

VA Northern Indiana Health Care System Marion Campus

**Construction Specifications
for**

Project No.: 610-11-114

**Project Name: Repair Roads, Catch Basins
and Other Underground Structures**



July 2015

**DEPARTMENT OF VETERANS AFFAIRS
SPECIFICATIONS
PROJECT 610-11-114 Repair Roads, Catch Basins and Other
Underground Structures**

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**SECTION 01 00 00
GENERAL REQUIREMENTS**

1.1 SAFETY REQUIREMENTS

Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

1.2 GENERAL INTENTION

- A. Contractor will completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor, supervision, equipment and materials to perform work for 610-11-114 Repair Roads, Catch Basins and Other Underground Structures as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. All employees of general contractor and subcontractors will comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

1.3 STATEMENT OF BID ITEM(S)

Refer to Bid Schedule in the Solicitation document for bid items.

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. Drawings and contract documents may be obtained from the website where the solicitation is posted. Additional copies will be at Contractor's expense, .

1.5 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan:

- 1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.

2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor's employees will not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. Before starting work the General Contractor will give one week's notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor will confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor will hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and will be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities will remain the property of the Contractor and will be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting

Officer, the buildings and utilities may be abandoned and need not be removed.

- C. Working space and space available for storing materials will be as determined by the COR.
- D. Workmen are subject to rules of Medical Center applicable to their conduct.
- E. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.
 - 1. Do not store materials and equipment in other than assigned areas.
 - 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
 - 3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

1.7 ALTERATIONS

N/A

1.8 DISPOSAL AND RETENTION

- A. Materials accruing from work removed and from demolition of buildings or structures, or parts thereof, will be disposed of as follows:
 - 1. Items not reserved will become property of the Contractor and be removed by Contractor from Medical Center.

2. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract will remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

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

- A. The Contractor will preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor will only remove trees when specifically authorized to do so, and will avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor will trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor will protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor will repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.
- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and

"Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

1.10 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, will be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, will conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, will be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor will immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.11 PHYSICAL DATA

None available.

1.12 PROFESSIONAL SURVEYING SERVICES

A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor will perform services specified herein and in other specification sections. The Contractor will certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

1.13 LAYOUT OF WORK

N/A

1.14 AS-BUILT DRAWINGS

N/A

1.15 USE OF ROADWAYS

N/A

1.16 RESIDENT ENGINEER'S FIELD OFFICE

N/A

1.17 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to written approval and compliance with the following provisions:
1. Permission to use each unit or system must be given by COR in writing. If the equipment is not installed and maintained in accordance with the written agreement and following provisions, the COR will withdraw permission for use of the equipment.
 2. Electrical installations used by the equipment will be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements will be properly sized, coordinated and adjusted. Installation of temporary electrical equipment or devices will be in accordance with NFPA 70, National Electrical Code, (2014 Edition), Article 590, *Temporary Installations*. Voltage supplied to each item of equipment will be verified to be correct and it will be

- determined that motors are not overloaded. The electrical equipment will be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
3. Units will be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 4. Automatic temperature control systems for preheat coils will function properly and all safety controls will function to prevent coil freeze-up damage.
 5. The air filtering system utilized will be that which is designed for the system when complete, and all filter elements will be replaced at completion of construction and prior to testing and balancing of system.

1.18 TEMPORARY USE OF EXISTING ELEVATORS

N/A

1.19 TEMPORARY USE OF NEW ELEVATORS

N/A

1.20 TEMPORARY TOILETS

- A. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor will keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.21 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government will make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services will be the prevailing rates charged to the Government. The Contractor will carefully conserve any utilities furnished without charge.

- B. The Contractor, at Contractor's expense and in a workmanlike manner, in compliance with code and as satisfactory to the Contracting Officer, will install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor will remove all the temporary connections, distribution lines, meters, and associated paraphernalia and repair restore the infrastructure as required.
- C. Contractor will install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor will meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- E. Water (for Construction and Testing): Furnish temporary water service.
1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. Water is available at no cost to the Contractor.
 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR discretion) of use of water from Medical Center's system.

1.22 NEW TELEPHONE EQUIPMENT

N/A

1.23 TESTS

N/A

1.24 INSTRUCTIONS

N/A

1.25 GOVERNMENT-FURNISHED PROPERTY

N/A

1.26 RELOCATED // EQUIPMENT // ITEMS //

N/A

1.27 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT

N/A

1.28 CONSTRUCTION SIGN

- A. Provide a Construction Sign where directed by the COR. All wood members will be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.
- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters will be of black gloss paint, except project title which will be blue gloss paint.
- C. Maintain sign and remove it when directed by the COR.
- D. Detail Drawing of construction sign showing required legend and other characteristics of sign is shown on the drawings.

1.29 SAFETY SIGN

- A. Provide a Safety Sign where directed by Resident Engineer COR. Face of sign will be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.

B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design will be painted with gloss paint of colors noted.

