand pump, for example a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be checked for tightness before the hypochlorite solutions is applied to the main.

E. Methods Of Chlorine Application

1. Continuous Feed Method

a. This method is suitable for general application.

1) Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 mg/l available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals.

Note: In the absence of a meter, the rate may be determined either by placing a pilot gage at the discharge or by measuring the time to fill a container of known volume.

2) Table 3 below gives the amount of chlorine residual required for each 100 feet of pipe of various diameters. Solutions of one percent (1%) chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The letter solution requires approximately one pound of calcium hypochlorite in 8.5 gallons of water.

b. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water shall contain no less than 3 mg/l chlorine throughout the length of the main.

TABLE 3

Chlorine Required to Produce 50 Mg/l Concentration
in 100 Feet of Pipe-by Diameter

Pipe Size (In.)	100 Percent Chlorine (Lb.)	One Percent Chlorine Solutions (gal.)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

2. Slug Method

   This method is suitable for use with mains of large diameter for which, because of the volumes of water involved, the continuous feed method is not practical.

   a. Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate (Item F, Methods of Chlorine Application, Paragraph (1), Note: into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at no less than 300 mg/l. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or Aslug@ of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/l for at least three (3) hours. The application shall be checked at a tap near the upstream end of the line by chlorine residual measurements.

   b. As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect appurtenances.

3. Tablet Method

   Tablet disinfection is best suited to short extensions (up to 2,500 feet) and smaller diameter mains (up to 24 inches). Because the preliminary flushing step must be eliminated, this method shall be used only when scrupulous cleanliness has been exercised. It shall not be used if trench water or foreign material has entered the main or if the water is below 5EC (41°F).

a. Placement of Tablets

1) Tablets are placed in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. They shall be attached by an adhesive, except for the tablets placed in hydrants and in the joints between the pipe sections. All the tablets within the main must be at the top of the main. If the tablets are fastened before the pipe section is placed in the trench, their position should be marked on the section to assure that there will be no rotation. In placing tablets in joints, they are either crushed and placed on the inside annular space, or, if the type of assembly does not permit, they are rubbed like chalk on the butt ends of the sections to coat them with calcium hypochlorite.

2) The adhesive shall be a food grade adhesive, such as Permatex Form-a-gasket #2, approved by the BOPU. There shall be no adhesive on the tablet except on the broad side next to the surface which the table is attached.

b. Filling and Contact

1) When installation has been completed, the main shall be filled with water at a velocity of more than one-foot/second. This water shall remain in the pipe for at least 24 hours. The water must remain in the pipe for at least 48 hours if the water temperature is below 41°F (5° C), maintaining no less than 3 mg/l chlorine.

2) Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

TABLE 4

Number of Hypochlorite Tablets of 5-G
Required for Dose of 50 Mg/l*

Length of Section (ft.)	Diameter of Pipe (In.)					
	2	4	6	8	10	12
13 or less	1	1	2	2	3	5
18	1	1	2	3	5	6
20	1	1	2	3	5	7
30	1	2	3	5	7	10
40	1	2	4	6	9	14

*Based on 3-: g available chlorine per tablet.

F. Final Flushing

1. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than one mg/l. Points of discharge of heavily chlorinated water shall be shown on drawings or designated in Special Provisions. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

G. Bacteriologic Tests

1. After final flushing, and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriologic quality and shall show the absence of coliform organisms. If the number and frequency of samples is not prescribed by the public health authority having jurisdiction, at least one sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main. From unchlorinated supplies, at least one sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main.

   Note: In the case of extremely long mains, it is desirable that samples be collected the length of the line as well as at its end. A sample shall be collected for every 600 feet of water main disinfected.

2. Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulphate. No hose or fire hydrant shall be used

in collection of samples. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

H. Repetition Of Procedure

If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. The tablet method cannot be used in these subsequent disinfections. When the samples are satisfactory, the main may be placed in service.

I. Procedure After Cutting Into Or Repairing Existing Mains

The procedures outlined in this section apply primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

1. Trench Treatment

When an old line is opened, either by accident or by design, the excavation will likely be wet and badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

2. Main Disinfection

a. Swabbing and Flushing: The following procedure is considered as a minimum that may be used.

b. Swabbing with Hypochlorite Solution: The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with a five percent (5%) hypochlorite solution before they are installed.

c. Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

d. Slug Method: Where practicable, in addition to the procedures of Paragraph (b) Swabbing With Hypochlorite Solution, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as

described in Item F, Methods Of Chlorine Application, Paragraph (2), Slug Method, except that the dose may be increased to as much as 500 mg/l, and the contact time reduced to as little as one-half hour. After chlorination, flushing shall be resumed and continue until discolored water is eliminated.

3. Sampling

a. Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of flow is unknown, samples shall be taken on each side of the main break.

3.3 DEQ DISCHARGE PERMIT

A. As required by DEQ Regulations, the Government/Contractor must file a NOI (Notice of Intent) and obtain a permit before discharging superchlorinated water or water from hydrostatic testing.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02675

SECTION 02700

SANITARY SEWER SYSTEMS

1.0 GENERAL

1.1 SUMMARY

A. This section consists of construction of sanitary sewer mains, including manholes, service lines, and other appurtenant structures, complete.

1.2 REFERENCES

A. Where the reference is made to an ASTM, ANSI or AASHTO designation, it shall be the latest revision at the time of call for bids, except as noted on the Drawings.

1.3 QUALITY ASSURANCE

A. Sewer pipe and fittings furnished under this contract shall be as called out in the Contract Documents. Wye or tee branches shall be of the same material and design as the sewer pipe used. Pipe strength classifications shall be as listed in the Contract Documents.

B. When required by the Contracting Officer, Contractor shall furnish certification by the manufacturer of the pipe to be furnished on this Project, certifying that the pipe and fittings comply with the applicable specifications. Required certification shall accompany each delivery of material.

C. All pipe shall be clearly marked with type, class and/or, thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

D. Type of joint, class, thickness designation, castings, lining, marking, testing, etc., shall be as specified.

2.0 PRODUCTS

2.1 MATERIALS

A. Polyvinyl Chloride (PVC) Pipe

1. PVC Sewer Pipe shall be produced by a continuous extrusion process, employing a prime grade of unplasticized polyvinyl chloride. The grade used shall be highly resistant to hydrogen sulfide, sulfuric acid, gasoline, oil, detergents and other chemicals commonly found in sewage and industrial wastes. The material shall conform to the requirements of ASTM D 1784, "Rigid Polyvinyl Chloride Compounds". The pipe shall have self-extinguishing flammability characteristics.

2. Pipe and fittings shall conform to ASTM D 3034, "Standard Specification for Polyvinyl Chloride Sewer Pipe and Fittings", or ASTM F 679 for sizes over 15 inches (380 mm) in diameter. PVC pipe shall have a minimum Standard Dimension Ratio (SDR) of 35.

3. Nominal laying lengths shall be not less than 12.5 feet (3.8 m), except

shorter lengths may be used adjacent to manholes, lamp holes or other appurtenances. Each length of pipe shall be marked with size, SDR, "Sewer Pipe" and Code Number.

4. Pipe Jointing

   a. Each length of pipe shall be provided with a bell designed so that a watertight joint will be obtained when jointing the bell and spigot with a rubber ring.

   b. The rubber gasket joint for PVC pipe and fittings shall consist of a rubber gasket which is compressed between the outer surface of the spigot and the inner surface of a retaining groove in the bell. The joint shall be completely sealed by the gasket so that the assembly will remain watertight under all conditions of service, including movements resulting from expansion, contraction, settlement and deformation of the pipe. The rubber ring joint assembly shall be made in strict accordance with the manufacturer's recommendations.

5. Wye or tee fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe.

B. Concrete Pipe

1. Concrete sewer pipe shall conform to ASTM C 14 and/or ASTM C 76, except as noted hereafter. Strength classifications for C-14 and/or C 76 specification pipe shall be as listed in the Contract Documents.

2. The maximum absorption allowed shall be eight percent (8%), as stated in the above ASTM Specification. For pipe sizes smaller than twelve inches (30 mm) in diameter the proportion of Portland Cement in the concrete mixture shall not be less than six and one-half (6.5) U.S. standard bags (94 pounds) per cubic yard of concrete, and the water cement ratio shall not exceed six (6) gallons per sack of cement.

3. The referenced ASTM specifications list permissible variations in pipe dimensions. They shall be strictly adhered to, and the uniformity of barrel thickness shall be such that a constant flow area without projections exists across joints.

4. Wye or tee fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe.

5. Joints for concrete pipe shall be made using flexible watertight, rubber-type gaskets conforming to ASTM C 443.

6. The pipe supplier shall furnish the Contracting Officer with certified test results from an independent testing laboratory on the following: (1) crushing strength using the 3-edge bearing method, (2) absorption, and (3) hydrostatic performance. Test results shall be furnished for each pipe size supplied for this project and the number of tests performed shall be in accordance with ASTM Specification C 14 and/or C 76, or a minimum of two percent (2%) of the number of pipe supplied, whichever

is greater. Cost of these tests shall be borne by the pipe supplier and/or Contractor.

C. Acrylonitrile Butadiene Styrene (Abs) Composite Sewer Pipe

1. ABS pipe shall conform in all aspects to ASTM D 2680, "ABS Sewer Pipe and Fittings."
2. Tee or wye fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe. Fittings shall be shop fabricated or molded from materials listed in paragraphs 4 and 5 of ASTM D 2680 and shall be of equivalent quality to those described.
3. All field joints shall be chemically welded. Primer, then cement shall be applied liberally to the outside of the spigot end and the inside of the coupling immediately prior to stabbing the pipe together. Pipe spigot end shall be supplied with home marks to assure proper jointing.
4. When other than full lengths of pipe are laid, the "cut end" of the pipe must be sealed with a sealant provided by the manufacturer of the pipe.

D. Vitrified Clay Pipe (VCP)

1. VCP pipe shall conform to ASTM C-700, and shall be "Extra-Strength".
2. Wye or tee fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe or a method approved by the Contracting Officer.
3. All field joints shall meet the manufacturer's requirements for the pipe being used and conform to the latest revision of ASTM C 425.
4. In addition to any deficiencies covered by ASTM C 700, clay pipe which has any of the following visual defects will not be accepted:
   a. Improperly formed pipe such that pipe intended to be straight has an ordinate, measured from the concave side of the pipe, exceeding 1/16 inch per foot of length.
   b. Pipe which is sufficiently out-of-round to prohibit proper jointing.
   c. Improperly formed bell and spigot ends.
   d. Fractured, cracked, chipped, or otherwise sufficiently damaged pipe which will result in an improperly constructed pipeline.
   e. Pipe that has been damaged during shipment or handling, even if previously approved before shipment.

E. Ductile Iron Pipe

1. Ductile iron pipe shall conform in all aspects to the latest revisions of ASTM A 746.

2. Wye or tee fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe or a method approved by the Contracting Officer.

3. All field joints shall meet the manufacturers' requirement for the brand of pipe being used.

F. Casing Pipe

1. Pipe used to case waterline crossings shall be SDR-26 PVC water pipe, SDR-35 PVC sewer pipe, or coated corrugated metal pipe, with a minimum diameter of 1.25 times the outside diameter of the carrier pipe.

2. Acceptance of the pipe at point of delivery will not relieve Contractor of full responsibility for any defects in material or workmanship of the completed pipeline.

G. Manholes

1. Manholes shall be constructed of precast concrete rings with frames and covers and steps in accordance with details shown on the plan drawings.

2. All manholes shall be designed to withstand AASHTO HS-20 loading.

H. Rings And Covers

1. Rings and covers shall be in accordance with the Contracting Officer's Standards. Covers shall be nonventilated type unless otherwise noted in the Special Provisions.

I. Precast Concrete Rings

1. Adjusting rings may be used for adjusting the manhole top elevation to coincide with existing ground elevations, except the total height of adjusting rings used per manhole shall not exceed 12 inches (300 mm). Adjusting rings shall be reinforced with the same percentage of steel as the riser and top.

2. Precast Concrete rings for manholes shall conform to ASTM C 478, "Precast Reinforced Concrete Manhole Risers and Tops".

J. Steps

1. When required, noncorrosive steps of rubber encased steel, aluminum, or nylon shall be used. Steps shall withstand vertical loads of 400 pounds (182 kg) and pull-out resistance of 1,000 pounds (454 kg).

K. Concrete Base

1. Concrete bases shall be precast or poured in the field on undisturbed earth. Concrete shall conform to Section 03304, Portland Cement Concrete.

L. Gravity Sewer Service Materials

1. Type of joint, class, thickness designation, castings, lining, marking, testing, etc., shall be as required in the Special Provisions.

3.0 EXECUTION

3.1 PIPE INSTALLATION

A. Responsibility For Material

1. Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include furnishing all material and labor required for the replacement of installed material discovered defective prior to final acceptance of the work or during the guarantee period.

2. Contractor shall be responsible for the safe storage of material intended for the work until it has been incorporated in the completed project.

B. Handling Of Pipe

1. All pipe furnished by Contractor shall be delivered and distributed at the site by Contractor. Pipe, fittings and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

2. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.

3. Pipe shall be handled so that no coating or lining will be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by Contractor at his expense in a manner satisfactory to the Contracting Officer.

C. Laying Pipe

1. All pipe shall be laid and maintained to the required lines and grades with fittings, tees and manholes at the required locations.

2. Contractor shall use good workmanship. All pipe shall be properly jointed home, using wood cushion and protective devices in accordance with manufacturer's recommendations.

3. Proper tools and equipment satisfactory to the Contracting Officer shall be used by Contractor for the safe and convenient prosecution of the work. All pipe and fittings shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.

4. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a plug or other means

approved by the Contracting Officer. Contractor shall clean and remove all sand, gravel, concrete and cement grout that has entered the lines in the process of construction.

5. The bottom of the trench shall be shaped to fit the bottom quadrant of the pipe, with holes for couplings just large enough to permit their assembly.

D. Joints

1. The spigot and bell ends of the pipe and couplings shall be thoroughly cleaned before joint assembly. Jointing of the pipe shall be in strict accordance with the recommendations of the manufacturer of the pipe and fittings. The correct position of the rubber gaskets and proper assembly of the pipe shall be checked by means of a feeler gauge prior to backfilling of the trench. On larger diameter pipe, which will provide room for workmen inside, all joints shall be visually inspected and gauged inside for proper position of the gasket and joint gap tolerances.
2. The sewers shall be installed within 1/4" (4.75 mm) for grade and shall not be off more than 1/2" (12.5 mm) for alignment. The Contracting Officer shall specify joint deflection tolerance where acceptable.

E. Tolerances

1. The sewers shall be installed within 1/4" (4.75 mm) for grade and shall not be off more than 1/2" (12.5 mm) for alignment. The Contracting Officer shall specify joint deflection tolerance where acceptable.

F. Separation Of Water Mains And Sewers

1. Parallel Installation
   a. Normal Conditions: Sanitary sewer mains and manholes shall be laid at least ten (3 m) feet horizontally from any water main whenever possible. The distance shall be measured edge-to-edge.
   b. Unusual Conditions: When local conditions prevent a horizontal separation of ten (3 m) feet as noted above, a sewer main may be laid closer to a water main, provided that:
      1) The top of the sewer main is at least eighteen (457 mm) inches below the bottom of the water main;
      2) Where eighteen (457 mm) inches vertical separation as noted above cannot be obtained, the sewer main shall be:
         a) constructed of materials and with joints that are equivalent to water main standards of construction, and tested to assure water tightness prior to backfilling; or
         b) placed in a separate casing pipe.
2. Crossing
   a. Normal Conditions: Sewers crossing water mains shall be laid below the water mains to provide a vertical separation of at least eighteen

(457 mm) inches, whenever possible. The distance shall be measured between the bottom of the water main and the top of the sewer.

b. Unusual Conditions: When local conditions prevent a vertical separation of at least eighteen (457 mm) inches as noted above, the following construction shall be used:

1) The sewer or water main shall be placed in a separate casing pipe; or

2) The sewer line shall be constructed of materials and with joints that are equivalent to water main standards of construction and tested to assure water tightness prior to backfilling;

3) The length of the sewer line constructed to water main standards or the casing pipe shall extend a minimum of nine feet (2.74 m) each side of the crossing.

4) Water mains passing under sewer lines shall in addition be protected by providing adequate structural support for the sewer line.

3.2 MANHOLE INSTALLATION

A. Manholes shall be constructed to the general dimensions shown. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels may be formed directly in the concrete of the manhole base or may be half-pipe laid in concrete. The floor of the manhole outside the channel shall be smooth and shall slope toward the channel not less than one inch per foot, nor more than two inches per foot.

B. Free drop inside the manhole shall not exceed two feet measured from the invert of the inlet pipe to the invert of the outlet pipe. Where the drop exceeds two feet, drop manholes shall be constructed as shown on the typical manhole detail.

C. All connections between wall sections or between sewer pipe and manhole walls shall be joined with "Kent Seal" manufactured by K.T. Snyder Company, or approved equal, in such a manner as to make the manhole watertight. Manhole construction shall be not greater than one manhole distance behind sewer construction, unless otherwise allowed by the Contracting Officer.

3.3 SERVICE LINE INSTALLATION

A. General

1. Service lines shall be constructed in accordance with drawings. The service line shall be installed to the property line. The end of the service

line shall be plugged with an approved stopper or plug. Grouting of plugs will not be permitted.

2. Wye or tee fittings shall be installed in the mainline sewer for connection of service lines. Wye or tee fittings shall be of the same material and design and of the same specifications of the sewer main pipe. Jointing of service pipe to wye or tee branches of main line pipe other than PVC, shall be accomplished with special joint adapters manufactured specifically for jointing the two different types of pipe.

B. Crossing

1. Normal Conditions: Sanitary sewer service lines crossing water mains shall be laid to provide a vertical separation of at least eighteen (457 m) inches whenever possible. The distance shall be measured from the top of the lower pipe to the bottom of the upper pipe.

2. Unusual Conditions: When local conditions prevent a vertical separation of at least eighteen (457 m) inches as noted above, the sanitary sewer service line shall be placed in a separate casing pipe, said casing pipe shall extend a minimum of ten (3 m) feet each side of center of the crossing.

C. Extending Sewer Services Into Private Property

1. Unless otherwise provided by local sewer ordinances, the property owners will be permitted to extend sewer services onto their property and connect fixtures thereto, as soon as the main sewer construction has progressed past the point of side sewer construction and leakage tests have been satisfactorily completed, provided the use of the connections will not interfere with the completion of the other parts of the contract work and provided the extension is approved by the Contracting Officer. Such sewer service connections shall be allowed only after final inspection and acceptance of main sewer.

D. End Pipe Marker

1. The end of newly installed sewer service lines shall be marked by Contractor at the property line by a post five (1.5 m) feet long buried in the ground a distance of three (1 m) feet, in addition to a one-half (12.5 mm) inch diameter reinforcing bar, eighteen (457 m) inches in length, buried vertically two (50 mm) inches below the ground surface.

3.4 TESTING

A. Light Test: After the trench has been backfilled and compacted as specified in Section 02225, Trench Backfill a light test shall be made between manholes to check alignment and grade for displacement of pipe. Except for curved alignments shown on the Drawings, the completed pipeline shall be such that a true circle of light can be seen from one manhole to the next. If alignment or grade is other than specified and displacement of pipe is found, Contractor shall remedy such defects at his own expense.

B. T.V. Inspection

1. The Contracting Officer may at his option require any or all sewer, sanitary or storm, to be inspected by the use of a television camera before final acceptance. The costs incurred in making the initial inspection shall be borne by the Contracting Officer unless otherwise noted in the Special Provisions.

2. Contractor shall bear all costs incurred in correcting any deficiencies found during television inspection including the cost of any additional television inspection that may be required by the Contracting Officer to verify the correction of said deficiency.

3. Contractor shall be responsible for all costs incurred in any television inspection performed solely for the benefit of Contractor.

C. Leakage Test

1. New sewer line will not be finally accepted until leakage tests have been made to assure the Contracting Officer that pipe laying and jointing are satisfactory.

   a. Water Test

      1) Where groundwater is a minimum of two (600 mm) feet above the sewer line, tests shall be made by sealing off the section of lines between manholes and measuring the infiltration by collecting or pumping the discharge into barrels or other approved methods. Tests shall be continued over a period of at least four (4) hours for each section tested. Sufficient time shall be allowed to soak lines and manholes in advance of performing tests.

      2) When groundwater is not above the pipe, testing shall be as follows:

         a) On flat slopes where the depth over the centerline of the pipe in the lower manhole of the section being tested will be not more than ten feet (3 m), the upper manhole shall be filled to a depth of two feet (600 mm) over the top of the pipe and the lower manhole blocked. When the above conditions cannot be met, the Contracting Officer may order Contractor to test the line in sections between manholes. The leakage shall be measured by checking the drop in water level in the manhole over a period of four (4) hours.

         b) The maximum allowable infiltration or exfiltration, including manholes, shall not exceed 200 gallons per day per mile of sewer, per inch of pipe diameter. This does not preclude the fact that obvious and concentrated leaks, such as open joints, pinched gaskets, cracked

barrels or bells, etc., will not be allowed. Contractor shall make repairs on concentrated leaks, and as necessary to reduce infiltration or exfiltration leakage below the specified rate, and at his own expense.

b. Air Test (Alternate)

1) As an alternate method to water testing, Contractor may utilize low pressure air as a means of testing the sewer mains. The test procedure shall be as described below:

a) Plug both ends of the pipe under test with airtight plugs and brace adequately to prevent slippage and blowout. One plug shall have an inlet tap or other provision for connecting an air hose.

b) The air supply hose, connected between the air compressor and the plug, shall have a throttling valve, an air bleed valve, and a high pressure shut-off valve for control. The low pressure side of the throttling valve shall have a tee for a monitoring pressure gauge, protected by a gauge cock. This cock is kept closed except when the pressure loss is being timed.

c) If the pipeline is submerged under groundwater, the backpressure, caused by the water head, is measured and added to the standard test pressures to compensate for the groundwater effect on the air test.

d) Air shall be applied slowly to the pipeline until the pressure reaches 4.0 psig. The air supply shall then be throttled so that the internal pressure is maintained between 4.0 and 3.5 psig for at least two (2) minutes. During this time the plugs shall be checked with soap solution to detect any plug leakage.

e) When the pressure reaches exactly 3.5 psig, a stop watch is started and the time recorded for the pressure to drop to 2.5 psig. The minimum time allowed for this pressure drop shall be computed based on an air loss rate of 2.0 cfm or an air loss rate of 0.0030 cfm per square foot of inner pipe surface under test, whichever rate gives the least time for the pressure drop. Should the time of the pressure drop between 3.5 and 2.5 psig be less than the allowable specified time, Contractor shall make the necessary leakage repairs and repeat the air test.

2. Manhole joints shall be checked for leakage by means of water testing as specified above.

D. Deflection Testing

1. After the pipe has been laid and backfilled, all flexible pipe systems shall be tested for deflection in the presence of the Contracting Officer. This test shall consist of pulling a mandrel (Go-No Go Device) through the pipe. The maximum deflection allowable shall not exceed 5% of the pipe's internal diameter for final inspection. Contractor shall conduct the test and shall furnish all necessary test equipment and labor. All pipe sections failing the test shall be removed and replaced at Contractor's expense.

E. Number Of Tests

1. A sufficient number of leakage tests shall be performed to assure the Contracting Officer that materials and workmanship are acceptable. Defective joints shall be repaired only by use of approved jointing material which is flexible when set and that has a permanent bond to the pipe. Pipe having cracked or broken barrels shall be replaced. The length of sewer line tested per test shall not exceed 800 feet.