C. Maintain sign and remove it when directed by COR.

1.30 PHOTOGRAPHIC DOCUMENTATION

N/A

1.31 FINAL ELEVATION DIGITAL IMAGES

N/A

1.32 HISTORIC PRESERVATION

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

1.33 VA TRIRIGA CPMS

N/A

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

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, certificates, and manufacturers' literature and data will also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work will equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Project Engineer, and action thereon will be taken by Project Engineer/COR on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Project Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, will refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price

and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1-8. Schedules called for in specifications and shown on shop drawings will be submitted for use and information of Department of Veterans Affairs and Project Engineer. However, the Contractor will assume responsibility for coordinating and verifying schedules. The Contracting Officer and Project Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
 - A. Submit samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in single, except where a greater number is specified.
 - B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter will be sent via e-mail to Project Engineer/COR and will contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs will be marked to indicate specific items submitted for approval.
 1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
 2. Each sample, certificate, manufacturers' literature and data will be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
 3. Required certificates will be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
 - C. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples will be

- marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- D. Approved samples will be kept on file by the Project Engineer at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- E. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, will be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules will be stamped and signed by Contractor certifying to such check.
1. For each drawing required, submit one legible photographic paper or vellum reproducible.
 2. Reproducible will be full size.
 3. Each drawing will have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 4. A space 120 mm by 125 mm (4-3/4 by 5 inches) will be reserved on each drawing to accommodate approval or disapproval stamp.
 5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
 6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
 7. When work is directly related and involves more than one trade, shop drawings will be submitted to Project Engineer under one cover.
- 1-10. Samples, shop drawings, test reports, certificates and manufacturers' literature and data, will be submitted for approval to
-

(Project Engineer/COR)

Zachary McDaniel

Project Engineer/COR

Northern Indiana Health Care Systems - VAMC

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**SECTION 01 35 26
SAFETY REQUIREMENTS**

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SECTION 01 35 26
SAFETY REQUIREMENTS

1.1 APPLICABLE PUBLICATIONS:

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Engineers (ASSE):

A10.1-2011.....Pre-Project & Pre-Task Safety and Health
Planning

A10.34-2012.....Protection of the Public on or Adjacent to
Construction Sites

A10.38-2013.....Basic Elements of an Employer's Program to
Provide a Safe and Healthful Work Environment
American National Standard Construction and
Demolition Operations

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

E84-2013.....Surface Burning Characteristics of Building
Materials

D. The Facilities Guidelines Institute (FGI):

FGI Guidelines-2010Guidelines for Design and Construction of
Healthcare Facilities

E. National Fire Protection Association (NFPA):

10-2013.....Standard for Portable Fire Extinguishers

30-2012.....Flammable and Combustible Liquids Code

51B-2014.....Standard for Fire Prevention During Welding,
Cutting and Other Hot Work

70-2014.....National Electrical Code

70B-2013.....Recommended Practice for Electrical Equipment
Maintenance

70E-2012Standard for Electrical Safety in the Workplace

99-2012.....Health Care Facilities Code

241-2013.....Standard for Safeguarding Construction,
Alteration, and Demolition Operations

F. The Joint Commission (TJC)

TJC ManualComprehensive Accreditation and Certification
Manual

G. U.S. Nuclear Regulatory Commission

10 CFR 20Standards for Protection Against Radiation

H. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1904Reporting and Recording Injuries & Illnesses

29 CFR 1910Safety and Health Regulations for General
Industry

29 CFR 1926Safety and Health Regulations for Construction
Industry

CPL 2-0.124.....Multi-Employer Citation Policy

I. VHA Directive 2005-007

1.2 DEFINITIONS:

A. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

- C. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- D. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.
- E. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
1. Death, regardless of the time between the injury and death, or the length of the illness;
 2. Days away from work (any time lost after day of injury/illness onset);
 3. Restricted work;
 4. Transfer to another job;
 5. Medical treatment beyond first aid;
 6. Loss of consciousness; or
 7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

1.3 REGULATORY REQUIREMENTS:

- A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable [federal, state, and local] laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Contracting Officer Representative or Government Designated Authority.

1.4 ACCIDENT PREVENTION PLAN (APP):

A. The APP (aka Construction Safety & Health Plan) will interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.

B. The APP will be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
2. Address both the Prime Contractors and the subcontractors work operations.
3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
4. Address all the elements/sub-elements and in order as follows:
 - a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:
 - 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
 - 2) Plan approver (company/corporate officers authorized to obligate the company);
 - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or

superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).

b. BACKGROUND INFORMATION. List the following:

- 1) Contractor;
- 2) Contract number;
- 3) Project name;
- 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

c. STATEMENT OF SAFETY AND HEALTH POLICY. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.

d. RESPONSIBILITIES AND LINES OF AUTHORITIES. Provide the following:

- 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
- 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel will include a copy of their resumes.
- 3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;
- 4) Requirements that no work will be performed unless a designated competent person is present on the job site;
- 5) Requirements for pre-task Activity Hazard Analysis (AHAs);
- 6) Lines of authority;

- 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. SUBCONTRACTORS AND SUPPLIERS. If applicable, provide procedures for coordinating SOH activities with other employers on the job site:

- 1) Identification of subcontractors and suppliers (if known);
- 2) Safety responsibilities of subcontractors and suppliers.

f. TRAINING.