F. Materials And Equipment For Testing

1. Except as noted in Paragraph B, all labor, equipment and materials (including water) necessary for making the tests of sewer lines shall be furnished by Contractor.

G. All tests, except deflection testing as specified under Paragraph D, shall be made after backfill is completed, but prior to any surface restoration or street surfacing. Contractor shall be responsible for finding and repairing all breaks and leaks revealed by the tests.

4.0 METHOD OF MEASUREMENT AND BASIS PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02700

SECTION 02776

CONCRETE SIDEWALKS, DRIVEWAY APPROACHES, CURB TURN FILLETS, VALLEY GUTTERS AND MISCELLANEOUS NEW CONCRETE CONSTRUCTION

1.0 GENERAL

1.1 SUMMARY

A. Concrete sidewalk and driveway approaches, curb turn fillets, valley gutters, new monument boxes and other miscellaneous new concrete construction shall consist of air-entrained Portland Cement Concrete constructed in accordance with these specifications. This work shall be in reasonably close conformity with the lines and grades, thicknesses, and typical cross sections shown on the plans or established by the Contracting Officer. See Drawings.

2.0 PRODUCTS

2.1 MATERIALS

A. Portland Cement Concrete: Air-entrained Portland Cement Concrete shall conform to the requirements of Section 03304, Portland Cement Concrete, Class 4000.

B. Reinforcing Steel: Reinforcing steel shall conform to the requirements of Section 03300, Steel Reinforcement.

C. Preformed Expansion Joint Material: Joint material shall comply with the requirements of AASHTO M 213, ASTM D 994, ASTM D 1751, or ASTM D 1752.

3.0 EXECUTION

3.1 GENERAL

A. Sidewalks and driveway approaches, either new or replacement, valley gutters and curb turn fillets shall be constructed at the locations shown on the plans and where directed by the Contracting Officer, and shall be in accordance with these specifications and plans.

B. The quantity of driveway approaches, concrete driveway replacement and concrete sidewalk replacement shown in the Proposal is an estimate and may be increased or decreased without an adjustment in unit prices as these items shall be considered "minor items."

3.2 SUBGRADE AND BASE COURSE PREPARATION

A. The subgrade shall be excavated or filled with suitable material to the required grades and lines.

B. All soft, yielding and otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted and extended a minimum of one foot (300 mm) outside the form lines.

C. The subgrade shall be 95% of maximum dry density as determined by AASHTO T 180 Modified Proctor Density.

D. When required on the plans base course will be installed to the required grade in accordance with Section 02231.

3.3 ERECTING FORMS

A. Forms, wood or steel, shall be staked securely in place, true to line and grade.

B. Sufficient support shall be given to the form to prevent movement in any direction, resulting from the weight of the concrete or the concrete placement.

C. Forms shall be clean and well-oiled prior to setting in place.

D. When set, the top of the form shall not depart from grade more than one-quarter inch (6.4 mm) when checked with a ten-foot (3 m) straightedge. The alignment shall not vary more than one-half inch (12.5 mm) in ten feet (3 m).

E. Immediately prior to placing the concrete, forms shall be carefully inspected for proper grading, alignment and rigid construction. Adjustments and repairs as needed shall be completed before placing concrete.

3.4 PLACING AND FINISHING CONCRETE

A. The subgrade or base course shall be properly compacted and brought to specified grade before placing concrete.

B. The subgrade or base course shall be thoroughly dampened immediately prior to the placement of the concrete.

C. Concrete shall be spaded and tamped thoroughly into the forms to provide a dense, compacted concrete free of rock pockets.

D. The exposed surfaces shall be floated, finished and broomed.

1. The surface of concrete shall be finished true to the lines and grades shown on the plans.

2. Concrete shall be worked until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. The surface shall then be floated with a wooden float to a smooth and uniform surface.

3. When the concrete has hardened sufficiently, the surface shall be given a broom finish. The broom shall be of an approved type. The strokes shall be square across the concrete from edge to edge with adjacent strokes overlapped. Strokes shall be made without tearing the concrete. The broomed finish shall produce regular corrugations not over one-eighth inch (2.36 mm) in depth.

4. Concrete that is adjacent to forms and formed joints shall be edged with a suitable edging tool to the dimensions shown on the plans.

E. The rate of concrete placement shall not exceed the rate at which the various placing and finishing operations can be performed in accordance with these specifications.

3.5 STRIPPING FORMS

A. Forms may be removed at such time as the concrete is sufficiently set that removal will be without danger of chipping or spalling.

1. When forms are removed before the expiration of the curing period, the edges of the concrete shall be protected with curing compound.

2. All forms shall be cleaned, oiled and be examined for defects before they are used again.

3.6 PROTECTION

A. The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting.

B. When concrete is being placed in cold weather and temperature may be expected to drop below 35°F, suitable protection shall be provided to keep the concrete from freezing until it is at least 72 hours old. Concrete damaged by freezing shall be removed and replaced at the Contractors expense.

3.7 CURING

A. Curing shall be in accordance with Section 03370, Concrete Curing.

3.8 JOINTS

A. Preformed Expansion Joints shall be installed at the locations shown in the standard details.

B. Contraction joints shall be provided between expansion joints at the intervals noted in the standard details. Joints in new construction shall match joints in adjacent existing concrete.

3.9 BACKFILL

A. In areas where lawns exist or as shown on the plans, the top four inches (100 mm) of backfill bringing its level up to the top of the sidewalk or driveway shall be black loam or good topsoil which is suitable for the growth of lawns.

1. It shall be placed out from the sidewalk or driveway a sufficient distance and in amount to replace turf or lawn removed during installation.

2. Backfill shall be completed by grading to match the existing lawn.

B. Where lawns do not exist, the top four inches (3 mm) of backfill shall be impervious dirt and shall be placed to conform with the typical sections shown on the plans.

C. Backfill shall be compacted to a density equal to the adjacent materials. It shall be leveled off to a neat and free draining surface.

3.10 TOLERANCES

A. The work shall be performed in a manner which results in the item being constructed true to line and grade, uniform in appearance and structurally sound.

B. Items found with unsightly bulges, ridges, low spots or other defects shall be removed and replaced at the Contractor's expense if the Contracting Officer considers them to be irreparable.

C. When checked with a ten-foot (3 m) straightedge, grade shall not deviate by more than one-quarter inch (6.4 mm) and alignment shall not vary by more than one-half (12.5 mm).

D. Final elevation shall not depart from plan elevation by more than ½ inch.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02776

SECTION 02810

IRRIGATION

1.0 GENERAL

1.1 DESCRIPTION

A. The applicable provisions of the General Conditions and Special Conditions of the specifications shall govern the work of this Section as if it were written here in full.

B. Furnish all work, materials, appliances, tools, equipment, facilities, transportation, and services necessary and incidental to performing all operations in connection with the installation of the complete irrigation system, as shown on the drawings and specified herein.

1.2 RELATED WORK

A. Sod: Section 02911

B. Landscape: Section 02955

1.3 ORDINANCES AND REGULATIONS

A. Local, municipal, and State laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above stated rules and regulations, or requirements of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above stated rules and regulations, the provisions of these specifications and drawings shall take precedence.

1.4 EXPLANATION OF THE DRAWINGS

A. The drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, plants, and other elements.

B. Due to the scale of the drawings, it is not possible to indicate or show all offsets, fittings and sleeves which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all work and shall plan his work accordingly, furnishing such offsets, fittings and sleeves as may be required to meet such conditions.

C. All work called for to provide a complete installation shall be furnished and installed whether or not specifically mentioned in the specifications.

D. The Contractor shall not install the irrigation system components where it is obvious in the field that obstructions, or discrepancies exist which may effect the function of the finished system. Such conditions shall be brought to the attention of the Contracting Officer's Representative who shall provide additional instructions. In the event that such conditions are not brought to the attention of the Contracting Officer's Representative, the Contractor shall assume full responsibility for any revisions necessary.

1.5 EXPERIENCE

A. The Contractor shall provide at least one person who shall be present at all times during execution of this portion of the work, and who shall be thoroughly familiar with the type of material being installed and who shall direct all work performed under this Section.

B. All work shall be installed by skilled persons, proficient in the trades required, in a neat, orderly and responsible manner with recognized standards of workmanship.

C. The Contractor shall have had not less then three (3) years experience in the installation of irrigation systems similar to those required for this project.

1.6 SUBMITTALS

A. Contractor shall submit full information for all equipment and materials indicated and required including manufacturer's "cut-sheets", data charts, performance characteristics and other relevant information.

B. Equipment or materials installed or furnished without prior approval of the Contracting Officer's Representative may by rejected and the Contractor will be required to remove such materials from the site at his own expense.

1.7 RECORD DRAWINGS

A. The Contractor shall at all times maintain a complete set of drawings on the project site and shall indicate on that set, in a clear and complete manner, all changes or modifications made to the irrigation system during construction. This shall include modifications to head locations, line locations, valve box locations, and any other revisions to the system which do not accurately reflect the drawings prepared by the Engineer.

B. The "record drawings" described above shall be delivered to the Contracting Officer's Representative at the time of Substantial Completion.

1.8 WARRANTY

A. All work under this Section shall be warranted in full for a period of not less than one (1) year from date of Final Acceptance.

1.9 PRODUCT HANDLING

A. Deliver, unload, store, handle materials, packaging, bundling, products in dry, weatherproof, waterproof condition in a manner to prevent damage, breakage, deterioration, intrusion, ignition vandalism. Deliver in original unopened containers prominently displaying manufacturer name, proprietary, volume, quantity, contents, instructions, conformance to local state, and federal law. Remove and replace cracked, broken, contaminated items or corrosive elements prematurely exposed to moisture, inclement weather, snow, ice, temperature extremes, fire, or jobsite damage.

B. Handling of PVC Pipe: The Contractor is cautioned to exercise care in handling, loading and storing of PVC pipe. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been damaged will be discarded and, if installed, shall be replaced.

C. Storage of Materials: All materials shall be carefully stacked or stored in an area designated for such storage.

1.10 JOBSITE CONDITIONS

A. Protection of Property (General): The Contractor shall be responsible for the preservation and protection of all trees, plants, monuments, structures and paved areas from damage due to his work. In the event damage does occur, all damaged items shall be repaired or replaced to the satisfaction of the Contracting Officer’s Representative and at the Contractor's expense.

B. The Contractor shall be responsible for locating all underground utilities prior to construction. The Contractor shall take whatever precautions are necessary to protect these underground utilities from damage, and, in the event damage does occur, all damage shall be repaired. All costs of repairs shall be paid by the Contractor.

1.11 EQUIPMENT TO BE FURNISHED

A. Supply as a part of this contract the following:

B. One set of all special tools required for removing, disassembling and adjusting each type of head and valve.

2.0 PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. All pipe shall be indelibly marked with the following;

- Manufacturer's name
- Nominal pipe size
- Schedule of class
- Pressure rating (psi)
- NSF (National Sanitation Foundation) seal of approval
- Date of extrusion

B. PVC pipe for main and lateral lines for spray and rotor zones shall be Class 200 belled end pipe manufactured from virgin polyvinyl chloride compound in accord with ASTM D 2241 and ASTM D 1784, cell classification 12454-B, Type 1, Grade 1.

C. Fittings for PVC pipe shall be standard weight, Schedule 40, injection molded PVC. Comply with ASTM D 1784 and D 2466, cell classification 12454-B.

Joint cement: Type as recommended by manufacturer of pipe and fittings.

D. Poly pipe for drip zone laterals shall be polyethylene low density 1" SDR 15 pipe meeting ASTM D 2239. Fittings shall be standard compression line fittings.

E. PVC sleeves shall be Schedule 40 PVC pipe, diameter as shown on the drawings.

F. Risers

1. All spray heads shall have risers of flexible black tubing constructed of virgin linear low density polyethylene material. The tubing shall have a wall thickness of 0.085". It shall nave a nominal inside diameter of 0.490" for use with spiral barb fittings without the necessity of glue or clamps. Each 18" length of tubing shall be capable of pressure testing at the rate of 100 psi per second to a minimum burst pressure of 350 psi. The swing pipe shall be capable of 8 gpm maximum.

   The tubing shall have an operating pressure rating of 80 psi at 110 deg. F.

2.2 VALVE BOX

A. Valve boxes for zone valve setups shall be thermoplastic boxes manufactured for use in irrigation system. Boxes shall have locking lids; lids shall be green in color. Lids shall have the words "IRRIGATION CONTROL VALVE" or "CONTROL VALVE" imprinted on the top surface. Boxes shall be large enough to comfortably accommodate valve setup as required. Each valve box cover shall have the number of the zone valve permanently imprinted into the outside top of the cover in minimum 1 inch high legible numbers.

2.3 ELECTRICAL CONTROL WIRING

A. The electrical control wire shall be No. 14 direct burial copper wire AWG U.F. U.L. approved or larger, if required to operate the system as designed.

B. All control wire shall be red. All common wires shall be white. Control wire connections and splices shall be made with water proof wire connectors. Extra zone wires shall be green.

2.4 ELECTRIC CONTROL VALVES

A. Automatic Controllers, Electrical

1. Controller shall be Rainbird model ESP-8MC or approved equal.

B. Spray and Rotor Zone Valves

1. Remote control valves for pop-up spray zones shall be Rainbird PEB valves of the size indicated on the drawings or approved equal.

C. Drip Control Valve

1. Remote control valves for drip zones shall be Rainbird model XCZ-075-PRF (zone kit) or approved equal.

2.5 RISER MOUNTED PRESSURE COMPENSATED EMITTER.

A. Drip system equipment shall consist of the following Rainbird products or approved equal:

1. Subterranean emitter box shall be model SEB-6X.

2. Multi outlet emission device shall be model XB-10-6.

3. ¼" distribution tubing shall be model DT-025.

4. Single outlet emitter shall be model XB-10.

5. Stake for distribution tubing to be ¼" tubing stake model TS-025.

6. End (flush) valves for installation at the ends of laterals to be 1" PVC ball valve. (provide transitional fittings as required).

2.6 IRRIGATION HEADS

A. Full or Part Circle Sprinklers and Nozzles

1. Pop-up sprinklers shall be Rainbird model 1804 or approved equal.

2. Nozzles shall be Rainbird MPR nozzles of the size indicated on the drawings or as required to match approved heads or for proper coverage without overspray on to paved surfaces or building.

2.7 QUICK COUPLER VALVES

A. Quick couplers valves shall be Rainbird model 5-RC or approved equal. Provide corresponding valve key and hose swivel.

2.8 ISOLATION BALL VALVES

A. Isolation ball valves shall as manufactured by Spears or approved equal.

3.0 EXECUTION

3.1 SITE REVIEW

A. Review all site conditions prior to construction.

3.2 STAKING AND LAYOUT

A. The Contractor shall provide all manpower and materials necessary for the staking of the irrigation system in accordance with plans, specifications and manufacturer's recommended spacing for proper distribution.

B. The Contractor shall stake the locations of all heads, main lines and lateral lines for inspection and approval of the Contracting Officer’s Representative prior to beginning any trenching or other actual installation work.

C. Contractor shall request such inspection at least ten (10) working days prior to the time of the desired inspection. All staking must be done before the Contracting Officer’s Representative will make this inspection.

3.3 TRENCHING

A. Trench excavation shall follow layout indicated on the drawings and as approved by the Contracting Officer’s Representative.

B. PVC main lines shall be 18" below finished grade.

C. PVC lateral lines and poly lateral lines shall be 12" below finished grade.

D. Any settling of trenches during warranty period shall be repaired at the Contractor's expense.

3.4 BACKFILLING OF TRENCHES

A. Backfilling of trenches shall not be done until pipe installation has been inspected by the Contracting Officer's Representative.

B. Irrigation trenches shall be backfilled with excavated materials approved for backfilling, consisting of earth free of rock and debris over 1" in size.

C. Trenches shall be backfilled in 6" lifts and settled with water and compacted every 6 inches so as to be at and stay at the proper finished grade prior to installation of sod or mulch over the trenches. Settling of trenches shall be the responsibility of the Contractor through the warranty period.

3.5 PIPING

A. All joints shall be made and pipe laid following manufacturer's recommendations for same.

3.6 WIRING

A. Control wiring shall be installed in main line pipe trenches and shall be laid such that it is below the top of the pipe and running consistently along one the side of the pipe. Wire shall be bundled and tied loosely with plastic ties every 25-30 feet.

B. There shall be a length of coiled wire (pigtailed) prior to the connection of the electrical control valve. Coils shall be formed by wrapping wire at least eight (8) times around a 1" pipe and withdrawing pipe.

C. All splices of zone control wires shall be made in a valve box.

D. One extra wire (green in color) shall be run along each length of main line from the controller to the last zone valve on each main line run. This wire shall be reserved for future use.

3.7 ELECTRIC CONTROL VALVE

A. Install as shown on the drawings, where approved by the Contracting Officer's Representative, and as per details and manufacturer's specifications.

3.8 VALVE BOX

A. Mount box so that top of box is flush with surrounding finished lawn grade. Boxes in rock mulch areas shall be set so that the top of the box is 1" above the rock mulch finished grade.

B. Where two or more boxes are in close proximity to each other, they shall be set so as to be parallel to each other.

3.9 IRRIGATION HEADS

A. Install as shown on the drawings and where approved by the Contracting Officer's Representative.

3.10 INSTALLATION OF DRIP IRRIGATION SYSTEM

A. Install drip irrigation components per the drawings.

3.11 TESTING

A. All main and lateral lines shall be tested at full operating pressure for a minimum of four hours to determine that no leaks exist. Should any leaks be found they shall be repaired and the line retested until satisfactory.

B. All lines shall be properly flushed to insure that the lines are clear of all dirt and other debris. Zone lines shall be flushed prior to installation of the sprinkler heads.

3.12 ADJUSTMENT OF COVERAGE

A. If it is determined that adjustments in the irrigation equipment will provide more adequate coverage, the Contractor shall make such adjustments prior to acceptance at the direction of the Contracting Officer's Representative and at no additional cost to the Owner. Adjustments may include settings of arcs, substitutions of nozzle sizes, radius adjustments, and settings of any and all valves.

3.13 CLEAN-UP

A. Clean-up shall be continuous and the Contractor shall be responsible for disposing of, off site, at no additional expense, any trash or debris generated by the installation of the work.

3.14 CONSTRUCTION ACCEPTANCE

A. The Contractor shall demonstrate to the Contracting Officer's Representative that the system is operating properly and completely prior to acceptance.

B. Items deemed not acceptable shall be reworked until acceptable.

3.15 WINTERIZATION

A. Contractor shall include in his bid and shall be responsible for winterizing the complete system at the conclusion of the sprinkling season (in which Final Acceptance occurs) upon notification by the Owner and within three working days of such notification. System shall be blown free of water using compressed air.

B. Winterization shall be done in the presence of the Owner's representative.

3.16 MANUALS AND INSTRUCTIONS

A. Manuals

1. The Contractor shall prepare and deliver to the Contracting Officer's Representative, three (3) copies of an "Operations Manual" for the irrigation system. The manual shall be logically organized and all entries shall be neatly typed; the manual shall be bound using a GBC or spiral binding and shall have a heavy duty cover. No handwritten material will be accepted.

2. The "Operations Manual" shall include at least the following:

   a. Cover page including project name and address

   b. Title page including project name and address, when and by whom it was prepared.

   c. Table of Contents.

   d. Directory listing names, addresses and telephone numbers of Engineer, Contractor, Subcontractors, and major suppliers.

   e. Complete instructions and specifications regarding operation and maintenance of all equipment and operable devices such as but not limited to the controller, emitters and valves.

   f. Manufacturers' bulletins, cut sheets and descriptive data for equipment, operable devices and other products with replaceable or serviceable components. Indicate the precise items included in this installation and delete or indicate those not included. Include nomenclature and number of all replaceable parts, name and address of nearest vendor and pertinent data regarding procurement procedures.

   g. Letters certifying that the Owner's personnel have been properly instructed in the use, adjustment and maintenance of all irrigation equipment.

h. Maintenance data on other products requiring special periodic cleaning or care.

i. Copies of all guarantees and warranties.

B. Instructions

1. The Contractor shall instruct the Owner's representative(s) on the proper operation and maintenance of the irrigation system. This shall be done in person and on the site at a time agreeable to both parties but prior to Final Payment. This shall be in addition to the preparation of any written manuals.

2. The Contractor shall instruct the Owner in detail regarding all information included, or to be included in the manual, in addition to the following:

- Start-up
- Shut-down
- Emergency operations
- Noise and vibration adjustments
- Safety procedures
- Tools
- Lubricants
- Control sequences
- Cleaning

3. In addition the Contractor shall instruct the Owner's representative in the proper method of winterizing the complete system at the conclusion of the sprinkling season. The system shall be blown free of water using compressed air.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

5.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment shall be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02810

SECTION 02820

GALVANIZED CHAIN LINK FENCE AND GATES

1.0 GENERAL

1.1 SECTION INCLUDES

A. Galvanized coated chain link fencing and accessories for industrial use.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete

1.3 SUBMITTALS

A. Changes in specifications may not be made after the bid date.

B. Shop Drawings: Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.

C. Product Data: Manufacturer's catalog cuts indicating material compliance and specified options.

2.0 PRODUCTS

2.1 MANUFACTURER

A. Products from qualified manufacturers having a minimum of five years experience manufacturing galvanized coated chain link fencing will be acceptable by the engineer as equal, if approved in writing, ten days prior to bidding, and if they meet the following specifications for design, size gauge of metal parts and fabrication.

B. Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

C. Approved Manufacturer: Master Halco / Anchor Fence, Baltimore, MD, or equals.

2.2 CHAIN LINK FENCE FABRIC (see index for selections)

A. Galvanized Wire: Zinc coated Wire, ASTM A 392 - 1.2oz/sf. [Wire Spec-A817-83, Class 1.]

B. Size: Helically wound and woven to height of 7feet (2130 mm) [as indicated on drawings] with 2" (50 mm) diamond mesh, 9 gauge, with a wire diameter of 3.76 mm and a breakload of 1290 lbf (5740 N).

C. Selvage of fabric twisted at top and twisted at bottom.

2.3 STEEL FENCE FRAMING

A. Steel Pipe - Type I: ASTM F 1083, standard weight schedule 40; minimum yield strength of 25,000 psi (170 MPa); sizes as indicated. Hot-dipped galvanized with minimum average 1.8 oz/ft² (550 g/m²) of coated surface area.

B. Steel Pipe - Type II: Cold formed and welded steel pipe complying with ASTM F 1043, Group IC, with minimum yield strength of 50,000 psi (344 MPa), sizes as indicated. Protective coating per ASTM F 1043, external coating Type B, zinc with organic overcoat, 0.9 oz/ft² (275 g/m²) minimum zinc coating with chromate conversion coating and verifiable polymer film. Internal coating Type B, minimum 0.9 oz/ft² (275 g/m²) zinc or Type D, zinc pigmented, 81% nominal coating, minimum 3 mils (0.08 mm) thick.

C. Formed Steel ("C") Sections: Roll formed steel shapes complying with ASTM F 1043, Group II, produced from 45,000-psi (310 MPa) yield strength steel; sizes as indicated. External coating per ASTM F 1043, Type A, minimum average 2.0 oz/ft² (610 g/m²) of zinc per ASTM A 123, or 4.0 oz/ft² (1220 g/m²) per ASTM A 525.

D. Steel Square Sections: (ASTM A 500, Grade B) Steel having minimum yield strength of 40,000 psi (275 MPa); sizes as indicated. Hot-dipped galvanized with minimum 1.8 oz/ft² (550 g/m²) of coated surface area.

E. End and Corner Post 2.875 od (73 mm) 5.79 lbs/ft (8.62 kg/m)

OR

Line (intermediate) Post 2.375 od (60 mm) 3.65 lbs/ft (5.43 kg/m)

OR

Rail and Braces 1.66 od (42 mm) 2.27 lbs/ft (3.38 kg/m)

2.4 GATES

A. Gate Frames: Fabricate chain link swing gates in accordance with ASTM F 900 using [galvanized steel tubular members, 2" (50 mm) square, weighing 2.60 lb/ft (3.87 kg/m)] [or] [aluminum tubular members, 2" (50 mm) square, weighing 0.94 lb/ft (1.39 kg/m)]. Fusion or stainless steel welded connections forming rigid one-piece unit. Polyolefin coated frames thermally fused with minimum 10 mils (0.254 mm) per ASTM 1043 (**after fabrication**). Coating before fabrication will not be allowed. (If gate frame is not to be polyolefin coated eliminate reference to polyolefin coating. For gates over 8' (2438 mm)

high or 15’ (4572 mm) wide, provide minimum 1-1/2” (38 mm) square additional horizontal and vertical interior members to ensure proper strength.

B. Chain Link Fence Fabric: Galvanized per ASTM A392 with color, mesh and guage to match fence. Install fabric with hook bolts and tension bars at all 4 sides (no substitution). Attach to gate frame at not more than 15” (381 mm) on center.

C. Hardware Materials: Hot dipped galvanized steel or malleable iron shapes to suit gate size. [Field coat moveable parts (e.g. hinges, latch, keeper, and drop bar) with Polyolefin touch up paint, provided by manufacturer, to match adjacent finishes].

D. Hinges: Structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing [180° (3.14 rad) inward] [or] [180° (3.14 rad) outward].

E. Latch: Forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.

F. Keeper: Provide keeper for each gate leaf over 5’ (1524 mm) wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

G. Double Gates: Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves.

H. Barbed Wire Top: Incorporate provisions for barbed extensions by extending vertical members 13” (380 mm) to accommodate three strands of barbed wire.

I. Gate Posts: [Steel pipe [ASTM F 1083] standard weight schedule 40; minimum yield strength of 25,000 psi (170 MPa)] [or] [Steel square sections (ASTM A 500, Grade B) having minimum yield strength of 40,000 psi (275) MPa] size as indicated. Hot-dipped galvanized with minimum 1.8 oz/ft² (550 kg/m²) of zinc [or respective material finished in accordance with ASTM F 1043].

Gate Leaf Single Width	Post Size (Round)	Weight
6 ft (1829 mm) or less	2.875 in (73 mm)	5.79 lb/ft (8.6 kg/m)
6 ft (1829 mm) to 12 ft (3657 mm)	4.00 in (101.6 mm)	9.11 lb/ft (13.6 kg/m)
12 ft (3657 mm) to 19 ft (5790 mm)	6.625 in (168.3 mm)	18.97 lb/ft (28.3 kg/m)
19 ft (5790 mm) to 23 ft (7010 mm)	8.625 in (219.1 mm)	28.55 lb/ft (42.5 kg/m)

OR

Gate Leaf Single Width	Post Size (Square)	Weight
6 ft (1829 mm) or less	2.5 in (63.5 mm) (3/16" wall) (4.76 mm)	5.1 lb/ft (7.54 kg/m)
6 ft (1829 mm)	4.0 in (101.6 mm)	
to 12 ft (3657 mm)	3/16" wall) (4.76 mm)	9.59 lb/ft (14.18 kg/m)
12 ft (3657 mm) to 19 ft (5790 mm)	6.0 in (152.4 mm) (3/16" wall) (4.76 mm)	14.65 lb/ft (21.67 kg/m)
19 ft (5790 mm) to 23 ft (7010 mm)	8.0 in (203.2 mm) (1/4" wall) (6.35 mm)	25.44 lb/ft (37.63 kg/m)

2.5 ACCESSORIES

A. Chain Link Fence Accessories: [ASTM F 626] Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

B. Post Caps: Formed steel, cast malleable iron, or aluminum alloy weather tight closure cap for tubular posts. Provide one cap for each post. Cap to have provision for barbed wire when necessary. "C" shaped line post without top rail or barbed wire supporting arms do not require post caps. (Where top rail is used, provide tops to permit passage of top rail.)

C. Top Rail And Brace Rail Ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

D. Top Rail Sleeves: 7" (178 mm) expansion sleeve with spring, allowing for expansion and contraction of top rail.

E. Wire Ties: 9 gauge [0.148" (3.76 mm)] galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge [0.092" (2.324 mm)] for rails and braces. Hog ring ties of 12-1/2 gauge [0.0985" (2.502 mm)] for attachment of fabric to tension wire.

F. Brace And Tension (Stretcher Bar) Bands: Pressed steel. At square post provide tension bar clips.

G. Tension (Stretcher) Bars: One piece lengths equal to 2 inches (50 mm) less than full height of fabric with a minimum cross-section of 3/16" x 3/4" (4.76 mm x 19 mm) or equivalent fiber glass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

H. Tension Wire: Galvanized coated steel wire, 7 gauge, [0.177"(4.5 mm)] diameter wire with tensile strength of 75,000 psi (517 MPa).

I. Truss Rods & Tightener: Steel rods with minimum diameter of 5/16" (7.9 mm). Capable of withstanding a tension of minimum 2,000 lbs.

J. Barbed Wire:[ASTM A 121] Class 3, zinc coated steel wire double-strand, 12-1/2 gauge [0.099"(2.51mm)] twisted line wire with galvanized steel, 4 point barbs spaced approximately 5" (127mm) on center.

K. Barbed Wire Supporting Arms: Pressed steel arms with provisions for attaching 3 rows or barbed wire. Arms shall withstand 250 lb. (113.5kg) downward pull at the outermost end of arm without failure.

1. Provide [450] [3 strands, single arm] [and] [6 strands double "V' arms].

2. Provide intermediate arms with hole for passage of top rail as required.

L. Nuts and bolts are galvanized.

M. Privacy Slats: (None)

2.6 SETTING MATERIALS

A. Concrete: minimum 28-day compressive strength of 3,000 psi (20 MPa).

3.0 EXECUTION

3.1 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations.

B. Ensure property lines and legal boundaries of work are clearly established.

3.2 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F 567 and manufacturer's instructions.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30° or more.

C. Space line posts uniformly [at 10' (3048 mm) on center maximum].

D. Concrete Set [Terminal] [And] [Gate] Posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 6" (152 mm) deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" (914 mm) below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.

E. Drive Anchor [line] posts: N/A

F. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

G. Bracing: Install horizontal pipe brace at mid-height for fences 6' (1829 mm) and over, on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Adjust truss rod, ensuring posts remain plumb.

H. Tension Wire: Provide tension wire at bottom of fabric [and at top, if top rail is not specified]. Install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 12-1/2 gauge [0.0985" (2.502 mm)] hog rings 24" (610 mm) oc.

I. Top Rail: Install lengths, 21' (6400 mm). Connect joints with sleeves for rigid connections for expansion/contraction.

J. Center Rails (for fabric height 12' (3658 mm) and over). Install mid rails between posts with fittings and accessories.

K. Bottom Rails: Install bottom rails between posts with fittings and accessories.

3.3 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on security side and attach so that fabric remains in tension after pulling force is released. eave approximately 2" (50 mm) between finish grade and bottom selvage. Attach fabric with wire ties to line posts at 15" (381 mm) on center and to rails, braces, and tension wire at 24" (600 mm) on center.

B. Tension (Stretcher) Bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15" (381 mm) on center.

3.4 ACCESSORIES

A. Tie Wires: Bend ends of wire to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

C. Barbed Wire: Uniformly space parallel rows of barbed wire on security side of fence. Pull wire taut and attach in clips or slots of each extension.

D. Slats: N/A

3.5 SWING GATE POST

A. Install gate posts in accordance with manufacturer's instructions.

B. Concrete Set Gate Posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 6" (152 mm) deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" (914 mm) below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post and slope to direct water away from posts.

1. Gate Posts and Hardware: Set keeper, stops, sleeves into concrete. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

3.6 GATE INSTALLATION

A. Install gates plumb, level, and secure for full opening without interference.

B. Attach hardware by means which will prevent unauthorized removal.

C. Adjust hardware for smooth operation.

D. Touch up hardware (see 2.04 C.)

3.7 CLEANING

A. Clean up debris and unused material, and remove from the site.

END OF SECTION 02820

SECTION 02896

FIBERGLASS / POLYESTER INTERLAYER

PAVING MAT (NON-WOVEN)

1.0 GENERAL

1.1 SUMMARY

A. This work shall consist of furnishing and installing Owens Corning TruPave^{R} Engineered Paving Mat, or approved equal, as shown on the plans and specifications.

1.2 SUBMITTALS

A. Contractor shall submit for Contracting Officer's approval the name of paving mat, test data, installation procedures, MSDS, and handling and storage procedures prior to incorporation into the work.

B. Manufacturer's recommended installation procedures which, when approved by Contracting Officer, shall become the basis for accepting or rejecting actual installation procedures used in the work.

1.3 QUALITY ASSURANCE

A. Deliver, handle, and store materials in accordance with manufacturer's instructions. All test methods shall be in accordance with latest ASTM procedures.

2.0 PRODUCTS

2.1 MATERIALS

A. The paving mat shall be constructed of a wet-formed non-woven material consisting of at least 60% fiberglass (by weight), the remainder comprised of polyester and binder. The material shall have a minimum average roll value (MARV) unit weight of 3.69 oz. /sq. yd (125 g/m2). The material shall be resistant to chemicals, mildew and rot, and shall not have any tears or holes that will adversely affect the in-situ performance and physical properties of the installed material. The paving mat shall meet the following physical requirements as follows:

PHYSICAL PROPERTIES OF ENGINEERED PAVING MAT			
Property	**Test Method**	**Units**	**Min. Value**
Mass per unit area	ASTM D 5261	g/m^2 (oz / yd^2)	136 (4.0)
Tensile Strength, MD	ASTM D 5035[1]	N/50 mm (lb/2 in)	> 200 (45)
Tensile Strength, CD	ASTM D 5035	N/50 mm (lb/2 in)	> 200 (45)
Elongation at max load, MD	ASTM D 5035	percent	< 5
Elongation at max load, CD	ASTM D 5035	percent	< 5
Melting point	ASTM D 276	C (F)	> 230 (> 446)

Note: Conditions for tensile strength measurements:

Sample width: 50 mm Sample length: 250 mm

Gage length: 175 mm Crosshead speed: 50 mm/min

[1]ASTM D 5035 is designated for materials that exhibit <11% elongation (ASTM D 5035. Section 1.2)

B. The mat manufacturer shall furnish a letter of certification covering the physical and engineering properties of the mat. A letter of certificate shall be furnished with each shipment stating that the paving mat complies with the specification requirements.

3.0 EXECUTION

3.1 PACKAGING AND ON SITE STORAGE

A. Engineering paving mat shall be shipped and stored for protection. The product must not be allowed to become wet prior to installation. Rolls shall be externally tagged for easy field identification. External tagging shall include the following:

1. Name of Manufacturer
2. Product type
3. Product grade
4. Lot number
5. Physical dimensions

3.2 PAVING MAT INSTALLATION

A. Installation of paving mat interlayer shall be performed or supervised during start-up by a trained and experienced installer certified by the manufacturer or their agent(s).

B. Surface to be overlaid with the paving mat shall be cleaned, dry and free and clear of all dirt and debris. At the direction of the Contracting Officer, any and all irregular surface conditions shall be leveled by the use of a bituminous wedge or scratch course installed by hand or with the use of a mechanically powered asphalt paving machine.

C. Mat shall be installed to the surface using mechanically powered installation equipment or by hand installed means. Mechanical equipment shall be capable of installing full width rolls of up to 12.5 feet in width. The installation by hand may also be used in situations where area requires specially cut sections, and/or where mechanically installed methods cannot be accomplished. Brooms or squeegees shall be used to remove any air bubbles and ensure paving mat is completely in contact with the tack-coated surface. Large wrinkles (1" and larger) shall be slit and lapped in the direction of paving and pressed down into the tack coat to insure adhesion. Burning or torching of wrinkles will not be allowed.

D. Paving mat shall be overlapped to provide a minimum of two (2) inches longitudinally and a minimum of four (4) inches transversely. Overlaps on the transverse roll ends shall be in the direction of the paving operation to avoid paving mat pick-up during asphalt installation. All overlapping of paving mat shall be tack coated to ensure proper adhesion.

3.3 TACK COAT APPLICATION

A. The asphalt tack coat shall be hot applied asphalt meeting grade requirements PG 64-22. The asphalt shall be between 310° and 335° F in the distributor truck at the time of application. Every effort shall be made to install paving mat over hot asphalt tack coat.

B. Tack coat application rate shall be 0.21 g/sq. yd. At the discretion and direction of the Contracting Officer, the application rate may be increased for heavily aged and/or deteriorated pavements to .25 g/sq. yd. In the event that the contractor has applied less and/or more tack coat than is required, the Contracting Officer shall direct the contractor to make the necessary adjustments to the equipment to achieve the desired results. The use of cutbacks, emulsion or materials containing solvents shall not be permitted for use as tack coat.

3.4 APPLICATION PROCEDURES

A. The tack coat application shall be applied using a mechanically operated distributor truck, calibrated to meet the specified application rate as called for in the plans and specifications. The tack coat application temperatures shall be sufficiently hot so as to ensure proper coverage and proper adhesion of the paving mat to the pavement surface. The use of hand sprayers, squeegees and or brush-applied tack coat may be used in locations where the distributor truck

cannot reach. Every effort shall be made to minimize the application of tack coat by hand-applied means. The tack coat shall be applied in a uniform application to sufficiently cover the surface prior to the installation of the paving mat.

B. The application width of tack coat shall be sufficiently wide to cover the entire width of the paving mat, plus any additional width required for overlapping joints. The tack coat shall be applied only as far in advance of the mat installation to ensure a tacky surface at the time of the mat installation. Traffic shall not be permitted to drive on the tack coat at any time.

C. Excess tack coat shall be cleaned from the pavement. In the event that installation operations must be curtailed, barricade the affected area where the tack coat and mat have been installed, thus preventing vehicular traffic from driving on the prepared surface.

D. Blotting the sealant, spreading sand or broadcasting bituminous asphalt mix over the paving mat shall be utilized to minimize and prevent construction and or paving tires/tracks from adhering to the tack coat and pulling up the mat. In the event that the paving mat has been displaced from the surface, additional rolling and or hand-brushing will be required to restore the bond between the surface and paving mat. An additional application of tack may be required to ensure adhesion. Additional tack coat or labor shall not be paid for shall be considered incidental to the installation of the paving mat.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 METHOD OF MEASUREMENT

A. Engineered paving mat will not be measured separately for payment.

4.2 BASIS OF PAYMENT

A. Basis of Payment will be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be lump sum.

END OF SECTION 02896

SECTION 02911

SOD

1.0 GENERAL

1.1 DESCRIPTION

A. The applicable provisions of the General Conditions and Special Conditions of the specifications shall govern the work of this Section as if it were written here in full.

B. Furnish all work, materials, appliances, tools, equipment, facilities, transportation, and services necessary and incidental to performing all operations in connection with the installation of sod, as shown on the drawings and specified herein.

C. Work includes preparation of finished grades, placement of sod, and other normally required work within areas as shown on the drawings.

1.2 RELATED WORK

A. Irrigation: Section 02810

1.3 QUALITY ASSURANCE

A. All materials shall be subject to inspection and approval prior to installation.

B. Applicable Standards:

1. American Association of Nurserymen, current edition of "American Standard for Nursery Stock. Published by American Association of Nurserymen, Inc., 635-636 Southern Building, Washington, DC.

2. Certificates of Inspection for Sod: All necessary State, Federal and other inspection certificates shall accompany the invoice for each shipment of materials as may be required by law, and showing source of origin. Certificates shall be made available to the Contracting Officer's Representative upon request.

1.4 SUBMITTALS

A. Statement of source of sod.

B. Statement of source of topsoil and sample of topsoil (1 cubic foot).

1.5 APPROVALS

A. Ensure that topsoil has been placed and approved prior to finished grading.

B. Ensure that grades have been approved and that the areas to receive sod are ready for work under this section prior to beginning work. This shall include installation of the irrigation system.

1.6 DELIVERY AND HANDLING

A. Do not deliver sod to site until all areas to receive sod have been properly prepared.

B. Protect sod from damage at all times. Materials which, in the opinion of the Contracting Officer's Representative, have been damaged shall not be used on the project.

1.7 MAINTENANCE

A. The Contractor shall begin maintenance immediately after sodding and shall continue maintenance until Final Completion. Maintenance shall include mowing, watering and fertilizing as necessary. Mowing shall be done when the general height of the grass reaches 4 inches. Grass shall be cut to a height of 2 ½-3 inches. All cut grass shall be picked up and removed from the site by the contractor.

2.0 PRODUCTS

2.1 SOD

A. Grass mix for sod shall be as follows:

B. Elite Plus as grown by Greenlawn Sod Co., Fort Collins, CO. or other mixture approved by the Contracting Officer's Representative.

Mixture: 90% Dwarf Tall Fescue

10% Bluegrass

C. Sod shall be in compliance with applicable Wyoming and Federal regulations, having a healthy root system, regularly fertilized, watered, mowed, sprayed and free from objectionable weeds and or grasses. Sod strips shall have from 5/8" minimum to 1" maximum thickness of soil adhering to root system. Sod which has dried out, or sod with adhering soil which breaks, tears or crumbles away will not be accepted. Sod rolls shall be kept moist, protected from sun, heat and wind, and properly protected in transport. The sod source shall be made known to and approved by the Contracting Officer's Representative prior to installation.

D. Sod rolls shall be cut into strips approximately 13" wide and six (6) feet long.

2.2 TOPSOIL

A. Topsoil shall be well-graded topsoil of good uniform quality. It shall be natural friable soil representative of productive soils in the vicinity. Topsoil shall be free of admixture of subsoil, foreign matter, objects larger than one-inch in any dimension, toxic substances, weeds and any material or substances that may be harmful to plant growth and shall contain a minimum of 5% and a maximum of 25% organic matter by weight.

B. Contractor shall furnish required planting soil. At least 10 days prior to soil delivery, notify Contracting Officer's Representative of the source(s) from which soil is to be furnished and submit sample for approval.

3.0 EXECUTION

3.1 SITE REVIEW

A. Irrigation systems are to be completely installed prior to proceeding with work of this Section in those areas where irrigation is to be installed.

3.2 SOIL PREPARATION

A. Spread approved topsoil 6 inches deep over full areas to receive sod.

3.3 SOD INSTALLATION

A. Hand rake all areas to receive sod so as to remove all debris, clods, stones, vegetative or other foreign matter larger than one inch (1") to a depth of four inches (6"). Be sure that all areas are to grade and approved by the Contracting Officer's Representative prior to placing sod.

B. Raked soil grades along paved edges shall be at a consistent depth of 2 inches below the top of sidewalks or curbs before sodding.

C. Contractor shall call for inspection of sod areas after preparation but before installation of sod.

D. Lay sod within thirty-six (36) hours from time of cutting. Do not install dormant sod; do not install sod if ground is frozen or muddy.

E. Lay sod parallel to contours with joints staggered. Joints must be butted tightly to prevent voids that could permit air drying of roots. No pieces of sod less then one foot square shall be used to patch sod.

F. Moisten prepared sod areas before laying sod if soil is very dry. Water thoroughly and allow surface to dry to a moist condition before laying sod.

Do not create a muddy condition or cause surface erosion.

G. When in position, the sod shall be watered, then rolled into contact with the soil so that no open joints are apparent and sod edges are neat and clean to all edges. The completed sodded surface shall be true to finished grade, even and firm at all points.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment shall be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02911

SECTION 02955

LANDSCAPE

1.0 GENERAL

1.1 DESCRIPTION

A. The applicable provisions of the General Conditions and Special Conditions of these specifications shall govern the work of this Section as if it were written here in full.

B. Furnish all work, materials, appliances, tools, equipment, transportation and services necessary and incidental with the installation of materials specified herein or as shown on the drawings.

1. Work included:
2. Materials and installation.
3. Grading of planting areas.
4. Planting of shrubs.
5. Installation of weed barrier and rock mulch.
6. Installation of metal landscape edger.

1.2 RELATED WORK

A. Irrigation: Section 02810

B. Sod: Section 02910

1.3 APPLICABLE STANDARDS

A. All plants furnished under this contract shall comply with:

1. ANSI Z60.1, "American Standard for Nursery Stock", latest edition. Nomenclature of Standardized Plant Names, Second Edition.
2. American Joint Committee of Horticultural Nomenclature, “Standardized Plant Names”, Latest Edition.
3. Botanical names shall take precedence over common names.
4. When required the Contractor shall deliver samples of materials or products to the Contracting Officer’s Representative for approval prior to

installation. Approved samples shall be representative of the installed material or products. Samples shall be clearly labeled.

1.4 DELIVERY AND HANDLING

A. The Contractor shall not deliver plant material to the site until all areas have been properly prepared. The Contractor shall protect materials from damage at all times. Materials which, in the opinion of the Contracting Officer's Representative, have been damaged shall not be used on the project.

B. All material shall be protected from damage and deterioration, including desiccation, during transport, delivery and storage.

C. The Contractor shall be responsible for storage and protection of all materials until final acceptance.

D. Storage of materials on site shall be in an area approved by the Contracting Officer's Representative.

1.5 INSPECTIONS

A. The Contractor shall call for plant material inspection by the Contracting Officer's Representative ten (10) working prior to scheduled planting. The Contractor is reminded that size, shape and other requirements shall be strictly enforced by the Contracting Officer's Representative.

1.6 GUARANTEES AND REPLACEMENT

A. The Contractor shall be responsible for all materials and workmanship until final acceptance unless otherwise specified.

B. The Contractor shall furnish certificates of plant material inspection to the Contracting Officer's Representative as may be required by Federal, State, or other authorities, upon request from the Contracting Officer's Representative.

C. The Contractor shall furnish a statement from his plant material supplier certifying that plants furnished are free from disease and were in compliance with the specifications pertaining to size, species, hardiness and nursery growing procedures upon shipment to the Contractor.

D. Prior to Final Payment, as required elsewhere in the specifications, the Contractor shall submit a written and signed "Statement of Plant Material Guarantee" to the Government stating the following:

E. Plants shall be guaranteed for twelve (12) months after Final Acceptance of the work by the Contracting Officer's Representative.

F. At the end of the guarantee period, inspection will be made by the Contracting

Officer's Representative upon written notice requesting such inspection submitted by the Contractor at least ten (10) days before the end of the guarantee period. No plant will be accepted unless it is alive and healthy. The Contractor shall replace any plants which are dead, or in the opinion of the Contracting Officer's Representative are in an unhealthy or unsightly condition, and/or have lost their natural form due to dead branches. Any rejected plant material shall be removed from the project site; these and any plant missing, due to the Contractor's negligence, shall be replaced as soon as conditions permit, but during the normal planting season.

G. All replacements shall be plants of the same kind and size as specified in the original construction documents. They shall be furnished and placed as specified under new planting; the cost shall be borne by the Contractor except for damage due to occupancy of the project, vandalism, or acts of neglect on the part of others, during the guarantee period after acceptance.

H. All replacement plants shall be guaranteed for 12 months after planting and all requirements of this section shall apply to any and all replacement plants.

1.7 PLANT MATERIAL SUBSTITUTIONS

A. Plant material substitutions shall be made only after the Contractor has submitted satisfactory evidence to the Contracting Officer's Representative that the plant material specified is not available and only prior to bidding. Final decisions related to plant material substitution shall be made only by the Contracting Officer's Representative. In no case shall plant substitutions increase the Contract price. The Contractor is advised to check plant availability prior to bidding.

1.8 SUBMITTALS

A. Submit samples of the following:

1. Rock mulch (1 cu ft) each type
2. Weed barrier (1 sq. ft.)
3. Planting topsoil (1 cu. ft.)
4. Landscape edger (2 lf)

B. The Contractor shall furnish certificates of plant material inspection to the Contracting Officer's Representative, upon request from the Contracting Officer's Representative.

C. The Contractor shall furnish a statement from the plant material supplier certifying that plants furnished are free from disease and that they are in compliance with the specifications pertaining to size, species, hardiness and

nursery growing procedures upon shipment to the Contractor. Copies of any and all inspection reports written, issued or required by State, Federal or local agencies shall be provided to the Contracting Officer's Representative.

1.9 PLANTING SCHEDULE

A. The Contractor shall schedule plant installation so that the related irrigation system is completed and functional prior to planting.

B. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice and approved by the Contracting Officer's Representative.

2.0 MATERIALS:

2.1 PLANT MATERIAL

A. General

1. Plants specified shall be from nursery grown stock furnished in the variety, size, grade and quantity indicated. Specifications and planting plans shall be strictly adhered to and no changes or substitutions will be allowed after award of the contract.

2. By submitting a bid and accepting award of the Contract, the Contractor acknowledges that he has investigated the supply of planting stock available and has obtained firm commitments from his suppliers assuring delivery of the specific plant materials as required for completion of the project.

3. All plant materials shall be grown in accordance with good horticultural practices and shall bear evidence of proper nursery care during growth under climatic conditions similar to those in the locality of the project for at least two years. They shall have been previously transplanted or root pruned according to standard nursery practice and inspected by State control agencies as required by the State where the work is being done.

4. All plants shall be dug in the spring of the year they are to be planted. Plants shall be typical of their species or variety and have normal habits of growth, be sound, healthy, and vigorous, well branched and densely foliated when in leaf. All plants (including root systems) shall be free of disease, disfiguring knots, sunscale, insect pests, eggs or larvae, dead or broken branches, bark abrasions, and have healthy, well-developed root systems. The root systems of container grown plants shall be sufficiently developed to hold the earth intact upon removal from the container.

5. All plants shall equal or exceed the measurements specified in the Plant Schedule on the Project Drawings; plants larger than specified may be

used only if approved by the Contracting Officer's Representative. Use of such larger plants will not increase the contract price and will not be basis to reduce quality in other plant species. If larger plants are approved, the spread of roots or ball of earth shall be increased in proportion to the size of the plant.

6. Plants shall not be pruned prior to delivery. Plants cut back from larger sizes to meet specified or consistent sizes will not be accepted.

7. Quantities of plant materials shown in the Plant Schedule do not necessarily represent the total numbers of plants that may be required and are given for the Contractor's convenience only. It shall be the responsibility of the Contractor to verify the accuracy of the quantities, as no compensation will be made for error in quantities on the Plant Schedule.

8. Each plant shall be properly identified with legible waterproof tags securely fastened. Tags shall remain on the plants until after final acceptance and then be promptly removed by the Contractor.

B. Shrubs

1. Spreading evergreens shall be full and evenly rounded in diameter. Planting sizes called for spreading evergreens shall be measured across the diameter of the plant spread (average spread).

2. Deciduous shrubs shall be measured from the top of the root ball to the average height of the plant. All deciduous shrubs shall be fully branched and representative of the common shape and fullness of the species.

2.2 PLANTING SOIL

A. Planting soil shall be well-graded topsoil of good uniform quality. It shall be natural friable soil representative of productive soils in the vicinity. Topsoil shall be free of admixture of subsoil, foreign matter, objects larger than one-inch in any dimension, toxic substances, weeds and any material or substances that may be harmful to plant growth and shall contain a minimum of 5% and a maximum of 25% organic matter by weight.

B. Contractor shall furnish required planting soil. At least 10 days prior to soil delivery, notify Contracting Officer's Representative of the source(s) from which soil is to be furnished and submit sample for approval.

2.3 ROCK MULCH

A. Rock mulch for use in planting beds and other surface mulch areas shall be of the types and sizes as indicated on the drawings and as approved by the Contracting Officer's Representative.

2.4 WEED BARRIER

A. Weed barrier for use under rock mulch shall be one of the following or approved equal:

- De Witt Weed Barrier manufactured by De Witt Company Inc., Polypropylene Division, Sikeston, Missouri, (Phone 1-800-325-0950)

  or

- Typar as manufactured by Reemay, Indianapolis, Indiana, (1-800-352-6776).

2.5 LANDSCAPE EDGER

A. Landscape edger shall be "EDG-KING" landscape edging as manufactured by Oly-Ola Sales, Inc., Villa Park, IL (800-EDGINGS) or approved equal. Provide with manufacturer's standard clips, connectors and stakes.

3.0 EXECUTION

3.1 INSPECTION

A. Verify that all grades are at the proper level prior to planting.

B. Verify that all irrigation work is completed prior to installation of weed barrier, mulch or plant material. Distribution tubing to plants in the planters shall be placed after installation of the plant material; however, all other elements of the drip irrigation system shall be in place prior to planting.

C. The Contracting Officer's Representative shall inspect all plant material prior to planting.

D. The Contracting Officer's Representative shall inspect and approve grade of mulch areas prior to placement of weed barrier or mulch.

E. The Contracting Officer's Representative shall inspect and approve irrigation system prior to planting or mulching.

3.2 PLANTING

A. Handling

1. Digging of plant material shall be done the same season of planting and shall be done by hand so as to not injure plants .

2. Plants shall be adequately protected at all times from excessive exposure to wind, sun, rain, hail, etc.

3. All plants shall be handled carefully to prevent injury to roots, trunks or branches. Any plant suffering damage sufficient to impair its health and/or natural form will be rejected. No plant shall be bound with wire or rope at any time so as to damage the plant. Improper handling and care of plant material causing damage shall be grounds for rejection of the plant.

B. Plant Placement

1. Plants shall be placed according to the spacing and location approved in the field by the Contracting Officer's Representative prior to actual installation of the plants. The contractor shall stake plant locations for approval by the Contracting Officer's Representative.

2. Set plants in center of pits, plumb and straight and at such a level that after settlement the crown of the plant shall be 2 inches above finish grade and forming a shallow trough directly over the ball of earth and slightly smaller than the pit to facilitate watering. When planting on a slope, the top-most root in the root ball shall be even with the grade on the uphill side of the tree.

3. Plants supplied in containers shall be installed immediately upon being removed from their containers. Removal of plants from containers shall be done in a manner that will not disturb the root system or the soil in which they are planted. Under no conditions shall the plant be removed from the containers by pulling on the main stem or plant growth. No plants shall be installed with their containers remaining attached.

3.3 WEED BARRIER

A. Place weed barrier on a properly prepared and leveled surface (approved by the Contracting Officer's Representative) according to manufacturer's recommendations as to overlap and other considerations.

B. Place weed barrier in all areas which are to receive rock mulch. In areas which are to receive plants, install weed barrier neatly cut and close to plant to minimize exposed earth.

3.4 MULCH

A. Place mulch in all areas as shown on the drawings. River rock and crushed rock mulch shall be a minimum of 3" deep and shall fully cover the area and surface to receive mulch. Cobble rock mulch shall be installed such that the area is fully covered and no weed barrier is visible when viewed from above. Top of rock mulch, except for cobble rock, shall be 1 inch below top of adjacent concrete or other pavement.

3.5 LANDSCAPE EDGER

A. Install in straight lines or smooth curves where indicated on the drawings. Top of edger shall be at finished sod level. Stake and secure according to manufacturer's specifications.

3.6 MAINTENANCE

A. Assure that plants are properly maintained and watered until Final Acceptance. Maintenance shall include pruning of broken branches (upon approval of the Contracting Officer's Representative), keeping mulch in place and other items as may be required for the health of the plant.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Basis of payment shall be made on a percentage of completion, not for each element in the Bid Schedule. The Bid Schedule will be a lump sum.

END OF SECTION 02955

DIVISION 3 – CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.

B. Related Sections:

1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
2. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement in combination with the following: fly ash subject to compliance with requirements.

1.4 SUBMITTALS

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

B. LEED Submittals:

1. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, and for equivalent concrete mixtures that do not contain portland cement replacements.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Welding certificates.

F. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Curing compounds.
5. Bonding agents.
6. Adhesives.
7. Repair materials.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

H. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5**.**
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

C. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following**:**

a. Fly Ash: ASTM C 618, Class F.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

1. Products: Subject to compliance with requirements:

a. Monofilament Micro-Fibers:

1) Axim Italcementi Group, Inc.; Fibrasol II P.
2) Euclid Chemical Company (The), an RPM company; Fiberstrand 100.
3) FORTA Corporation; FORTA Econo-Mono.
4) Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
5) Metalcrete Industries; Polystrand 1000.
6) Nycon, Inc.; ProConM.
7) Propex Concrete Systems Corp.; Fibermesh 150.
8) Sika Corporation; Sika Fiber PPM.

2.7 VAPOR RETARDERS

A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.8 CURING MATERIALS

A. Water: Potable.

B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. BASF Construction Chemicals - Building Systems; Kure 200.
c. ChemMasters; Safe-Cure Clear.
d. Conspec by Dayton Superior; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
f. Edoco by Dayton Superior; Res X Cure WB.
g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.

h. Kaufman Products, Inc.; Thinfilm 420.
i. Lambert Corporation; AQUA KURE - CLEAR.
j. L&M Construction Chemicals, Inc.; L&M Cure R.
k. Meadows, W. R., Inc.; 1100-CLEAR.
l. Nox-Crete Products Group; Resin Cure E.
m. Right Pointe; Clear Water Resin.
n. SpecChem, LLC; Spec Rez Clear.
o. Symons by Dayton Superior; Resi-Chem Clear.
p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Slump Limit: 3 inches (76 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Slump Limit: 3 inches (76 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
3. Slump Limit: 3 inches (76 mm), plus or minus 1 inch (25 mm).
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

5. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m).

D. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
3. Slump Limit: 3 inches (76 mm), plus or minus 1 inch (25 mm).
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
5. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m).

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete

surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Form openings, chases, offsets, sinkages, keyways, blocking, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for, walls, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete foundations.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, or ceramic tile .

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces [**indicated**] [**where ceramic or quarry tile is to be installed by either thickset or thin-set method**]. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at

correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse

aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.12 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to perform tests and to submit reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03300

SECTION 03304

PORTLAND CEMENT CONCRETE

1.0 GENERAL

1.1 SUMMARY

A. Portland cement concrete material requirements.

B. Mix design requirements.

C. Method of measurement and basis of payment

D. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder

1.2 SUBMITTALS

A. Mix Design: Submit each proposed mix design 14 days prior to use in the Work. Indicate whether mixes have been designed for pumping. Include in the report the following information.

1. Water-cement ratio.
2. Proportion of materials in the mix.
3. Source and type of cement.
4. Analysis of water to be used unless potable.
5. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.
6. Slump, air content, and temperature of samples.
7. Unit weight of fresh and dry light weight concrete.

B. Concrete Quality Charts. Comply with ACI 214 and ACI 301, and submit the following.

1. Specified strength (fc').
2. Required average strength (fcr).
3. Compressive strength versus date of sample.

C. Optional design mix:

1. At the Contractor's option, he may elect to provide a concrete mix that has been previously designed, tested, and used within the past year which provides the quality required by these Specifications.

2. If this Contractor exercises this option, he shall submit to the Contracting Officer for his approval all pertinent data, including test results to substantiate the design mix requested to be furnished.

D. Aggregate Test Report: Submit for each aggregate source.

1. Date of test analysis.

2. Sieve analysis.

3. Organic impurities.

4. Sodium sulfate soundness test.

5. Reactivity of aggregate.

6. Complete identification of aggregate source of supply. Coarse aggregate shall be from a quarried source such as the Harriman Quarry.

1.3 QUALITY ASSURANCE

A. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures, or aggregate without the Contracting Officer's approval.

B. In proportioning materials for mixing, use scales certified by the State of Wyoming. Do not use volume measurement except for water and liquid admixtures.

C. Do not change the quantity of cement per cubic yard from approved mix design without written approval of the Contracting Officer.

D. Use of admixture will not relax hot or cold weather placement requirements.

E. Ready-mixed concrete to be in accordance with Alternate No. 3 of ASTM C 94 and requirements in this Section.

F. Control Testing of Concrete: In Accordance with Section 03305.

1.4 REFERENCES

A. AASHTO 26: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

B. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

C. ACI 211.2: Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

D. ACI 211.3: Standard Practice for Selecting Proportions for Non-Slump Concrete.

E. ACI 214: Recommended Practice for Evaluation of Strength Test Results of Concrete. F.ACI 301: Specifications for Structural Concrete for Buildings.

F. ASTM C 33: Standard Specification for Concrete Aggregates.

G. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

H. ASTM C 94: Standard Specification for Ready-Mix Concrete.

I. ASTM C 150: Standard Specification for Portland Cement.

J. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete.

K. ASTM C 289: Standard Test Method for Potential Reactivity of Aggregates (Chemical Method).

L. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.

M. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

1.5 DEFINITIONS

A. Average Strength (fcr): The required average strength for 30 consecutive strength tests which statistically assures no more than the permissible proportions of tests will fall below Specified Strength.

B. Specified Strength (fc'): The indicated strength.

1.6 PRODUCT STORAGE AND HANDLING

A. Store bagged and bulk cement in weatherproof enclosures to exclude moisture and contaminants.

B. Stockpile aggregate to avoid segregation and prevent contamination.

C. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

2.0 PRODUCTS

2.1 CEMENT

A. ASTM C 150, Type II (moderate). Type I in above grade structure if approved, or as recommended by soils the Contracting Officer.

B. Do not use air entraining cement.

2.2 WATER

A. Clean, potable and free from injurious amounts of foreign matter.

B. Comply with AASHTO 26.

2.3 AGGREGATES - GENERAL

A. Gravel, crushed slag, crushed stone, or other inert materials, composed of hard, strong, durable particles free of injurious coatings. Coarse aggregate shall be from a quarried source (Harriman Quarry).

B. The materials passing the No. 200 (0.075 mm) sieve shall not exceed 1.75 percent by weight in the combined coarse and fine aggregate.

2.4 COARSE AGGREGATE

A. Sieve Analysis: Graded in accordance with ASTM C 33, as indicated in Table No. 03304-2.04.

B. Gradation limits of Table No. 03304, Subsection 2.04 may be changed if, in the judgment of the Contracting Officer, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids, and the maximum aggregate size does not exceed the following requirements.

1. 1/5 of narrowest dimension between forms.
2. 1/3 of depth of slabs.
3. 3/4 of minimum clear spacing between reinforcing bars.

C. Deleterious Substances: Maximum percentage by weight.

1. Soft Fragments: 2.0 percent
2. Coal and Lignite: 0.3 percent
3. Clay Lumps: 0.3 percent
4. Other Deleterious Substances: 2.0 percent

TABLE NO. 03304-2.04						
SIEVE SIZES	**COARSE AGGREGATE Percent Passing by Weight**					
	Grade 47		**Grade 57**		**Grade 67**	
2 Inches (50 mm)	100	----	----	----	----	----
12 Inches (38 mm)	95	100	100	----	----	----
1 Inch (25 mm)	----	----	95	100	100	----
3/4 Inch (19 mm)	35	70	----	----	90	100
2 Inch (12.5 mm)	----	----	25	60	----	----
3/8 Inch (9.5 mm)	10	30	----	----	20	55
No. 4 (4.75 mm)	0	5	0	10	0	10
No. 8 (2.36 mm)	----	----	0	5	0	5

2.5 FINE AGGREGATE

A. Sieve Analysis: Graded in accordance with ASTM C 33, as follows:

TABLE NO. 03304-2.05 MASTER GRADING BAND LIMITS FOR FINE AGGREGATE		
SIEVE SIZE	**FINE AGGREGATE Percent Passing by Weight**	
	Minimum	**Maximum**
3/8 Inch (9.5 mm)	100	----
No. 4 (4.75 mm)	95	100
No. 16 (1.18 mm)	45	80
No. 50 (0.30 mm)	10	30
No. 100 (0.150 mm)	2	10

B. Deleterious Substances: Maximum percentage by weight.

1. Coal and Lignite: 0.3 percent.
2. Clay Lumps: 0.5 percent.
3. Other Deleterious Substances: 2.0 percent.

2.6 SOUNDNESS AND REACTIVITY OF AGGREGATE

A. Determine coarse and fine aggregate soundness in accordance with ASTM C 88.

1. For Coarse Aggregate: Weight loss; not exceeding 12 percent by weight when subjected to 5 cycles of sodium sulfate or 18 percent by weight when subjected to 5 cycles of magnesium sulfate.

2. For Fine Aggregate: Weight loss; not exceeding 10 percent by weight when subjected to 5 cycles of sodium sulfate or 15 percent by weight when subjected to 5 cycles of magnesium sulfate.

B. Size No. 57 shall be the gradation used for coarse aggregate in Concrete Placement. Aggregates shall be free of substances that are deleteriously reactive with alkalies in the cement in an amount sufficient to cause excessive expansion of the concrete. Determine alkali-silica reactivity of each source of both fine and course aggregates in accordance with ASTM C 1260 (ASTM C 1260 Potential Alkali Reactivity of Aggregates {Mortor Bar Method}).

C. Current year (2008/2009) test results of ASTM C 1260-94 for the reactivity of aggregates shall be provided with the mix design. The Mortar Bar Method shall reflect the aggregate proportions utilized in the mix design. When expansion exceeds 0.10 percent, remedial measures to be utilized for mitigation shall be determined and incorporated into the mix design.

2.7 ADMIXTURES

A. Air Entrainment: ASTM C 260.

B. Water Reducing and Set Retarding Agents: ASTM C 494.

1. Type A: Set water reducing.

2. Type B: Set retarding.

3. Type C: Set accelerating.

4. Type D: Water reducing and set retarding.

5. Type E: Water reducing and set accelerating.

6. Type F: High range water reducing (super plasticizer). *

7. Type G: High range water reducing and set retarding. *

*The relative durability factor of water reducing admixtures shall not be less than 80, and the chlorides content (as C1-) shall not exceed 1 percent by weight of the admixtures.

C. Calcium Chloride: None allowed.

D. Pozzolan: Pozzolan conforming to the requirements of ASTM C 618, Class F, is allowed as a Portland cement replacing agent under the following conditions:

1. The maximum percentage of Portland cement replacement is:

   a. 15 percent, for concrete exposed to weather.

   b. 20 percent, for interior concrete.

2. The ratio of replacement by weight of Pozzolan to cement shall be 1.25 to 1.0.

3. The minimum cement content shall be used in the design formulas before replacement is made.

4. Loss of ignition of pozzolan is less than 3 percent, and the water requirement does not exceed 100 percent.

5. All other requirements of this Section still apply.

6. Mix designs including trial batches are required for each aggregate source and for each concrete class.

2.8 ACI MIX DESIGN

A. The amount by which the average strength (fcr) of a concrete mix exceeds the specified compressive strength (fc') shall be based upon no more than 1 in 100 random individual strength tests falling more than 500 psi below the specific strength.

B. Proportion the materials in accordance with ACI 211.1, 211.2, or 211.3 as applicable to produce concrete having the properties or limitations of Table No. 03304-2.08.

2.9 HAND MIXING

A. Do not hand mix batches exceeding 0.5 cubic yards (0.38 m3).

B. Hand mix only on watertight platform. Mix cement and aggregate prior to adding water.

C. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency.

2.10 HEATING, WATER, AND AGGREGATE

A. Do not allow products of fuel combustion to contact the aggregate.

B. Heat mixing water to 150ºF. maximum. Heat aggregates uniformly.

C. Do not mix cement with water and aggregate at a mix temperature greater than 100°F.

TABLE NO. 03304-2.08

CONCRETE MIX PROPERTIES

CONCRETE PROPERTIES	CLASS 7000	CLASS 6000	CLASS 5000	CLASS 4000	CLASS 3000	CLASS 2000
Specified Compressive Strength f_c= at 28 days, min. psi	7000 (48.26 Mpa)	6000 (41.37 Mpa)	5000 (34.47 Mpa)	4000 (27.58 Mpa)	3000 (20.68 Mpa)	2000 (13.8 Mpa)
Compressive Strength at 7 days, psi, min. (a)	4690 (32.3 Mpa)	4020 (27.7 Mpa)	3350 (23.1 Mpa)	2680 (18.5 Mpa)	2010 (13.8 Mpa)	1430 (9.9 Mpa)
Cement content (94-lb. (42.5 kg) sacks of cement per cubic yard of concrete), min. (b)	(c)	(c)	(c)	6.0	5.5	4.5
Entrained air content (% by column)	(d)	(d)	(d)	6% ±1	6±1 ±1.5	4.5
Slump range, in. (e)	2 to 4 (50-100 mm)	2 to 4 (50-100 mm)	2 to 4 (50-100 mm)	2 to 4 (50-100 mm)	2 to 4 (50-100 mm)	2 to 5 (50-125 mm)

(a) Used for monitoring purposes only.

(b) Includes pozzolan replacements.

(c) Cement content shall be appropriate to produce a mixture meeting the requirements for water/cement ratio and workability for the specific job conditions.

(d) Air content shall be appropriate to the exposure conditions.

(e) Not more than 8 inches (200 mm) after adding high range water reducing admixture (super-plasticizer) at site.

(f) Not allowed if concrete is exposed to freezing and thawing temperatures. Use Class 4000 or higher compressive strength and 6±.0 percent air entrainment.

3.0 EXECUTION

3.1 INSTALLATION

A. Concrete Work; Section 03310.

B. Concrete Quality Control; Section 03305.

C. Concrete Curing; Section 03370.

END OF SECTION 03304

SECTION 03305

CONCRETE QUALITY CONTROL

1.0 GENERAL

1.1 SUMMARY

A. Testing requirements for Contractor's quality control of Portland cement concrete mixtures.

B. Re-testing potentially defective concrete.

C. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder

1.2 SUBMITTALS

A. Field and laboratory control test reports for material properties enumerated herein.

B. Material certificates.

1.3 QUALITY ASSURANCE

A. Test Forms and Storage Areas: ASTM C 31.

B. Control testing in accordance with Section 01400.

1.4 REFERENCES

A. ACI 318: Building Code Requirements for Reinforced Concrete.

B. ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field.

C. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

D. ASTM C 42: Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

E. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).

F. ASTM C 138: Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

G. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.

H. ASTM C 173: Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

I. ASTM C 231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

J. ASTM C 567: Standard Test Method for Unit Weight of Structural Lightweight Concrete.

K. ASTM D 4832: Standard Test Method for Preparation and Testing of Soil-Cement Slurry Test Cylinders.

1.5 PROJECT CONDITIONS

A. Furnish labor to assist in obtaining and handling samples at site or sources.

B. As a result of failed tests, perform remedial Work at no additional cost to the Contracting Officer.

2.0 PRODUCTS Not used.

3.0 EXECUTION

3.1 TESTING COMPRESSION STRENGTH

A. Obtaining Samples: Unless indicated otherwise, secure composite samples in accordance with ASTM C 172. Obtain samples from different portions of the batch of concrete.

B. Casting:

1. Cast and cure 4 concrete cylinders in accordance with ASTM C 31. Determine slump, air content, and temperature of concrete casting.

2. For controlled low-strength material (CLSM) and lime treated fills, cast concrete cylinders in accordance with ASTM D 4832.

C. Testing: Perform compression tests on samples in accordance with ASTM C 39.

1. Test 1 cylinder at 7 days and the remainder at 28 days.

2. For controlled low-strength material (CLSM) and lime treated fills, test 1 cylinder at 3 days and the remainder at 28 days.

3. If any one cylinder in a 28-day test shows definite evidence, other than low strength, of improper sampling, molding, handling, curing, or testing, discard. The average strength of the remaining cylinders shall be

considered the test result.

3.2 TESTING FLEXURAL STRENGTH

A. Obtaining Samples: Secure composite samples in accordance with ASTM C 172. Obtain samples from different portions of the batch of concrete.

B. Casting: Cast and cure 4 concrete beams in accordance with ASTM C 31. Determine slump, air content, and temperature of concrete casting. Report deviations from requirements.

C. Testing: Perform flexural tests on samples; ASTM C 78.

1. Test 1 beam at 7 days or as approved by the Contracting Officer for determining when construction traffic is permitted on paved surfaces.

2. Test the remaining beams at 28 days. If any one beam in a 28-days test shows definite evidence, other than low strength, of improper sampling, molding, handling, curing, or testing, discard. The average strength of the remaining beams shall be considered the test results.

3.3 TESTING ONCRETE PAVEMENT THICKNESS

A. Determined from cores secured in accordance with ASTM C 42.

3.4 TESTING CONCRETE PAVING SMOOTHNESS

A. Maximum perpendicular distance between 3 straightedge points and the pavement surface:

1. Parallel to Centerline: 1/8 inch (3.2 mm) to 10 feet (3 m).

2. Perpendicular to Centerline: 1/4 inch (6.4 mm) to 10 feet (3 m).

3.5 ADDITIONAL TESTING

A. Slump Test: ASTM C 231.

B. Air Test:

1. Normal weight concrete air content; ASTM C 231.

2. Light weight concrete air content; ASTM C 173.

C. Unit Weight:

1. Normal weight concrete; ASTM C 138.

2. Light weight concrete; ASTM C 567.

D. When requested, test concrete in place by impact hammer, sonoscope, or other non-destructive device:

1. To determine relative strengths in various locations in Work.

2. To aid in evaluating concrete strength.

3. To select areas to be cored.

4. To verify quality control in the absence of Control Testing.

3.6 RE-TESTING POTENTIALLY DEFECTIVE CONCRETE

A. If a concrete test result is below specification and the Work is considered potentially deficient:

1. A request to the Contracting Officer for re-testing must be made within 35 days from time of placement if Contractor desires re-test.

2. No coring or re-testing shall be done after 40 days have elapsed from the time of placement.

3. Only 1 re-test shall be allowed for a test sublot.

B. Obtain and test cores in accordance with ASTM C 42. Secure a minimum of 3 cores from each sublot considered potentially deficient. Coordinate test locations with the Contracting Officer.

C. If concrete in Work will be dry under service condition, air dry cores for 7 days before tests. Unless otherwise specified, use air temperature 60 to 80EF. and relative humidity less than 60 percent.

D. If concrete in Work under service conditions will be more than superficially wet, test cores after moisture conditioning (liquid or vapor water cure).

E. If 1 or more cores shows evidence of having been damaged before testing, provide replacement.

F. Evaluate cores in accordance with ACI 318.

G. If core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the Work, load test may be required and evaluated in accordance with ACI 318.

H. Fill core holes with non-shrink, low slump concrete mortar. Coat sides of holes with an approved concrete epoxy resin adhesive. Match color and texture of surrounding concrete.

END OF SECTION 03305

SECTION 03310

CONCRETE WORK

1.0 GENERAL

1.1 SUMMARY

A. Concrete placement operations for cast-in-place slabs on grade, slabs on fill, structural building frame, and other concrete components.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder

1.2 SUBMITTALS

A. Quality control test reports and material certificates; Section 03305.

B. Record of Placed Concrete: Record date, location of pour, quantity, air temperature, and Contractor's quality control test samples taken.

C. Product name, type, and chemical analysis of the following as applicable:

1. Curing compound.
2. Sealing compound.
3. Chemical hardener.
4. Bonding compound.

D. Batch Delivery Ticket: Submit for each batch delivered to site.

1. Slump of batch at the job site.
2. Date.
3. Producer and plant.
4. Job.
5. Name of contractor.
6. Serial number of ticket.
7. Truck number and time dispatched.

8. Volume of concrete.

9. Reading of revolution counter at first addition of water.

10. Signature or initials of Ready-Mix representative.

11. Type and brand of cement.

12. Amount of cement.

13. Total water content (W/C ratio).

14. Water added for receiver of concrete and receiver's initials.

15. Admixture types and amounts.

16. Maximum size of aggregate.

17. Separate weights of fine and coarse aggregate.

18. Indication that all ingredients are as previously certified or approved.

1.3 QUALITY ASSURANCE

A. Rejection: Concrete Work which fails to meet one or more of the following requirements and which cannot be brought into compliance shall be rejected. The Contracting Officer shall determine appropriate modifications or payment adjustments to be made.

1. Appearance: Concrete exposed to view with defects which adversely affect appearance of specified finish.

2. Strength: Strength of concrete fails to comply with any of the following requirements.

   a. The average of three 28-day compressive or flexural strength samples made from the same batch of concrete falls below the acceptance level.

   b. Reinforcing steel size, quantity, strength, position, damage, or arrangement at variance with requirements.

   c. Concrete which differs from required dimensions or location in such a manner as to reduce its strength or load carrying capacity.

   d. Method of curing is not as specified.

   e. Inadequate protection of concrete from extremes of temperature during the early stages of hardening and strength development.

f. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength development.

g. Workmanship likely to result in deficient strength.

3. Slab Tolerance: Finishing which fails to comply with Section 03345 requirement.

4. Material Sources: Failure to comply with Section 03305.

B. Finishers: Approved by the Contracting Officer or ACI certified.

1.4 REFERENCES

A. ACI 301: Specifications for Structural Concrete for Buildings.

B. ACI 305: Hot Weather Concreting.

C. ACI 306.1: Cold Weather Concreting.

D. ACI 309: Standard Practice for Consolidation of Concrete.

E. ASTM 347: Recommended Practice for Concrete Formwork.

F. ASTM A 185: Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.

G. ASTM A 615: Standard Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.

2.0 PRODUCTS

2.1 MATERIALS

A. Concrete: Class as indicated, material in accordance with Section 03304.

B. Bonding Compound: Polyvinyl acetate base or acrylic base, non-rewettable type.

C. Vapor Barrier: 10 mil thick, clear, polyethylene sheet. Type recommended for below grade application and shall be free from pin holes, tears, scars, and other defects.

D. Forms: Form standards shall comply with all pertinent provisions of ACI 347.

E. Reinforcement: In accordance with ASTM A 185, Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement; and ASTM A 615, Standard Specification for Deformed and Plain Billet - Steel Bars.

F. Coverings and Curing Compound: In accordance with Section 03370.

G. Non-shrink Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland Cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C-621.

3.0 EXECUTION

3.1 PREPARATION

A. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not impede placing concrete.

B. Do not allow construction loads to exceed member capacity.

C. Prepare previously placed concrete by cleaning with steel brush and applying bounding compound. Apply bonding compound in accordance with manufacturer's instructions.

D. At locations where new concrete is dowelled to existing Work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

3.2 DELIVERY

A. Slump: Do not discharge concrete if its slump is greater or less than permissible slump. Report results of slump test on batch delivery tickets.

B. Concrete Placement Time Limit: After the introduction of mixing water to the cement and aggregates at the batch plant, discharge concrete from truck mixer within the following air temperatures and time periods.

1. Air temperature less than 80°F.: 1-1/2 hours.

2. Air temperature over 80°F. without a retarder added to the mix: 1 hour maximum.

3. Air temperature over 80°F. with retarder added to the mix: 1-1/2 hours maximum.

C. Tempering

1. When concrete arrives at site with slump below specified, water may be added if the maximum approved water/cement ratio and the maximum slump is not exceeded, provided that:

a. The approved mix design has allowed for on-site addition of water.

b. The amount of water added at the site is accurately measured to±1 gallon of the desired added amount.

c. That water addition is followed by 3 minutes of mixing at mixing speed prior to discharge.

d. That the person authorized to add water is mutually approved of in writing by the Contracting Officer, Contractor, and Ready-Mix Supplier.

2. Do not add water after concrete discharge from the mixer commences.

D. Cold Weather, Hot Weather Concreting: Maintain mixed concrete temperature at times of placement between 60°F. and 90°F.

E. Super-plasticizer

1. Pre-measure and add high range water reducing agent in accordance with manufacturer's instructions.

2. If added at site, add agent using injection equipment capable of rapidly and uniformly distributing the admixture to the concrete. Prior to discharge, mix for a minimum of 5 minutes at a drum rate not less than 12 rpm or more than 15 rpm.

3. If added at plant, do not deliver to site unless batch delivery ticket displays water/cement ratio prior to super-plasticizer addition.

4. Tempering with super-plasticizer after expiration of allowable delivery times is prohibited.

3.3 CONCRETE PLACEMENT

A. Notify the Contracting Officer minimum 24 hours prior to commencement of concrete placement operations.

B. Place concrete in accordance with ACI 301.

C. Hot Weather Placement: When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated to the total amount of mixing water.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot so

that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Wet forms thoroughly before placing concrete.

D. Cold Weather Placement

1. Protect concrete Work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified. If necessary to place concrete under conditions of low temperature, placement shall be approved by the Contracting Officer.

2. When air temperature has fallen to or is expected to fall below 40°F., uniformly heat all water and aggregates before mixing, as required to obtain a concrete mixture temperature of not less than 50°F. and not more than 70°F for 3 days or 50°F. for 5 days.

3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen material.

4. Do not use calcium chloride, salt and other material containing antifreeze agents, or chemical accelerators, unless otherwise accepted in writing by the Contracting Officer.

E. Do not disturb reinforcement, inserts, embedded parts, and formed joints.

F. Do not break or interrupt successive pours such that cold joints occur.

G. Honeycomb or embedded debris in concrete is not acceptable.

3.4 JOINTS AND JOINT SEALING

A. Expansion and contraction joints, as shown on drawings.

3.5 CONSOLIDATION

A. In accordance with ACI 309.

B. Keep spare vibrator available during concrete placement operations.

3.6 FINISHING

A. Do not add water to concrete surface (i.e., sprinkle) without written approval.

B. Slab Finishing Tolerance: In accordance with Section 03345.

C. Finishes: In accordance with Section 03345. When type of finish is not

indicated, use following finishes as applicable:

1. Sidewalks, garage floors, and ramps: Broom or belt finish.

2. Exterior concrete pavement: Broom or belt finish.

3. Exterior platforms, steps, and landings, exterior and interior pedestrian ramps, not covered by other finish materials: Non-slip finish.

4. Surfaces intended to receive bonded applied cementitious applications: Scratched finish.

5. Surfaces intended to receive roofing, except future floors, waterproofing membranes, and roof surfaces which are future floors or sand bed terrazzo: Floated finish.

6. Floors and roof surfaces which are floors intended as walking surfaces or to receive floor coverings: Troweled finish.

7. Unpainted concrete surfaces not exposed to public view: Rough as-cast form finish.

8. Unpainted concrete surfaces exposed to public view: Smooth as-cast form finish.

9. Concrete surfaces to receive paint or plaster: Grout cleaned finish.

3.7 CURING

A. Cure in accordance with Section 03370. Unless specified otherwise, apply a liquid membrane curing compound.

3.8 CONTROL TESTING

A. Arrange for and perform all control testing required for qualification of proposed materials and the establishment of mix designs, in determining strengths for early form removal and other needs of Contractor.

B. One slump test for each batch of concrete placed in the Work.

C. Two slump tests, one before and one after the addition of super-plasticizer.

3.9 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required levels, lines, details, and elevations.

B. Structural analysis and additional testing may be required at no additional cost of the Contracting Officer when the strength of a structure is considered potentially deficient.

C. Patch imperfection. Refer to Section 03345 requirements.

3.10 PROTECTION AND REPAIRS

A. Protection: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimum moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Random Cracks in Pavement Slabs on Grade: When cracks occur within 2 feet of expansion or construction joints, remove and repair, or if approved by the Contracting Officer grout with epoxy adhesive grout. Use saw cuts and dowels in all cut planes.

END OF SECTION 03310

SECTION 03345

CONCRETE FINISHING

1.0 GENERAL

1.1 SUMMARY

A. Finishing interior and exterior concrete surfaces.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder

1.2 SUBMITTALS

A. Name, type, chemical analysis and manufacturer's recommended rate of application for liquid chemical hardener.

1.3 REFERENCES

A. ACI 303: Guide to Cast-in-Place Architectural Concrete Practice.

1.4 PROJECT CONDITIONS

A. Protect adjacent materials and finishes from dust, dirt, and other surface or physical damage during finishing operations. Provide protections as required and remove from site at completion of Work.

2.0 PRODUCTS

2.1 MATERIALS

A. Mortar and Grout: Provide Submittals.

B. Dry Shake: Blend of metallic or mineral aggregate with Portland cement concrete in proportions recommended by manufacturer.

C. Proprietary Materials: If permitted or required, proprietary compounds may be used in lieu of or in addition to foregoing materials. Use such compounds in accordance with manufacturer's recommendations.

D. Liquid-Chemical Hardener: Colorless, aqueous solution containing a blend of magnesium fluosilicate, zinc fluosilicate, and a wetting agent. Mixture contains not less than 2 pounds fluosilicate per gallon and does not interfere with adhesives and bonding of finishes where such is indicated.

3.0 EXECUTION

3.1 PREPARATION

A. Examine the areas and conditions under which Work of this Section will be performed.

B. Correct conditions detrimental to timely and proper finishing.

C. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISHING OF FORMED SURFACES

A. General

1. Allow concrete to cure not more than 72 hours before commencing surface finish operations, unless approved otherwise.

2. Revise the finishes as needed to secure approval.

B. As-Cast Form Finish

1. Rough: Patch defects, chip or rub off fins exceeding 1/4 inch (6.4 mm) height.

2. Smooth: Patch tie holes and defects and remove fins completely.

a. When surface texture is impaired and form joints misaligned, grind, bushhammer, or correct affected concrete.

b. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.

c. Repair major mortar leakage as a defective area.

d. When workmanship is less than acceptable standard, provide one of rubbed finishes at no additional cost to the Contracting Officer.

C. Rubbed Finish

1. Smooth Rubbed: Remove forms and perform necessary patching as soon after placement as possible.

a. Finish newly hardened concrete no later than 24 hours following form removal.

b. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.

2. Grout Cleaned: Undertake no cleaning operations until all contiguous surfaces are completed and accessible.

   a. Wet surface of concrete sufficiently to prevent absorption of water from grout.

   b. Apply grout uniformly.

   c. Immediately after grouting, scrub surface with cork float or stone to coat surface and fill voids.

   d. While grout is still plastic, remove excess grout by working surface with rubber float or sack.

   e. After surface whitens from drying, rub vigorously with clean burlap.

   f. Keep damp for at least 36 hours after final rubbing.

3. Cork Floated: Remove forms within 2 to 3 days of placement where possible.

   a. Remove ties.

   b. Remove all burrs and fins.

   c. Dampen wall surface.

   d. Apply mortar with firm rubber float or with trowel, filling all surface voids.

   e. Compress mortar into voids.

   f. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer.

   g. Produce final texture with cork float using a swirling motion.

D. Unformed Finish

1. After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces.

2. Float to texture which is reasonably consistent with formed surfaces.

3. Continue final treatment on formed surfaces uniformly across uniformed surfaces.

E. Blasted Finish

1. Perform abrasive blasting within 24 to 72 hours after casting.

2. Coordinate with form work construction, concrete placement schedule, and form work removal to ensure that surfaces are blasted at the same age for uniform results.

3. Re-apply curing protection after blast finishing.

F. Architectural Finish

1. General: In accordance with ACI 303.

2. Tooled Finish:

a. Dress thoroughly cured concrete surface with electric, air, or hand tools to uniform texture, and give a bush hammered surface texture.

b. Remove sufficient mortar to exposed coarse aggregate in relief and to fracture coarse aggregate for tooled finish.

G. Patched Finish

1. Repair defective areas.

a. Remove honeycomb and defective concrete to sound concrete.

b. Make edges perpendicular to surface or slightly undercut.

c. Featheredges are not permitted.

d. Dampen area to be patched and at least 6 inches surrounding it to prevent absorption of patching mortar water.

e. Prepare bonding grout.

f. Mix to consistency of thick cream.

g. Brush into surface.

2. Tie Holes: Unless indicated otherwise, after being cleaned and thoroughly dampened, fill tie holes solid with patching mortar.

3. Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial and obtain a good color match with concrete when both patch and concrete are cured and dry.

a. Mix white and gray Portland cement as required to match surrounding concrete to produce grout having consistency of thick paint.

b. Use a minimum amount of mixing water.

c. Mix patching mortar in advance and allow to stand without frequent manipulation, without addition of water, until it has reached stiffest placeable consistency.

d. After initial set, dress surfaces of patches manually to obtain same texture as surrounding surfaces.

4. After surface water has evaporated from patch area, brush bond coat into surface.

a. When bond coat begins to lose water sheen, apply patching mortar.

b. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface.

c. Leave undisturbed for at least 1 hour before final finish.

d. Keep patched area damp for 72 hours or apply curing compound.

e. Do not use metal tools in finishing an exposed patch.

5. Where as-cast finishes are indicated, total patched area may not exceed 1 in 500 of as-cast surface. This is in addition to form tie patches, if ties are permitted to fall within as-cast areas.

6. In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate.

a. Outer 1 inch of patch shall contain same aggregates as surrounding concrete.

b. For aggregate transfer finish, patching mixture shall contain same selected colored aggregates.

c. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

3.3 FINISHING SLABS

A. Slab Finishing Tolerances:

1. Class A finish: 1 in 1,000.

2. Class B finish: 1 in 500.

3. Class C finish: 1 in 250.

B. Broom and Belt Finish: After concrete has been placed, consolidated, struck-off, and leveled to the required tolerance, roughen surface transversely with stiff brushes, rakes, or burlap belt before final set.

C. Floated Finish: After concrete has been placed, consolidated, struck-off, and leveled, do not work further until ready for floating.

1. Begin floating when water sheen has disappeared and surface has stiffness sufficient to permit operation.

2. During or after first floating, check planeness of entire surface with a 10 foot (3 m) long straightedge applied at 2 or more different angles.

3. Cut down high spots and fill low spots to the required tolerance.

4. Re-float slab immediately to a uniform sandy texture.

D. Trowel Finish

1. Float finish surface.

2. Power trowel.

3. Hand trowel as required to provide surface. Do not apply water (i.e., sprinkle) to surface of concrete in finishing operations.

4. First troweling after power floating shall produce smooth surface relatively free of defects but which may still show some trowel marks.

5. Second trowel by hand after surface has hardened.

6. Leave finished surface essentially free of trowel marks, uniform in texture and appearance.

7. On surfaces intended to support floor coverings, grind off defects which would show through floor coverings.

E. "Dry Shake" Finish: Give surface a floated finish.

1. Apply approximately 2/3 of a blended material for required coverage to surface by a method that ensures even coverage without segregation.

2. Begin floating immediately after application of first "dry shake".

3. After material has been embedded by floating, apply remainder of blended material to surface at right angles to prevent application.

4. Make second application heavier in any areas not sufficiently covered by first application.

5. Immediately follow with second floating.

6. After selected material has been embedded by second floating, complete operation with a broomed, floated, or troweled finish, as indicated.

F. Non-slip Finish: Give surface a "dry shake" application, using crushed, ceramically bonded, aluminum oxide particles. Apply at 25 pounds (11.3 kg)per 100 square feet (9.3 m2).

G. Exposed Aggregate Finish: Immediately after surface of concrete has been leveled to tolerance and surface water has dissipated, spread aggregate uniformly over surface to provide complete coverage to the depth of a single stone.

1. Embed aggregate into surface by light tamping.

2. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance.

3. Start exposure of aggregate after matrix has hardened sufficiently to prevent dislodgment.

4. Flow ample quantities of water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush.

5. Continue until aggregate is uniformly exposed.

6. An approved chemical retarder sprayed onto freshly floated surface may be used to extend working time.

H. Chemical-Hardener Finish: Apply liquid chemical-hardener finish to interior concrete floors where indicated. Do not apply liquid chemical concrete hardener on floor areas scheduled to receive synthetic matrice terrazzo, setting beds for tile, terrazzo, vinyl flooring, or like items. Apply hardener after complete curing and drying of concrete surface in accordance with manufacturer's recommendations. Evenly apply each coat, and allow 24 hours for drying between coats. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

END OF SECTION 03345

SECTION 03370

CONCRETE CURING

1.0 GENERAL

1.1 SUMMARY

A. Concrete curing material requirements and methods.

B. Reference Section 18113 for LEED requirements and Section 19113 for commissioning requirements. Consult them for further instructions and be governed by the requirements thereunder

1.2 SUBMITTALS

A. Manufacturer's specifications, test data, and other data required to prove compliance with the specified requirements.

B. Manufacturer's recommended installation procedures which, when approved by the Contracting Officer, will become the basis for accepting or rejecting actual installation procedures used in the Work.

1.3 QUALITY ASSURANCE

A. Use workers who are trained, experienced, and completely familiar with the curing and protection requirements of ACI 301 and the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Maintain concrete with minimum moisture loss at relatively constant temperature recommended by manufacturer for a period necessary for hydration of cement and hardening of concrete.

1.4 REFERENCES

A. ACI 301: Specifications for Structural Concrete for Buildings.

B. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.

C. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

D. AST, C 642: Standard Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

1.5 PRODUCT HANDLING

A. Protect the materials of this Section before, during, and after installation, and protect the Work and materials of other trades.

B. In the event of damage, immediately make replacements and repair at no additional cost to the Contracting Officer.

2.0 PRODUCTS

2.1 WATER

A. Clean, non-straining and non-detrimental.

2.2 MOISTURE-RETAINING SHEET MATERIALS

A. ASTM C 171, white, waterproof paper, polyethylene film, or burlap-polyethylene sheet.

2.3 ABSORPTIVE MAT MOISTURE COVER

A. Cotton or burlap fabric, clean roll goods.

2.4 CURING COMPOUND

A. Liquid membrane, in accordance with ASTM C 1315, Type 1, Class A.

B. Substance type: Unless indicated, Contractor to select from the following:

1. Chlorinated rubber.

a. Type of Compound: Type 2, white pigmented (Titanium Oxide (TiO2), 7 to 9 percent by weight of total solids.

b. Vehicle Solids Material: Class B, restricted to all resin materials. 40 percent minimum by weight of total solids remainder of vehicles solids to chlorinated parafin.

c. Total Solids: 25 percent minimum by weight of compounds.

d. Viscosity: 20 seconds maximum (Ford Cup).

e. Fineness of Grand: 6 minimum.

f. Drying Time:

1) Set to Touch: 20 minutes maximum.

2) Dry Hard: 45 minutes.

3) Alkali Resistance: 48 hours minimum.

g. Salt Spray (5% @ 95EF.): 500 hours minimum.

2. Sodium silicate.

a. Type of Compound: Type 2, white pigmented.

b. Vehicle Solids Material: Class A, no restriction.

3. Poly-siloxane (alkyl-alkoxy siloxane).

a. Type of Compound: Type 1, clear or translucent without dye.

b. Vehicle Solids Material: Class B, restricted to all resin materials.

C. Water Solubility: Less than 1 percent.

D. Weight Gain: At least 85 percent reduction of water absorption during initial 24 hour curing period when compared to untreated test sample, ASTM C 642.

E. Scaling Resistance: Weight loss less than 2.0 percent when subject to 500 cycles of freeze-thaw.

3.0 EXECUTION

3.1 INSPECTION

A. Verify concrete surfaces are ready for curing. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Prepare the surface in strict accordance with manufacturer's recommendations.

3.3 MOISTURE COVER CURING

A. Apply one or both of the following methods.

1. Water or continuous water-fog spray.

2. Cover concrete surface with absorptive mat, thoroughly saturate with water, and keep continuously wet.

B. Place absorptive mat to provide coverage of concrete surfaces and edges. Lap over adjacent absorptive covers.

3.4 MOISTURE-RETAINING SHEET CURING

A. Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss.

B. Repair any holes or tears during curing period.

3.5 FORMED SURFACE CURING

A. Cure formed concrete surface, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed.

B. If forms are removed, continue curing by curing compound or methods indicated above, as applicable.

3.6 UNFORMED SURFACE CURING

A. Cure unformed surfaces, such as slabs, floor toppings, and other surfaces by application of appropriate curing method.

B. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless approved otherwise.

3.7 CURING COMPOUNDS

A. Apply the approved product to the designated surfaces in strict accordance with the manufacturer's recommended application procedures.

B. Apply immediately following the final finishing operation as soon as the concrete is firm enough to work on.

C. Apply uniformly in continuous operation.

D. Maintain continuity of coating and repair damage during cure period.

E. Should side forms be removed before expiration of cure period, coat exposed surface with curing compound.

F. Unless specified otherwise by manufacturer of curing compound, do not use curing compound on surfaces which are to be covered with coating materials.

3.8 SCHEDULE OF CURING APPLICATIONS

A. Concrete Exposed to Potable Water (as in Water Storage Reservoirs): Moisture cover curing.

END OF SECTION 03370

DIVISION 4 – MASONRY

SECTION 04810

UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Products installed, but not furnished, under this Section include the following:

1. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."
2. Sealing of unit masonry furnished under Division 9 Section “Painting”.

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Samples for Initial Selection: For the following:

1. Unit masonry Samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
2. Colored mortar Samples showing the full range of colors available.

C. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless indicated as bullnose.

B. Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 Mpa).
2. Weight Classification: Lightweight.
3. Provide Type II, nonmoisture-controlled units.
4. Size (Width): Manufactured to the following dimensions:

    a. 4 inches (102 mm) nominal; 3-5/8 inches (92 mm) actual.

    b. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.

    c. 12 inches (305 mm) nominal; 11-5/8 inches (295 mm) actual.

5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
    a. Where units are to be left exposed, provide color and texture matching the range represented by Contracting Officer's sample.

C. Decorative Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 Mpa).
2. Weight Classification: Lightweight.
3. Provide Type II, non-moisture-controlled units.
4. Size: Manufactured to dimensions indicated for non-decorative units.

    a. 4 inches (102 mm) nominal; 3-5/8 inches (92 mm) actual.

    b. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.

    c. 12 inches (305 mm) nominal; 11-5/8 inches (295 mm) actual.

5. Finish: Exposed faces of the following general description matching color, pattern, and texture of Contracting Officer’s samples.
    a. Normal-weight aggregate, split-face finish, colored

b. Accent Band: Normal-weight aggregate, smooth-face finish, scored (3 scores per unit), colored.

D. Concrete Building Brick: ASTM C 55 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi (17.3 MPa).
2. Weight Classification: Lightweight.
3. Provide Type II, nonmoisture-controlled units.
4. Size: Manufactured to the following actual dimensions:

a. Modular: 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

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

C. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
1. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

E. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

F. Water: Potable.

2.3 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).

2.4 MASONRY JOINT REINFORCEMENT

A. General: ASTM A 951 and as follows:

1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
2. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
3. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
4. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units where indicated.

B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.

C. For multi-wythe masonry, provide types as follows:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch (16 mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.5 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim" and below:
1. Copper: 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.34 mm) thick for fully concealed flashing; 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick elsewhere.
2. Fabricate through-wall metal flashing embedded in masonry from sheet metal indicated above and with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.
3. Fabricate metal expansion-joint strips from sheet metal indicated above, formed to shape indicated.
4. Fabricate metal flashing terminations from sheet metal indicated above. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and then down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.

B. Contractor's Option for Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above. For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of 5-oz./sq. ft. (1.5-kg/sq. m) sheet copper bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
2. Asphalt-Coated Copper Flashing: Manufacturer's standard product consisting of 5-oz./sq. ft. (1.5-kg/sq. m) sheet copper coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
3. Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.040 inch (1.0 mm).

4. EPDM Flashing: Manufacturer's standard flashing product formed from a terpolymer of ethylene-propylene diene, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Metal Flashing:

    a. Cheney Flashing (Dovetail); Cheney Flashing Company, Inc.
    b. Cheney Flashing (Sawtooth); Cheney Flashing Company, Inc.
    c. Keystone 3-Way Interlocking Thruwall Flashing; Keystone Flashing Co.

2. Copper-Laminated Flashing:

    a. Copper Fabric Flashing; Advanced Building Products, Inc.
    b. Copper Fabric; AFCO Products, Inc.
    c. H & B C-Fab Flashing; Hohmann & Barnard, Inc.
    d. Type FCC-Fabric Covered Copper; Phoenix Building Products.
    e. Copper Fabric Flashing; Polytite Manufacturing Corp.
    f. Copper Fabric Flashing; Sandell Manufacturing Co., Inc.
    g. York Copper Fabric Flashing; York Manufacturing, Inc.

3. Asphalt-Coated Copper Flashing:

    a. Cop-R-Cote; Advanced Building Products, Inc.
    b. Cop-A-Cote; AFCO Products, Inc.
    c. H & B C-Coat Flashing; Hohmann & Barnard, Inc.
    d. Type ACC-Asphalt Bituminous Coated; Phoenix Building Products.

e. Coated Copper Flashing; Polytite Manufacturing Corp.
f. Coated Copper Flashing; Sandell Manufacturing Co., Inc.
g. Copperseal; York Manufacturing, Inc.

4. Rubberized-Asphalt Flashing:

a. Dur-O-Barrier; Dur-O-Wal, Inc.
b. Perm-A-Barrier Wall Flashing; W. R. Grace & Co., Construction Products Division.
c. Textroflash; Hohmann & Barnard, Inc.
d. Poly-Barrier Self-Adhering Wall Flashing; Polytite Manufacturing Corp.
e. Polyguard 300; Polyguard Products, Inc.
f. Everlastic MF-40; Williams Products, Inc.

5. EPDM Flashing:

a. FlashGuard; Firestone Building Products.
b. Or Approved Equal.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from urethane.

B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.

C. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (9-mm) OD by 4 inches (100 mm) long.

D. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm).

E. Cavity Drainage Material: 1-inch- (25-mm-) thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.

F. Available Products: Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:

1. Cavity Drainage Material:

a. Mortar Break; Advanced Building Products, Inc.
b. CavClear Masonry Mat; CavClear.

c. Mortar Net; Mortar Net USA, Ltd.
d. Mortar Stop; Polytite Manufacturing Corp.

2.8 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.
1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
2. For reinforced masonry and where indicated, use Type N.

C. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Limit pigments to the following percentages of cement content by weight:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

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

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

E. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns,

and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

3.6 BONDING OF MULTIWYTHE MASONRY

A. Use two-piece laddur-type reinforcement for interior wythe, and ties that extend into veneer wythe that engage eyes or hooks into laddur-type reinforcement.

B. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches (406 mm) o.c.
2. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.

    a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:
1. Install preformed control-joint gaskets designed to fit standard sash block.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

C. Install flashing as follows:
   1. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least 8 inches (200 mm), and behind air-infiltration barrier or building paper.
   2. At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn flashing up not less than 2 inches (50 mm) to form a pan.
   3. Extend sheet metal flashing 1/2 inch (13 mm) beyond face of masonry at exterior and turn flashing down to form a drip.
   4. Cut flashing off flush with face of wall after masonry wall construction is completed.

D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:

   1. Use round plastic tubing or rectangular plastic tubing to form weep holes.
   2. Space weep holes formed from plastic tubing 16 inches (400 mm) o.c.
   3. Place cavity drainage material immediately above flashing in cavities.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Contracting Officer's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.

3.12 MASONRY WASTE DISPOSAL

A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04810

DIVISION 5 – METALS

SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.

2. Grout.

B. Related Sections:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

2. Division 5 Section "Steel Deck" for field installation of shear connectors through deck.

3. Division 5 Section "Metal Stairs."

4. Division 9 painting Sections for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 SUBMITTALS

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

B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

4. Indicate type, size, and length of bolts.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.

2. AISC 360.

3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Clean and relubricate bolts and nuts that become dry or rusty before use.

1.7 COORDINATION

A. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:

1. W-Shapes: 60 percent.
2. Channels, Angles: 60 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 25 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

C. W-Shapes: ASTM A 992/A 992M.

D. Channels, Angles[**, M**] [**, S**]-Shapes: ASTM A 36/A 36M.

E. Plate and Bar: ASTM A 36/A 36M.

F. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade [**B**] [**C**], structural tubing.

G. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

B. Unheaded Anchor Rods: ASTM A 36/A 36M.

1. Configuration: Hooked.
2. Nuts: ASTM A 563 (ASTM A 563M) [**heavy-**]hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.

4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

5. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.3 PRIMER

A. Primer: Comply with Division 9 painting Sections.

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Mark and match-mark materials for field assembly.

2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces.[**Do not thermally cut bolt holes or enlarge holes by burning.**]

2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

2.6 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces to be field welded.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts**.**

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M[**and AWS D1.8/D1.8M**] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

B. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 05120

SECTION 05210

STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. K-series steel joists.
2. K-series steel joist substitutes.
3. Joist accessories.

B. Related Sections include the following:
1. Division 4 Section "Unit Masonry Assemblies" for installing bearing plates in unit masonry.

1.3 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

a. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Indicate locations and details of bearing plates to be embedded in other construction.

D. Welding certificates.

E. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.7 SEQUENCING

A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

1. Recycled Content: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Bearing Plates: ASTM A 36/A 36M.

C. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

G. Camber joists according to SJI's "Specifications."

H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of [**horizontal**] [**or**] [**diagonal**] bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

C. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by [**hand-tool cleaning, SSPC-SP 2**] [**or**] [**power-tool cleaning, SSPC-SP 3**].

B. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel [**bearing plates**] [**and**] [**framework**]. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Field welds will be visually inspected according to AWS D1.1/D1.1M.

B. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

C. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05210

SECTION 05310

STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Noncomposite vented form deck.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill.
2. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

    a. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

D. Product Certificates: For each type of steel deck, signed by product manufacturer.

E. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

C. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Steel Deck:

    a. ASC Profiles, Inc.
    b. Canam Steel Corp.;The Canam Manac Group.
    c. Consolidated Systems, Inc.
    d. DACS, Inc.
    e. D-Mac Industries Inc.
    f. Epic Metals Corporation.
    g. Marlyn Steel Decks, Inc.
    h. New Millennium Building Systems, LLC.
    i. Nucor Corp.; Vulcraft Division.
    j. Roof Deck, Inc.
    k. United Steel Deck, Inc.
    l. Valley Joist; Division of EBSCO Industries, Inc.
    m. Verco Manufacturing Co.

n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade **33 (230)**, **G60 (Z180)** zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 NONCOMPOSITE VENTED FORM DECK

A. Noncomposite Vented Steel Form Deck: Fabricate ribbed- and vented-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 **(230)**, G60 **(Z180)** zinc coating.

2. Profile Depth: 15/16 inch (24 mm**)**.
3. Design Uncoated-Steel Thickness: 0.0295 inch (0.75 mm).
4. Span Condition: Double span, Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.
6. Vent Slot Area: Manufacturer's standard vent slots providing 1-1/2 percent open area.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Galvanizing Repair Paint: [**ASTM A 780**] [**SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight**].

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches (450 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. [**Weld**] [**or**] [**mechanically fasten**] to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 8 inches apart, but not more than 12 inches apart.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (910 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior non-load-bearing wall framing.
   2. Roof trusses.

B. Related Sections include the following:
   1. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

   1. Design Loads: As indicated

   2. Deflection Limits: Design framing systems to withstand[**design loads**] without deflections greater than the following:
      a. Roof Trusses: Vertical deflection of 1/360 of the span.

   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

      a. Upward and downward movement of 1/2 inch (13 mm).

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

a. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

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

B. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: **1 inch (25 mm)** plus the design gap for (1/2").

2.4 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard-shape steel sections.

2.5 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Install sealer gaskets to isolate the underside of wall bottom track and the top of foundation wall.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to[**top and**] bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches (406 mm).

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

B. Truss Spacing: As indicated.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.

E. Erect trusses without damaging framing members or connections.

F. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses.".

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   2. Elevator hoist beams.
   3. Loose bearing and leveling plates.
   4. Miscellaneous steel trim including loading-dock edge angles.
   5. Metal ladders.
   6. Metal ships' ladders.
   7. Metal floor plate and supports.

B. Products furnished, but not installed, under this Section include the following:

   1. Loose steel lintels.

C. Related Sections include the following:

   1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
   2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
   3. Division 5 Section "Metal Stairs."

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.4 FASTENERS

A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

B. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

C. Eyebolts: ASTM A 489.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

F. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

G. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 painting Sections.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm), unless otherwise indicated.

C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.10 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:
1. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
2. Prime interior ladders, where indicated, including brackets and fasteners, with zinc-rich primer.

2.11 METAL SHIPS' LADDERS

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers, pipe and tube railings, and bar grating treads, unless otherwise indicated. Provide brackets and fittings for installation.

1. Fabricate ships' ladders, including treads and railings from steel.
2. Comply with applicable requirements in Division 5 Section "Metal Stairs" for railings.

B. Prime interior steel ships' ladders, where indicated, including treads, railings, brackets, and fasteners, with zinc-rich primer.

2.12 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of thickness indicated below:

1. Thickness: As indicated.

B. Provide steel angle supports as indicated.

C. Include steel angle stiffeners, and fixed and removable sections as indicated.

2.13 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

END OF SECTION 05500

SECTION 05511

METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Industrial-type stairs with steel grating treads.
3. Steel tube railings attached to metal stairs.
4. Steel tube handrails attached to walls adjacent to metal stairs.

B. Related Sections:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.

B. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Prefilled metal-pan stair treads.
2. Metal floor plate treads.
3. Grout.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: For qualified professional engineer.

F. Welding certificates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

F. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

G. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

F. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

G. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.

D. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts,[**railings,**] clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.6 STEEL-FRAMED STAIRS

A. Stair Framing:

1. Fabricate stringers of steel channels or tubes.

    a. Provide closures for exposed ends of channel or tube stringers.

2. Construct platforms of steel channel or tube headers and miscellaneous framing members as indicated.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness indicated.

1. Steel Sheet: Uncoated cold, or hot rolled steel sheet.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
4. Shape metal pans to include nosing integral with riser.
5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.7 STAIR RAILINGS

A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-5/8-inch- (41-mm-) diameter top and bottom rails and 1-1/2-inch- (38-mm-) diameter posts.

2. Picket Infill: 1/2-inch- (13-mm-) square pickets spaced less than 4 inches (100 mm) clear.
3. Intermediate Rails Infill: 1-5/8-inch- (41-mm-) diameter intermediate rails spaced less than 21 inches (533 mm) clear.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

C. Form changes in direction of railings as follows:

1. As detailed.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect posts to stair framing by direct welding unless otherwise indicated.
2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

1. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Division 3 Section "Cast-in-Place Concrete."

3.2 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

END OF SECTION 05511

DIVISION 6 – WOOD AND PLASTICS

SECTION 06160

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wall sheathing.

2. Roof sheathing.

3. Building paper.

4. Building wrap.

5. Sheathing joint-and-penetration treatment.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.

2. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.

3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

a. Include statement indicating costs for each certified wood product.

1.4 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Oriented strand board.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Oriented Strand Board: DOC PS 2.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.2 WALL SHEATHING

A. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16. 1/2 inch (13 mm).

2. Nominal Thickness: Not less than

3. Size: 48 by 96 inches (1219 by 2438 mm).

2.3 ROOF SHEATHING

A. Glass-Mat gypsum Roof Sheathing:

1. Product: Subject to compliance with requirements, provide “Dens-Deck Prime” roof board by G-P Gypsum Corporation.

2. Type and Thickness: Type X, 5/8-inch (15.9 mm) thick.

3. Size: 48 by 96 inches (1219 by 2438 mm).

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch (0.835 mm) thick, attach sheathing to comply with ASTM C 1002.

2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.

2.5 WEATHER-RESISTANT SHEATHING PAPER

A. Building Paper: ASTM D 226, Type 2 (No. 30 asphalt-saturated organic felt), unperforated.

B. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.

b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.

c. Ludlow Coated Products; Barricade Building Wrap.

d. Pactiv, Inc.; GreenGuard Classic Wrap.

e. Reemay, Inc.; Typar HouseWrap.

2. Water-Vapor Permeance: Not less than **152** g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).

3. Allowable UV Exposure Time: Not less than three months.

C. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Subflooring:

2. Wall Sheathing:

a. Screw to cold-formed metal framing.

b. Space panels 1/8 inch (3 mm) apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.

2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.

3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.4 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.

2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.

B. Building Paper (Roof): Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

C. Building Wrap (Walls): Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.

2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 06160

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Perimeter wall insulation (supporting backfill).
   2. Cavity-wall insulation.
   3. Concealed building insulation.
   4. Vapor retarders.
   5. Sound attenuation insulation.

B. Related Sections include the following:
   1. Division 4 Section "Unit Masonry Assemblies" for insulation installed in cavity walls and masonry cells.
   2. Division 7 Section "Exterior Insulation and Finish Systems - Class PB" for insulation specified as part of these systems.
   3. Division 7 Section EPDM Membrane Roofing for insulation specified as part of roofing construction.
   4. Division 9 Section Gypsum Board Assemblies for installation in metal-framed assemblies of insulation specified by referencing this Section.
   5. Division 15 Section "Mechanical Insulation."

1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 SUBMITTALS

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

B. Research/Evaluation Reports: For foam-plastic insulation.

C. LEED Submittals:

1. Product Data for Credit MR4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

1. Available Manufacturers:

   a. DiversiFoam Products.
   b. Dow Chemical Company.
   c. Owens Corning.
   d. Pactiv Building Products Division.

2. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), unless otherwise indicated.

2.3 GLASS-FIBER BLANKET INSULATION

A. Available Manufacturers:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (blankets with Kraft membrane facing), Class C (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with kraft-face vapor-retarder membrane on 1 face.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
   1. 3-5/8 inches (92 mm) thick with R-value of R-13.
   2. 6 inches (152 mm) thick with R-value of R-19.
   3. 9 inches (229 mm) thick with R-value of R-30.

E. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.4 AUXILIARY INSULATING MATERIALS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

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

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated.

3.6 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

D. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.7 INSTALLATION OF INSULATION IN WALLS CEILINGS FOR SOUND ATTENUATION

A. Install 3-inch- (76-mm-) thick, unfaced glass-fiber blanket insulation over suspended ceilings at partitions in a width that extends insulation 48 inches (1219 mm) on either side of partition.

B. Install nom. 3 inch (76 mm) thick, unfaced glass-fiber blanket insulation in widths and lengths that fill the cavities formed by framing members.

3.8 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07241

POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior insulation and finish system (EIFS) applied over masonry, gypsum sheathing.

B. Related Sections:
1. Division 6 Section "Sheathing" for sheathing and weather-resistant sheathing paper.
2. Division 7 Section "Joint Sealants" for sealing joints in EIFS with elastomeric joint sealants.

1.3 SYSTEM DESCRIPTION

A. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

1.4 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with the following:

1. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
2. Weathertightness: Resistant to water penetration from exterior into EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.

1.5 SUBMITTALS

A. Product Data: For each type and component of EIFS indicated.

B. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of joint sealants and exposed accessories involving color selection.

C. Samples for Verification: 24-inch- (600-mm-) square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including a typical control joint filled with sealant of color selected.

D. Qualification Data: For Installer.

E. Manufacturer Certificates: Signed by manufacturers certifying that EIFS and joint sealants comply with requirements.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each water-/weather-resistive barrier**,** insulation, reinforcing mesh, joint sealant, and coating.

G. Maintenance Data: For EIFS to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.

C. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
2. Full-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which EIFS is a part, complies with UBC Standard 26-4 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies containing foam-plastic insulation.

3. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.

D. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate installation of EIFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and barrier coating of EIFS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Dryvit Systems, Inc.
   2. Finestone; Degussa Wall Systems, Inc.
   3. Senergy; Degussa Wall Systems, Inc.
   4. Sto Corp.
   5. TEC; an H. B. Fuller company.

2.2 MATERIALS

A. Compatibility: Provide adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.

B. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.

C. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

D. Insulation Adhesive: EIFS manufacturer's standard formulation designed for adhering layers of insulation to each other (insulation shall not be adhered to substrate).
   1. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.

E. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:

   1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
   2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
   3. Dimensions: Provide insulation boards not more than 24 by 48 inches (610 by 1219 mm) and in thickness indicated, but not more than 4 inches (102 mm) thick or less than thickness allowed by ASTM C 1397.

4. Foam Shapes: Provide with profiles and dimensions indicated on Drawings.

F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) per EIMA 105.01; complying with ASTM D 578 and the following:
   1. Intermediate-Impact Reinforcing Mesh: Not less than 10 oz./sq. yd. (339 g/sq. m).
   2. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd. (127 g/sq. m).
   3. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).
   4. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd. (244 g/sq. m).

G. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following:

   1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
   2. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

I. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating complying with the following:

   1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
   2. Colors: As selected by Contracting Officer from manufacturer's full range.

J. Water: Potable.

K. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; selected for properties of pullout, tensile, and shear strength required to resist design loads of application indicated; capable of pulling fastener head below surface of insulation board; and of the following description:

   1. For attachment to steel studs from 0.033 to 0.112 inch (0.84 to 2.84 mm) in thickness, provide steel drill screws complying with ASTM C 954.
   2. For attachment to light-gage steel framing members not less than 0.0179 inch (0.45 mm) in thickness, provide steel drill screws complying with ASTM C 1002.
   3. For attachment, provide manufacturer's standard fasteners suitable for substrate.

L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-

stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.

1. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
2. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.

2.3 ELASTOMERIC SEALANTS

A. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in ASTM C 1481 and with requirements in Division 7 Section "Joint Sealants" for products corresponding to description indicated below:

1. Multicomponent, nonsag urethane sealant.
2. Single-component, nonsag, neutral-curing silicone sealant.

B. Sealant Color: As selected by Contracting Officer from manufacturer's full range.

2.4 MIXING

A. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of EIFS.

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

3.3 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C 1397 and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 SUBSTRATE PROTECTION APPLICATION

A. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.

B. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

3.5 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at window sills**,** and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.
   1. Window Sill Flashing: Use at windows unless otherwise indicated.
   2. Expansion Joint: Use where indicated on Drawings.

3.6 INSULATION INSTALLATION

A. Board Insulation: Mechanically attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:
   1. Mechanically attach insulation to substrate by method complying with EIFS manufacturer's written instructions. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:

      a. Steel Framing: 5/16 inch (8 mm).

2. Apply insulation over dry substrates in courses with long edges of boards oriented horizontally.
3. Begin first course of insulation from a level base line and work upward.
4. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.
    a. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.

5. Interlock ends at internal and external corners.
6. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
7. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
8. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/16 inch (1.6 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm).
9. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
10. Interrupt insulation for expansion joints where indicated.
11. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
12. After installing insulation and before applying reinforcing mesh, fully wrap board edges with strip reinforcing mesh. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.
13. Treat exposed edges of insulation as follows:

    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
    b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.

14. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS protective-coating lamina.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where EIFS manufacturer requires joints in long continuous elevations.

3.7 BASE-COAT INSTALLATION

A. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch (1.6-mm) dry-coat thickness.

B. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches (204 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
1. Intermediate-impact reinforcing mesh.

C. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.

1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches (200 mm) wide.
2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.8 FINISH-COAT INSTALLATION

A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.

B. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Texture: As selected by Contracting Officer from manufacturer's full range.

3.9 INSTALLATION OF JOINT SEALANTS

A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 7 Section "Joint Sealants" and in ASTM C 1481.
   1. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
   2. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
   3. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
   4. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.

3.10 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07241

SECTION 07610

SHEET METAL ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following custom-fabricated sheet metal roofing:
   1. Standing-seam metal roofing.

B. Related Sections include the following:

   1. Division 5 Section "Steel Deck" for steel roof deck supporting sheet metal roofing.
   2. Division 7 Section "Building Insulation" for roof insulation.
   3. Division 7 Section "Sheet Metal Flashing and Trim" for fasciae, copings**,** flashings and other sheet metal work not part of sheet metal roofing.
   4. Division 7 Section "Roof Accessories" for accessories on roof.
   5. Division 7 Section "Joint Sealants" for field-applied sheet metal roofing sealants.
   6. Division 9 Section "Painting" for field painting sheet metal roofing.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide complete sheet metal roofing system, including, but not limited to, custom-fabricated metal roof pans, cleats, clips, anchors and fasteners, sheet metal flashing and drainage components related to sheet metal roofing, fascia panels, trim, underlayment, and accessories as indicated and as required for a weathertight installation.

B. Wind-Uplift Resistance: Provide custom-fabricated sheet metal roofing capable of resisting the following design negative uplift pressure. Provide clips, fasteners, and clip spacings of type indicated and with capability to sustain, without failure, a load equal to 3 times the design negative uplift pressure.

   1. Design Negative Uplift Pressure: Provide assembly that complies with UL580 for Class 90 wind-uplift resistance.

C. Thermal Movements: Provide sheet metal roofing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal roofing thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide sheet metal roofing that does not allow water infiltration to building interior, with metal flashing and connections of sheet metal roofing lapped to allow moisture to run over and off the material.

1.4 SUBMITTALS

A. Product Data: For each product indicated. Include details of construction relative to materials, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, and keyed references to termination points. Distinguish between shop- and field-assembled work. Include the following:

1. Details for forming sheet metal roofing, including seams and dimensions.
2. Details for joining and securing sheet metal roofing, including layout of fasteners, clips, and other attachments. Include pattern of seams.
3. Details of termination points and assemblies, including fixed points.
4. Details of expansion joints, including showing direction of expansion and contraction.
5. Details of roof penetrations.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
7. Details of special conditions.
8. Details of connections to adjoining work.

C. Samples for Initial Selection: For each type of sheet metal roofing indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of sheet metal roofing.

B. Custom-Fabricated Sheet Metal Roofing Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.

C. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal roofing pans, components, and other sheet metal roofing materials so as not to be damaged or deformed. Package sheet metal roofing materials for protection during transportation and handling.

B. Unload, store, and erect sheet metal roofing materials in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Store sheet metal roofing materials to ensure dryness. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

E. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Installer's Warranty: Roofing Installer's warranty, on warranty form at end of this Section, signed by Roofing Installer, in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Loose parts.
c. Wrinkling or buckling.
d. Failure to remain weathertight, including uncontrolled water leakage.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
f. Galvanic action between sheet metal roofing and dissimilar materials.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 ROOFING SHEET METALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
2. Surface: Smooth, flat finish.
3. Thickness: 0.0276 inch (0.7 mm), unless otherwise indicated.

4. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings:

a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605.

2) Color: As selected by Contracting Officer from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Self-Adhering, Polyethylene-Faced Sheet: ASTM D 1970, 40 mils (1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.

1. Available Products:

a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "A."
b. Grace, W. R. & Co.; Grace Ice and Water Shield.
c. Henry Company; Perma-Seal PE.
d. Johns Manville International, Inc.; Roof Defender.
e. NEI Advanced Composite Technology; AC Poly Ice and StormSeal.
f. Owens Corning; WeatherLock.
g. Polyguard Products, Inc.; Polyguard Deck Guard.
h. Protecto Wrap Company; Rainproof TM.

C. Slip Sheet: Building paper, minimum 5 lb/100 sq. ft. (0.24 kg/sq. m), rosin sized.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Nails for Copper Roofing: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch (2.8 mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
2. Exposed Fasteners: Heads matching color of sheet metal roofing by means of plastic caps or factory-applied coating.

3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Zinc-Tin Alloy-Coated Steel: ASTM B 32, 100 percent tin.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight and as recommended by roll-formed sheet metal roofing manufacturer for installation indicated.

F. Expansion-Joint Sealant: For hooked-type expansion joints, which must be free to move, provide nonsetting, nonhardening, nonmigrating, heavy-bodied polyisobutylene sealant.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured by a roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

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

a. Atlas Roofing Corporation.
b. Firestone Building Products.
c. Insulfoam LLC; a Carlisle company.
d. Or Approved Equal.

2.6 ACCESSORIES

A. Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures,

clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as sheet metal roofing.
2. Cleats: Mechanically seamed cleats formed from the following material:
   a. Metallic-Coated Steel Roofing: 0.0250-inch- (0.65-mm-) thick, stainless-steel or nylon-coated aluminum sheet.

3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
4. Closures: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent sheet metal roofing.

C. Roof Curbs: Fabricated from 0.0478-inch- (1.2-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; with welded top box and bottom skirt, and integral full-length cricket. Fabricate curb subframing of minimum 0.0598-inch- (1.5-mm-) thick, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads, of size and height indicated. Finish roof curbs to match sheet metal roofing.

D. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating sheet metal roofing, and complete with predrilled holes, clamps, or hooks for anchoring.

1. Seam-Mounted, Stop-Type Snow Guards: Colored polycarbonate stops designed for attachment to vertical ribs of standing-seam sheet metal roofing with stainless-steel set screws.

   a. Available Products:

      1) Alpine Snow Guards, Div. of Vermont Slate & Copper Services, Inc.; Model No. 30.
      2) Berger Bros. Co.; RT Snow Guards.
      3) Polar Blox; Standing Seam Snowguard.

E. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.7 FABRICATION

A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.

1. Standing-Seam Roofing: Form standing-seam pans with finished seam height of 1-1/2 inches (38 mm).

B. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

C. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.

D. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, sheet metal roofing supports, and other conditions affecting performance of work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances.
3. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for flashings, and penetrations through sheet metal roofing.

B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before sheet metal roofing installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

B. Install fasciae and copings to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.3 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment and building-paper slip sheet on roof sheathing under sheet metal roofing. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated below, in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

1. Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply at locations indicated below, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

1. Roof perimeter for a distance up from eaves of 36 inches (900 mm) beyond interior wall line.

2. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (150 mm).
3. Hips and ridges for a distance on each side of 12 inches (300 mm).
4. Roof to wall intersections for a distance from wall of 18 inches (460 mm).
5. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches (460 mm).

C. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

D. Apply slip sheet over underlayment before installing sheet metal roofing.

3.4 INSTALLATION, GENERAL

A. General: Install sheet metal roofing perpendicular to purlins or supports. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Field cutting of sheet metal roofing by torch is not permitted.
2. Rigidly fasten eave end of sheet metal roofing and allow ridge end free movement due to thermal expansion and contraction. Predrill roofing.
3. Provide metal closures at rake walls and each side of ridge and hip caps.
4. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install ridge and hip caps as sheet metal roofing work proceeds.
7. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.
8. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.

B. Fasteners: Use fasteners of sizes that will not penetrate completely through substrate.

1. Steel Roofing: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of dissimilar metals.

D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

E. Fascia: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.5 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

A. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges, unless otherwise indicated.

1. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
2. Nail cleats not more than 12 inches (300 mm) o.c. Bend tabs over nails.

B. Seal joints as shown and as required for leakproof construction. Provide low-slope transverse seams using cleats where backup of moisture may occur.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.
1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

D. Provide expansion cleats in roof panels that exceed 30 feet (9.1 m) in length.

E. Zinc-Tin Alloy-Coated Steel Roofing: Paint exposed surfaces of zinc-tin alloy-coated steel with one coat of zinc-tin alloy-coated steel primer and one coat of zinc-tin alloy-coated steel finish coat as soon as possible after installation, each coat applied at a dry film thickness of not less than 2.5 mils (0.06 mm). Comply with manufacturer's written instructions.

F. Standing-Seam Roofing: Attach standing-seam metal pans to substrate with cleats, double-nailed at 12 inches (305 mm) o.c. Install pans reaching from eave to ridge before moving to adjacent pans. Lock each pan to pan below with transverse seam.

Before pans are locked, apply continuous bead of sealant to top flange of lower pan. Crimp standing seams by folding over twice so cleat and pan edges are completely engaged.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet sheet metal roofing.

D. Stop-Type Snow Guards: Attach snow guards to sheet metal roofing with adhesive, sealant, or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate sheet metal roofing.

1. Provide two rows of snow guards, at locations indicated on Drawings, spaced 12 inches apart, beginning 12 inches up from gutter.

E. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by manufacturer.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films, if any, as sheet metal roofing is installed. On completion of sheet metal roofing installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07610

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Manufactured through-wall flashing.
2. Formed roof drainage system.

B. Related Sections include the following:
1. Division 4 Section "Unit Masonry Assemblies" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
2. Division 7 Section "Metal Roof Panels" for factory-formed metal roof panels and flashing and trim not part of sheet metal flashing and trim.
3. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
1. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft. (1.48 to 2.15 kPa): 90-lbf/sq. ft. (4.31-kPa) perimeter uplift force, 120-lbf/sq. ft. (5.74-kPa) corner uplift force, and 45-lbf/sq. ft. (2.15-kPa) outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other

detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SHEET METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

   1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

         1) Color: As selected by Contracting Officer from manufacturer's full range.

B. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

2) Color: As selected by Contracting Officer from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars**,** and gutter accessories from same metal as gutters.

1. Gutter Style: F.
2. Expansion Joints: Lap type.

3. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following material:
   a. Prepainted, Metallic-Coated Steel: 0.0336 inch (0.85 mm) thick.

B. Downspouts: Fabricate open-face downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Fabricate downspouts from the following material:
   a. Prepainted, Metallic-Coated Steel: 0.0217 inch (0.55 mm) thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Joint Style: Butt, with 12-inch- (300-mm-) wide concealed backup plate and 6-inch- (150-mm-) wide exposed cover plates.
2. Fabricate copings from the following material:
   a. Prepainted, Metallic-Coated Steel: 0.0396 inch (1.0 mm) thick.

B. Counterflashing: Fabricate from the following material:
1. Prepainted, Metallic-Coated Steel: 0.0217 inch (0.55 mm) thick.

C. Flashing Receivers: Fabricate from the following material:
1. Prepainted, Metallic-Coated Steel: 0.0217 inch (0.55 mm) thick.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
2. Pretinning is not required for [**lead-coated copper**] [**zinc-tin alloy-coated stainless steel**] [**and**] [**lead**].

3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored straps spaced not more than 36 inches (900 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.
5. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.24 m) apart. Install expansion joint caps.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

1. Provide elbows at base of downspout to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches (100 mm) in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch (600-mm) centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch (400-mm) centers.
2. Anchor interior leg of coping with screw fasteners and washers at 20-inch (500-mm) centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

SECTION 07720

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Ridge Vents

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

1. With Contracting Officer's approval, adjust location of roof accessories that would interrupt roof drainage routes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.

B. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
2. Power-Coat Finish: Immediately after cleaning and pre-treating, electrostatically apply manufacturer's standard baked-polymer thermo=setting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

    a. Color and Gloss: As selected by Contracting Officer from manufacturer's full range.

C. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use, mill finished.

D. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.

E. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: ASTM C 920, silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

2.4 ROOF VENTS

A. Roof Vents: Fabricate roof hatches with insulated double-wall lids and insulated single-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

1. Available Manufacturers:

    a. DCSM, Inc.
    b. Peterson PAC-CLAD ‘SS Ridge Vent’.
    c. Or Approved Equal.
2. Material: 24 ga Galvanized steel, or Galvalume
3. Finish: Kynar 500, color as selected by Contracting Officer.
4. Size: Lengths shall be min 10 to 12 feet (254 to 305 mm).
5. Accessories:

a. Expanded metal/perforated interior screen.
b. Miters.
c. Endcaps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.3 TOUCH UP

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 07720

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Control and expansion joints in unit masonry.

b. Joints between different materials listed above.

c. Perimeter joints between materials listed above and frames of doors and windows.

d. Other joints as indicated.

2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Perimeter joints of exterior openings where indicated.

b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.

c. Joints between plumbing fixtures and adjoining walls, floors, and counters.

d. Other joints as indicated.

B. Related Sections include the following:

1. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.

2. Division 9 Section "Ceramic Tile" for sealing tile joints.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. LEED Submittals:

1. Product Data for Credit EQ4.1: For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.

C. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Contracting Officer from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Single-Component Neutral- and Basic-Curing Silicone Sealant:

1. Available Products:

    a. Dow Corning Corporation; 791.

    b. Dow Corning Corporation; 795

    c. GE Silicones; SilPruf NB SCS9000.

    d. GE Silicones; UltraPruf II SCS2900.

    e. Pecora Corporation; 865.

    f. Pecora Corporation; 895.

    g. Pecora Corporation; 898.

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 50.

4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: Concrete masonry units to hollow metal frames, aluminum storefront frames, and aluminum coated with high-performance coating.

6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

D. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

1. Available Products:

    a. Dow Corning Corporation; 786 Mildew Resistant.

    b. GE Silicones; Sanitary SCS1700.

    c. Tremco; Tremsil 200 (white or clear depending on application.)

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 25.

4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: Ceramic tile, plumbing fixtures, and plastic laminate.

E. Multicomponent Nonsag Urethane Sealant:

1. Available Products:

    a. Pecora Corporation; Dynatrol II.

    b. Tremco; Dymeric 511.

    c. Tremco; Vulkem 922.

2. Type and Grade: M (multicomponent) and NS (nonsag).

3. Class: 50.

4. Use[s] Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: M, G**,** A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: Gypsum board, hollow metal, anodized aluminum, plastic laminate.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant : Comply with ASTM C 834, Type P, Grade NF.

B. Available Products:

1. Bostik Findley; Chem-Calk 600.

2. Pecora Corporation; AC-20+.

3. Schnee-Morehead, Inc.; SM 8200.

4. Sonneborn, Division of ChemRex Inc.; Sonolac.

5. Tremco; Tremflex 834.

2.5 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable

of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Masonry.

    b. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.

    b. Glazed surfaces of ceramic tile.

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

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

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

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

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form

smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant.

2. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range.

B. Joint-Sealant Application: Exterior perimeter joints between unit masonry and frames of doors and windows.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant.

2. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range.

C. Joint-Sealant Application]: Vertical control and expansion joints on exposed interior surfaces of exterior walls.

1. Joint Sealant: Multicomponent nonsag urethane sealant.

2. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range.

D. Joint-Sealant Application: Interior perimeter joints of exterior openings.

1. Joint Sealant: Multicomponent nonsag urethane sealant.

2. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range.

E. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant.

2. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range.

F. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors and windows.

1. Joint Sealant: Latex sealant.

2. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range.

END OF SECTION 07920

DIVISION 8 - DOORS AND WINDOWS

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard hollow metal [**doors**] [**and**] [**frames**].
2. Custom hollow metal [**doors**] [**and**] [**frames**].

B. Related Sections

1. Division 4 Section "Unit Masonry Assemblies" for embedding anchors for hollow metal work into masonry construction.
2. Division 8 Section "Stainless-Steel Doors and Frames" for hollow metal doors and frames manufactured from stainless steel.
3. Division 8 Section "Door Hardware" for door hardware for hollow metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, [**fire-resistance rating,**] [**temperature-rise ratings,**] and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).

D. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-(102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Kewanee Corporation (The).
5. Mesker Door Inc.
6. Pioneer Industries, Inc.
7. Steelcraft; an Ingersoll-Rand company.
8. Windsor Republic Doors.

B. Custom Door Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Krieger Specialty Products
2. Overly Door Company
3. Security Metal Products Corp.
4. or equal

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Division 8 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
   a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.

      1) Locations: Exterior doors.

3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.

   a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as knocked down unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
5. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
6. Frames for Borrowed Lights: 0.053-inch- (1.3-mm-) thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 CUSTOM HOLLOW METAL DOORS (Doors 37,38,39 and 41)

A. General: Provide doors not less than 1-3/4 inches (44.5 mm) thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces. Comply with ANSI/NAAMM-HMMA 861.

1. Doors must be security rated.
2. Doors must maintain minimum STC-50.
3. Door must maintain minimum 8-minute access/intruder delay.
4. Coordinate with door hardware requirements.

B. Interior Door Face Sheets: Fabricated from cold-rolled steel sheet.

1. Interior/Room Fact: Minimum 0.042-inch (1.0 mm) thick.
2. Exterior/Hall Face: Minimum 0.25-inch (6 mm) thick.

C. Core Construction: Provide sound-attenuation rated cores for Doors 37, 38, 39, 41.

1. Steel-Stiffened Core: 0.026-inch- (0.7-mm-) thick, steel vertical stiffeners of same material as interior face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart, spot welded to face sheets a maximum of 5 inches (127 mm) o.c. Spaces filled between stiffeners with glass- or mineral-fiber insulation.

a. Sound Attenuation-Rated Doors: Provide doors fabricated with sound attenuation rating of not less than STC-50.

D. Vertical Edges for Single-Acting Doors: Beveled 1/8 inch in 2 inches (3 mm in 50 mm).

E. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.

F. Top and Bottom Channels: Closed with continuous channels, minimum 0.053 inch (1.3 mm) thick, of same material as face sheets and spot welded to both face sheets.

G. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as door face sheets.

2.6 CUSTOM HOLLOW METAL FRAMES

A. General: Fabricate frames of construction indicated. Close contact edges of corner joints tight with faces mitered and stops butted or mitered. Continuously weld faces and soffits and finish faces smooth. Comply with ANSI/NAAMM-HMMA 861.

1. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricated from 0.053-inch- (1.3-mm-) thick steel sheet.

B. Interior Frames: Fabricated from cold-rolled steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as frame.

D. Head Reinforcement: Provide minimum 0.093-inch- (2.3-mm-) thick, steel channel or angle stiffener for opening widths more than 48 inches (1219 mm).

2.7 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.8 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.9 LOUVERS

A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2.10 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        1) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) high.
        2) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
3. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. Install frames with removable glazing stops located on secure side of opening.
   b. Install door silencers in frames before grouting.
   c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   d. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   e. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

   a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

SECTION 08211

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Louvers and light frames for flush wood doors.

B. Related Sections:
1. Division 8 Section "Glazing" for glass view panels in flush wood doors.
2. Division 9 Sections “Wood Stains and Transparent Finishes” for field finishing doors.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction**,** louvers, and trim for openings.

B. LEED Submittals:

1. Product Data for Credit MR4.1 and MR4.2: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.

2. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.

4. Indicate fire-protection ratings for fire-rated doors.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors from single manufacturer.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

C. Forest Certification: Provide doors made with not less than 70 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252, UBC Standard 7-2.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Graham; an Assa Abloy Group company.
4. VT Industries Inc.
5. Or approved equal.

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.

2. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

D. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf (3100 N).
b. Screw Withdrawal, Edge: 400 lbf (1780 N).

E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Red oak
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Pair and Set Match: Provide for doors hung in same opening.
6. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
7. Exposed Vertical and Top Edges: Same species as faces.
8. Core: Particleboard.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering press.
10. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

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

    a. Air Louvers Inc.
    b. Anemostat; a Mestek company.
    c. Hiawatha Incorporated.
    d. L & L Louvers, Inc.
    e. LL Building Products, Inc.; a division of GAF Materials Corporation.
    f. Louvers & Dampers, Inc.; a Mestek company.
    g. McGill Architectural Products.

2. Blade Type: Vision-proof, inverted V.
3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Louvers: Factory install louvers in prepared openings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

END OF SECTION 08211

SECTION 08411

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for punched openings.
4. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.

d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

C. Product Test Reports: For blast-resistant aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Structural Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

   a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2. Entrance Doors:

   a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
   b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Blast Resistance:

1. Hazard Rating: Minimal Hazard per ASTM F 1642.
2. Performance Condition: 2 per GSA-TS01.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
    b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
    c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

J. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.
2. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).

2.2 MANUFACTURERS

A. Basis-Of-Design Product: The design for aluminum-framed systems is based on #451T by Kawneer Company, Inc. Subject to compliance with requirements, provide the named product, or a comparable product by one of the following:

1. Kawneer Company, Inc.
2. Manko.
3. Tubelite, Inc.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Color anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Provide manufacturer’s compatible sill receptor.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N)to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Named products are basis-of-design products. Provide named hardware manufacturer's products, or comparable products that are equivalent in function and quality and that are recommended and supplied by entrance system manufacturer.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

C. Pivot Hinges: BHMA A156.4, Grade 1.

1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

F. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305, and shall be compatible with **ADVANTOR** locking device.

G. Locking Device: Entry doors shall be required to be compatible with locking device as manufactured and as specified by **ADVANTOR**. Refer to Section 08712 for ADVANTOR locking device.

H. Strikes: Prep doors for exterior door entrance system so as to accept magnetic strike for **ADVANTOR** locking device.

I. Panic Exit Device: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305, and compatible to **ADVANTOR** locking device.

1. Standard: SHMA A156.3, Grade 1.

J. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

K. Automatic Door Operator: Surface applied heavy-duty automatic door opener with push-plate activation. Must integrate with **ADVANTOR** access control system.

1. Standard: ANSI A156.19 , Grade 1.
2. Suggested Manufacturers:

a. Besam
b. LCN
c. Record

L. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

M. Weather Stripping: Manufacturer's standard replaceable components.

N. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

O. Silencers: BHMA A156.16, Grade 1.

P. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

2.6 GLAZING

A. Glazing: Comply with Section 08800 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Storefront Framing: Fabricate components for assembly using screw-spline system.

D. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

E. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: As selected by Contracting Officer from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 07920 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 08800 "Glazing."

F. Install weatherseal sealant according to Section 07920 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
    b. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.5 DOOR HARDWARE SCHEDULE

A. Door Openings 01 and 02.

1. Hinges: Kawneer standard top, bottom, and intermediate offset pivot hinges.
2. Exit Device: Kawneer "Paneline II CR-90, concealed rod device system. Provide for ADVANTOR lock device in one leaf of Door Opening 01.
3. Closer: "SAM11" concealed overhead/single-acting closer with concealed top arm.
4. Pull: Kawneer "G-2" (one per leaf).
5. Threshold: Kawneer standard for offset pivot and overhead closer. Shall include anchors and jamb clips, not to exceed ½-inch (12.7 mm) in height with beveled edges.

B. Door Opening 02.

1. Hinges: Kawneer standard top, bottom, and intermediate offset pivot hinges.
2. Exit Device: Kawneer "Paneline II CR-90, concealed rod device system. Provide for **ADVANTOR** lock device in both leafs of Door Opening 02.
3. Electromagnetic Lock: Refer to Section 08712. Electromagnetic lock supplied by ADVANTOR Systems Corporation (no substitutions).
4. Locking Device; Refer to Section 08712. Locking device supplied by ADVANTOR Systems Corporation (no substitutions).
5. Automatic Door Operator: Operator must integrate with **ADVANTOR** electromagnetic lock and locking device.
6. Pull: Kawneer "G-2" (one per leaf).
7. Threshold: Kawneer standard for offset pivot and overhead closer. Shall include anchors and jamb clips, not to exceed ½-inch (12.7 mm) in height with beveled edges.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08411

SECTION 08712

DOOR HARDWARE (SCHEDULED BY DESCRIBING PRODUCTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Swinging doors.

2. Cylinders for doors specified in other Sections.

B. Related Sections include the following:

1. Division 8 Section "Steel Doors and Frames" for door silencers provided as part of the frame.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Final replacement cores and keys to be installed by Owner.

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

    a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

D. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Contracting Officer, and Government about door hardware and keying.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with FED-STD-795, "Uniform Federal Accessibility Standards," as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch (13 mm) high. Bevel raised thresholds with a slope of not more than 1:2.

F. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Contracting Officer so that blanks (keys) and cylinders may be keyed by Government.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Government of other rights Government may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Government's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3.

1. Door Hardware Sets: Requirements for quantity, item, design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

2.2 HINGES AND PIVOTS, GENERAL

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

1. Hinges:
    a. Bommer Industries, Inc.
    b. Hager Companies.
    c. McKinney Products Company; Div. of ESSEX Industries, Inc.
    d. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.
    e. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Standards: Comply with the following:

1. Butts and Hinges: BHMA A156.1.
2. Template Hinge Dimensions: BHMA A156.7.

C. Quantity: Provide the following, unless otherwise indicated:
1. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).

D. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

E. Hinge Applications: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

F. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Stainless steel, with stainless-steel pin.
3. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

G. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

    a. Outswinging exterior doors.
    b. Outswinging corridor doors with locks.
2. Corners: Square.

H. Fasteners: Comply with the following:
1. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
2. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors. Finish screw heads to match surface of hinges.

2.3 LOCKS AND LATCHES, GENERAL

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

1. Mechanical Locks and Latches:
   a. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (NO SUBSTITUTIONS)

B. Standards: Comply with the following:

1. Bored Locks and Latches: BHMA A156.2.

C. Bored Locks: BHMA Grade 1; Series 4000.

D. Lock Trim: Comply with the following:

1. Lever: Wrought, forged, or cast.
2. Knob: Wrought.
3. Escutcheon (Rose): Wrought, forged, or cast.
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

1. Bored Locks: BHMA A156.2.

F. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Bored Locks: Minimum 1/2-inch (12.7-mm) latchbolt throw.

G. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

2.4 AUXILIARY LOCKS AND LATCHES

A. Access Control Lockset: Electronic, programmable stand-alone locking system with keypad and card reader. Programmed to work with either smart card-only or dual credential modes. Provide mechanical key override on all locks for emergency access. Use of key is recorded on audit trail.

1. Available Manufacturers: Subject to compliance with requirements, provide the following:
   a. KABA Ilco Inc.; a KABA Group Company; 5800-Series (no substitution).

2. Standards: Comply with the following:
   a. Cylindrical: ANSI/BHMA A156.25, Grade 1.

b. Exit Trim: ANSI/BHMA A156.3, Grade 1

B. Security Control Lockset: Electronic, programmable locking system with keypad and card reader. Supplied only by ADVANTOR Systems Corporation (no substitution) for doors 2, 13, & 27 only.

2.5 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated. Electromagnetic lock supplied only by ADVANTOR Systems Corporation (no substitution) for Doors 2, 13, & 27 only.

DOOR BOLTS, GENERAL

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

1. Manual Flush Bolts:
   a. Glynn-Johnson; an Ingersoll-Rand Company.
   b. Hager Companies.
   c. Ives: H. B. Ives.
   d. NT Quality Hardware; an Ingersoll-Rand Company.
   e. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.
   f. Triangle Brass Manufacturing Company, Inc.

C. Standards: Comply with the following:
1. Manual Flush Bolts: BHMA A156.16.

D. Flush Bolts: BHMA Grade 1, designed for mortising into door edge.

E. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
1. Mortise Flush Bolts: Minimum 3/4-inch (19-mm) throw.

F. Dust Proof Strikes: BHMA A156.16, Grade 1.

2.6 EXIT DEVICES, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (NO SUBSTITUTIONS)

B. Standard: BHMA A156.3.

1. BHMA Grade: Grade 1.

C. Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Outside Trim: Pull with cylinder; material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

G. Through Bolts: For exit devices and trim on metal doors and fire-rated wood doors.

2.7 CYLINDERS AND KEYING

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

1. Cylinders: Same manufacturer as for locks and latches.

B. Standards: Comply with the following:

1. Cylinders: BHMA A156.5.

C. Cylinder Grade: BHMA Grade 1.

D. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.

E. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

F. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
      a. Furnish permanent cores to Owner for installation. Keyway for permanent cores shall be "HL."

G. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate as follows:
   1. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.

H. Keys: Provide nickel-silver keys complying with the following:

   1. Quantity: In addition to one extra blank key for each lock, provide the following:

      a. Provide two (2) keys (blanks) per cylinder/door.

2.8 OPERATING TRIM, GENERAL

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

   1. Baldwin Hardware Corporation.
   2. Hager Companies.
   3. Ives: H. B. Ives.
   4. NT Quality Hardware; an Ingersoll-Rand Company.
   5. Stanley Commercial Hardware; Div. of The Stanley Works.
   6. Triangle Brass Manufacturing Company, Inc.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate from stainless steel, unless otherwise indicated.

2.9 CLOSERS, GENERAL

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

   1. Surface-Mounted Closers:
      a. Corbin Russwin Architectural Hardware; Div. of Yale Security Inc.
      b. LCN Closers; an Ingersoll-Rand Company.
      c. Norton Door Controls; Div. of Yale Security Inc.
      d. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.
      e. Or Equal.

B. Standards: Comply with the following:

1. Closers: BHMA A156.4.

C. Surface Closers: BHMA Grade 1.

D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.10 PROTECTIVE TRIM UNITS, GENERAL

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

1. Metal Protective Trim Units:
   a. Baldwin Hardware Corporation.
   b. Hager Companies.
   c. Ives: H. B. Ives.
   d. NT Quality Hardware; an Ingersoll-Rand Company.
   e. Triangle Brass Manufacturing Company, Inc.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:
1. Stainless Steel: 0.050 inch (1.3 mm) thick; beveled top and 2 sides.

D. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

E. Furnish protection plates sized 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in schedule.

2.11 STOPS AND HOLDERS, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Baldwin Hardware Corporation.
2. Glynn-Johnson; an Ingersoll-Rand Company.
3. Hager Companies.
4. Ives: H. B. Ives.
5. NT Quality Hardware; an Ingersoll-Rand Company.
6. Triangle Brass Manufacturing Company, Inc.

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Mechanical Door Holders: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 1.

D. Mechanical Door Holders: BHMA Grade 1.

E. Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

2.12 DOOR GASKETING, GENERAL

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

1. Door Gasketing:

a. Hager Companies.
b. National Guard Products, Inc.
c. Pemko Manufacturing Co., Inc.
d. Reese Enterprises, Inc.
e. Zero International, Inc.

2. Door Bottoms:

a. Hager Companies.
b. National Guard Products, Inc.
c. Pemko Manufacturing Co., Inc.
d. Reese Enterprises, Inc.
e. Zero International, Inc.

B. Standard: Comply with BHMA A156.22.

C. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

D. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

E. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

F. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

H. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

2.13 THRESHOLDS, GENERAL

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

1. Hager Companies.
2. National Guard Products, Inc.
3. Pemko Manufacturing Co., Inc.
4. Reese Enterprises, Inc.
5. Zero International, Inc.

B. Standard: Comply with BHMA A156.21.

2.14 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use

through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2.15 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
   1. BHMA 628: Satin aluminum, clear anodized, over aluminum base metal.
   2. BHMA 630: Satin stainless steel, over stainless-steel base metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of door hardware.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.

   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
2. Consult with and instruct Owner's personnel on recommended maintenance procedures.

3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

A. General: Provide hardware for each door to comply with requirements of Section "Door Hardware", hardware set. Numbers indicated in Door Schedule, and in the following schedule of hardware sets.

1. Hardware sets indicate quantity, item, manufacturer and product designation, size and finish, or color, as applicable.

B. The following hardware schedule indicates the name of one manufacturer for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated, or where more than one manufacturer is specified under Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with the requirements:

PRODUCTS	**MFR SPECIFIED**
Hinges	McKinney
Closers	Sargent
Cylinders	Sargent (No Substitutions)
Access Control Lockset	KABA (No Substitutions)
Lockset/Latchset (Restroom only)	Sargent (No Substitutions)
Exit Devices	Sargent (No Substitutions)
Pushbutton Lockset	Simplex (KABA)
Floor/Wall Stops	Trimco
Thresholds/Weatherstripping	Pemko
Kick Plates	Trimco

HARDWARE SET 01
Doors 1
See Section 08411 Storefront Entrance Systems

HARDWARE SET 02
Door 2

HARDWARE SET 03
Door 3

6 each – Hinges - #TA2314, 4.5 x 4.5, US32D, NRP
2 each – Closer - #351 x P9 x EN
1 each – Lockset – E-Plex 5800 Series, cylindrical, 2-3/4" backset, US26D
2 each – Flushbolt - #3917 x 12, PL
1 each – Dust Proof Strike - #3911, PL
2 each – Floor Stop - #1201 – 5, PL
2 each – Door Holder - #1221 – 4, AL
1 each – Threshold - #270A x Length as required
1 each – Stile Weatherstrip - #355CS x Length as required
2 each – Door Shoe - #216APK x Length as required
1 set – Weatherstrip - #316APK x Length as required

HARDWARE SET 04
Doors 4, 6

3 each – Hinges - #TA2314, 4.5 x 4.5, US32D, NRP
1 each – Closer - #351 x P9 x EN
1 each – Rim Exit Device - #8800 Series, US32D (Door 6 ONLY)
1 each – Lockset – E-Plex #5800 Series, 2-3/4" backset, US26D
(Door 6 – No interior trim)
1 each – Threshold - #270A x Length as required
1 each – Floor Stop - #1201-5, US32D
1 each – Door Shoe - #216APK x Length as required
1 set – Weatherstrip - #316APK x Length as required

HARDWARE SET 05
Door 5 (Note: one leaf to be card reader lockset; the other leaf – exit only)

8 each – Hinges - #TA2314, 4.5 x 4.5, US32D, NRP
2 each – Closer - #351 x P9 x EN
2 each – Rim Exit Device - #8800 F-Series, US32D
1 each – Removeable Mullion - #L980
1 each – Lockset – E-Plex, #5800 Series, 2-3/4" backset, US26D
1 each – Threshold - #270A x Length as required
2 each – Floor Stop - #1201-5, US32D
2 each – Door Shoe - #216APK x Length as required
2 sets – Weatherstrip - #316APK x Length as required

HARDWARE SET 06

Doors 7,8,9,10,13,14,15,16,22,23,24,25,26,27,28

1 each – Rim Exit Device - #8800 Series, US32D (Doors 13, 27 only)
3 each – Hinges - #TA2714, 4.5 x 4.5, US32D
1 each – Closer - #351 x P9 x EN
1 each – Lockset – E-Plex 5800 Series, 2-3/4" backset, US26D
1 each – Lockset – ADVANTOR #HID RPK4O IClass Reader/Keypad (Doors 13, 27 only)
1 each – Mag Lock – ADVANTOR #SMC M62 top Mount Mag Lock (Doors 13, 27 only)
1 each – Floor Stop - #W1212 S.S. (Doors 14, 16, 22)
1 each – Wall Stop - #1270CV, AL (Doors 8,9,10,15,23,24,25,26,28)
1 set – Smoke Seal - #S88D x Length as required

HARDWARE SET 07

Doors 17,18

8 each – Hinges - #TA2714, 4.5 x 4.5, US32D
2 each – Closer - #351 x P9 x EN
1 each – Lockset - E-Plex, 5800 Series, 2-3/4" backset, US26D
2 each – Flushbolt - #3917 x 12, PL
1 each – Dust Proof Strike - #3911, PL
2 each – Floor Stop - #1201-5, US32D
1 each – Stile Weatherstrip - #355CS x Length as required
1 each – Threshold - #270A x Length as required
2 each – Door Shoe - #217APK x Length As Required
1 set – Weatherstrip - #316APK x Length as required

HARDWARE SET 08

Doors 11,12

3 each – Hinges - #TA2714, 4.5 x 4.5, US32D
1 each – Closer - #351 x P9 x EN
1 each – Lockset - #28-10U65LL, US26D
1 each – Wall Stop - #1270CV, AL
1 set – Smoke Seal - #S88D x Length as required

HARDWARE SET 09

Doors 20,21

3 each – Hinges - #TA2714, 4.5 x 4.5, US32D
1 each – Closer - #351 x P9 x EN
1 each – Hospital Latch - #1580, US32D
1 each – Wall Stop - #1270CV, S.S.
1 set – Smoke Seal - #S88D x Length as required

HARDWARE SET 10
Door 19

1each – Sargent mortise cylinder exterior and interior

- Note: Openings for doors noted as such are to be prepped for future security hardware devices (key card readers, IDS systems, etc). Provide junction boxes in one (1) location:

    1. A junction box at top/head, 6-inches off strike edge for future door status switch, magnetic hold-open devices, etc. minimum 9-foot cables/pull wires to each frame to be supplied loose. Conduit must be provided by Contractor from door junction boxes to an open area above door to allow future installation by another Contractor.

END OF SECTION 08712

SECTION 08800

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.

2. Doors.

3. Interior borrowed lites.

4. Storefront framing..

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

E. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and

practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For laminated-glass lites, properties are based on products of construction indicated.

2. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal 1/2-inch- (12.7-mm-) wide interspace.

3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:

   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
   b. Solar Heat Gain Coefficient: NFRC 200.
   c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant

Samples between two strips of material representative in color of the adjoining framing system.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, laminated glass and insulating glass.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

E. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

F. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

   1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."

   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

2. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

B. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

C. Wired Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.

D. Laminated Glass: ASTM C 1172, and complying with other requirements specified and with the following:

1. Interlayer: Polyvinyl butyral or cured resin of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
b. For cured-resin interlayers, laminate lites with laminated-glass manufacturer's standard cast-in-place and cured-transparent-resin interlayer.

2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

E. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.

3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

4. Sealing System: Dual seal, with primary and secondary sealants as follows:

   a. Manufacturer's standard sealants.

5. Spacer Specifications: Manufacturer's standard spacer material and construction.

6. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

   a. Spacer Material: Aluminum with mill or clear anodic finish.
   b. Desiccant: Molecular sieve or silica gel, or blend of both.
   c. Corner Construction: Manufacturer's standard corner construction.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

   1. EPDM, ASTM C 864.

   2. Silicone, ASTM C 1115.

   3. Thermoplastic polyolefin rubber, ASTM C 1115.

   4. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

   1. EPDM.

   2. Silicone.

3. Thermoplastic polyolefin rubber.

4. Any material indicated above.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by Contracting Officer from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Class 25 Neutral-Curing Silicone Glazing Sealant:

a. Available Products:

1) Dow Corning Corporation; 799.
2) GE Silicones; UltraGlaze SSG4000.
3) GE Silicones; UltraGlaze SSG4000AC.
4) Polymeric Systems Inc.; PSI-631.
5) Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
6) Tremco; Proglaze SG.
7) Tremco; Spectrem 2.
8) Tremco; Tremsil 600.

b. Type and Grade: S (single component) and NS (nonsag).
c. Class: 25.
d. Use Related to Exposure: NT (nontraffic).
e. Uses Related to Glazing Substrates: M**,** G, A, and, as applicable to glazing substrates indicated, O.

1) Use O Glazing Substrates: Coated glass, color anodic aluminum and aluminum coated with a high-performance coating.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.8 MONOLITHIC FLOAT-GLASS UNITS

A. Monolithic Float Glass Units.

1. To be used on all interior door vision lites, side lites, and interior aluminum storefront entry systems.
2. Annealed clear float glass, ASTM 1036, Type I, Class 1, Quality q3.
3. Kind FT (Fully tempered).

4. Thickness: ¼ inch (6 mm).

2.9 INSULATED GLASS UNIT

A. Insulated Glass Unit.

1. To be used in all exterior aluminum window units (except Window Types "E" and "F"), and exterior aluminum storefront entry systems.

2. Overall Thickness: 1-inch (25 mm).

3. Outboard Layer
   a. Annealed clear float glass, ASTM 1036, type 1, Class 1, Quality q3.
   b. Provide E-coating on 2nd surface.
   c. Kind FT (fully tempered).
   d. Thickness ¼-inch (6 mm).

4. Air Space: ¼-inch (6 mm) hermetically sealed dehydrated air space.

5. Inboard layer
   a. Annealed clear float glass, ASTM 1036, Type 1, Class 1, Quality q3.
   b. Kind FT (fully tempered).

2.10 INSULATED LAMINATED GLASS UNIT

A. Insulating Laminated Glass Unit:

1. To be used in Window Type "E" and "F" only.

2. Overall Thickness: 1-inch (25 mm).

3. Outboard Lite
   a. Annealed clear float glass, ASTM 1036, type 1, Class 1, Quality q3.
   b. Provide E-coating on 2nd surface.
   c. Kind FT (fully tempered).
   d. Thickness: 1/8-inch (3 mm).

4. Air Space: hermetically sealed dehydrated air space.

5. Inboard Laminated Glass Unit:
   a. Inner Lite: 1/8-inch (3 mm) satin etch annealed clear float glass, ASTM 1036, Type 1, Class 1, Quality q3.

b. Interlayer: Polyvinyl butyral (PVB) plastic interlayer, clear, 0.03-inch (.76 mm) thick.
c. Inboard lite 1/8-inch (3 mm) annealed clear float glass, ASTM 1036, Type 1, Class 1, Quality q3.
   1) Kind FT (fully tempered).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08800

SECTION 08952

FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes assemblies incorporating fiberglass sandwich panels and aluminum frame systems as follows:

1. Wall assemblies.

B. Related Sections include the following:
1. Division 7 Section "Joint Sealants" for sealants installed at perimeters of assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure.
4. Panels must meet Department of Defense (DOD) Minimum Anti-Terrorism Standards for Buildings (UFC 4-010-01) for conventional building standoff distances and ISC Security Design Criteria Level C loading.

B. Failure includes the following:
1. Water leakage.
2. Thermal stresses transferred to building structure.
3. Noise or vibration created by wind and thermal and structural movements.
4. Loosening or weakening of fasteners, attachments, and other components.
5. Delamination of fiberglass-sandwich-panel faces from panel cores.

C. Structural Loads:

1. Wind Loads: As indicated by structural design data on Drawings.

D. Deflection of Assemblies:

1. Vertical Assemblies: Limited to 1/45 of clear span for each assembly component.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 PERFORMANCE TESTING

A. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.

B. Air-Infiltration Test: ASTM E 283.

1. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
2. Maximum Air Leakage: 0.06 cfm/sq. ft. (0.30 L/s per sq. m).

C. Test for Water Penetration under Static Pressure: ASTM E 331.

1. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (479 Pa).
2. Water Leakage: None.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for assemblies.

B. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Test Reports: Submit product test reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Test Reports required are:
1. Blast Analysis and testing of translucent sandwich panels demonstrating equivalent performance to ¼-inch laminated glass per DOD UFC 4-010-01.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Maintenance Data: For assemblies to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Entity capable of assuming engineering responsibility, including preparation of Shop Drawings, and performing work of this Section and who is acceptable to manufacturer.

B. Manufacturer Qualifications: For fiberglass sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICBO ES AC04, "Sandwich Panels."

C. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

E. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Deterioration of metals and other materials beyond normal weathering.
c. Water leakage.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.

1. Defects include, but are not limited to, the following:

a. Fiberbloom.
b. Delamination of coating, if any, from exterior face sheet.
c. Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
d. Delamination of panel face sheets from panel cores.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. CPI Daylighting.
2. Kawall Corporation.
3. Major Industries, Inc.
4. Or Equal.

2.2 ALUMINUM FRAME SYSTEMS

A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.

B. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

1. Construction: One-piece extruded-aluminum components.

C. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) thick.

D. Frame-System Gaskets: Manufacturer's standard.

E. Frame-System Sealants: As recommended in writing by manufacturer.

F. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.

1. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

G. Frame System Fabrication:

1. Fabricate components before finishing.
2. Fabricate components that, when assembled, have the following characteristics:

a. Profiles that are sharp, straight, and free of defects or deformations.
b. Accurately fitted joints with ends coped or mitered.
c. Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within the assembly to exterior.

3. Fabricate sill closures with weep holes and for installation as continuous component.
4. Reinforce components as required to receive fastener threads.

2.3 FIBERGLASS SANDWICH PANELS

A. Panel Construction: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core and complying with requirements applicable to panel materials in ICBO ES AC04, "Sandwich Panels."

1. Face-Sheet, Self-Ignition Temperature: 650 deg F (343 deg C) or more per ASTM D 1929.
2. Face-Sheet Burning Extent: 1 inch (25 mm) or less per ASTM D 635.
3. Face-Sheet, Smoke-Developed Index: 450 or less per ASTM E 84.

4. Interior Face-Sheet, Flame-Spread Index: Not more than 50 per UL723.

B. Panel Thickness: 2-3/4 inches (70 mm).

C. Panel U-Factor: Not more than 0.22 (1.25), measured in Btu/sq. ft. x h x deg F (W/sq. m x K) according to NFRC 100 or ASTM C 1363 using procedures described in ASTM C 1199 and ASTM E 1423.

D. Panel Strength Characteristics:

1. Maximum Panel Deflection: 3-1/2 inches (89 mm) when a 4-by-12-foot (1.2-by-3.6-m) panel is tested according to ASTM E 72 at 34 lbf/ sq. ft. (1.6 kPa), with a maximum 0.090-inch (2.3-mm) set deflection after 5 minutes.
2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf (1334 N) concentrated load when applied to a 3-inch- (76-mm-) diameter disk according to ASTM E 661.

E. Grid Core: Mechanically interlocked extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).

1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), in alloy and temper recommended in writing by manufacturer.
2. I-Beam Construction: One-piece extruded-aluminum components.
3. Grid Pattern: Inline rectangle, nominal 12 by 24 inches (305 by 610 mm).

F. Exterior Face Sheet:

1. Thickness: 0.070 inches (1.778 mm).
2. Color: As selected by Contracting Officer from manufacturer's full range.
3. Color Stability: Not more than 3.0 units Delta E when measured according to ASTM D 2244 after outdoor weathering in southern Florida according to procedures in ASTM D 1435 with panels mounted facing south and as follows:

    a. Panel Mounting Angle: Not more than 5 degrees from horizontal.
    b. Exposure Period: 60 months.

4. Erosion Protection: Integral, embedded glass erosion barrier.
5. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf (81 J) by a 3-1/4-inch- (83-mm-) diameter, 5-lb (2.3-kg) free-falling ball according to test procedure in UL 972.

G. Interior Face Sheet:

1. Thickness: 0.045 inch (1.143 mm).
2. Color: As selected by Contracting Officer from manufacturer's full range.

H. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.

1. Compatible with facing and core materials.
2. Tensile and shear bond strength of aged adhesive ensures permanent adhesion of facings to cores, as evidenced by testing according to ASTM C 297 and ASTM D 1002 after accelerated aging procedures that comply with aging requirements for adhesives with high resistance to moisture in ICBO ES AC05, "Sandwich Panel Adhesives."

I. Panel Fabrication: Factory assemble and seal panels.

1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.

    a. White spots indicating lack of bond at intersections of grid-core members are limited in number to 4 for every 40 sq. ft. (3.7 sq. m) of panel and limited in diameter to 3/64 inch (1.2 mm).

2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
3. Fabricate panel to allow condensation within panel to escape.
4. Reinforce panel corners.

2.4 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Contracting Officer from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.

D. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.

E. Install components plumb and true in alignment with established lines and elevations.

F. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (13 mm) over total length.

END OF SECTION 08952