- 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
- 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc...) and any requirements for periodic retraining/recertification are required.
- 3) Procedures for ongoing safety and health training for supervisors and employees will be established to address changes in site hazards/conditions.
- 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

g. SAFETY AND HEALTH INSPECTIONS.

- 1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.

- 2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

h. ACCIDENT INVESTIGATION & REPORTING. The Contractor will conduct mishap investigations of all OSHA Recordable Incidents. The APP will include accident/incident investigation procedure & identify person(s) responsible to provide the following to the Contracting Officer Representative.

- 1) Exposure data (man-hours worked);
- 2) Accident investigations, reports, and logs.

i. PLANS (PROGRAMS, PROCEDURES) REQUIRED. Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor will address all applicable occupational risks in site-specific compliance and accident prevention plans. These Plans will include but are not be limited to procedures for addressing the risks associates with the following:

- 1) Emergency response ;
- 2) Contingency for severe weather;
- 3) Fire Prevention ;
- 4) Medical Support;
- 5) Posting of emergency telephone numbers;
- 6) Prevention of alcohol and drug abuse;
- 7) Site sanitation (housekeeping, drinking water, toilets);
- 8) Night operations and lighting ;
- 9) Hazard communication program;
- 10) Welding/Cutting "Hot" work ;
- 11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
- 12) General Electrical Safety
- 13) Hazardous energy control (Machine LOTO);

- 14) Site-Specific Fall Protection & Prevention;
- 15) Excavation/trenching;
- 16) Asbestos abatement;
- 17) Lead abatement;
- 18) Crane Critical lift;
- 19) Respiratory protection;
- 20) Health hazard control program;
- 21) Radiation Safety Program;
- 22) Abrasive blasting;
- 23) Heat/Cold Stress Monitoring;
- 24) Crystalline Silica Monitoring (Assessment);
- 25) Demolition plan (to include engineering survey);
- 26) Formwork and shoring erection and removal;
- 27) PreCast Concrete.

C. Submit the APP to the Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative or Government Designated Authority, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

E. Once work begins, changes to the accepted APP will be made with the knowledge and concurrence of the Contracting Officer Representative. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to

remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34) and the environment.

1.5 ACTIVITY HAZARD ANALYSES (AHAS):

N/A

1.6 PRECONSTRUCTION CONFERENCE:

- A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project will attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.
- B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- C. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor will revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.7 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):

- A. The Prime Contractor will designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor will designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.

- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs will be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.
- E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.8 TRAINING:

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have Three (3) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

- B. All designated CPs will have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations will have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers will have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they will undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing will include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation will be provided to the Resident Engineer that individuals have undergone contractor's safety briefing.
- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.9 INSPECTIONS:

- A. The SSHO will conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs will conduct frequent and regular safety inspections (daily) of the their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO will conduct a

formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

- B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) will randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.
1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
 2. Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
 3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
 4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:

- A. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$5,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer

Representative determine whether a government investigation will be conducted.

- B. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162, and provide the report to the Contracting Officer Representative within 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.
- D. A summation of all OSHA recordable accidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE):

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
 - 1. Safety glasses - unless written authorization is given by the Contracting Officer Representative appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
 - 2. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 will be worn by each person on site unless written authorization is given by Contracting Officer Representative.

3. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

1.12 INFECTION CONTROL

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas.
- B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the Engineer. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: **Class II**, however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:

1. Class I requirements:

- a. During Construction Work:

- 1) Notify Contracting Officer Representative or Government Designated Authority.
 - 2) Execute work by methods to minimize raising dust from construction operations.
 - 3) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.

- b. Upon Completion:

- 1) Clean work area upon completion of task

- 2) Notify the Contracting Officer Representative.

2. Class II requirements:

a. During Construction Work:

- 1) Notify the Contracting Officer Representative.
- 2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
- 3) Water mist work surfaces to control dust while cutting.
- 4) Seal unused doors with duct tape.
- 5) Block off and seal air vents.
- 6) Remove or isolate HVAC system in areas where work is being performed.

b. Upon Completion:

- 1) Wipe work surfaces with cleaner/disinfectant.
- 2) Contain construction waste before transport in tightly covered containers.
- 3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
- 4) Upon completion, restore HVAC system where work was performed
- 5) Notify the Contracting Officer Representative.

3. Class III requirements:

a. During Construction Work:

- 1) Obtain permit from the Facility Safety Officer or Contracting Officer Representative or Government Designated Authority.
- 2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.

- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
- 5) Contain construction waste before transport in tightly covered containers.
- 6) Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the Facility Safety Officer and the Contracting Officer Representative and thoroughly cleaned by the VA Environmental Services Department.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Vacuum work area with HEPA filtered vacuums.
- 4) Wet mop area with cleaner/disinfectant.
- 5) Upon completion, restore HVAC system where work was performed.
- 6) Return permit to the Contracting Officer Representative or Government Designated Authority.

4. Class IV requirements:

a. During Construction Work:

- 1) Obtain permit from the Facility Safety Officer.
- 2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.
- 5) Seal holes, pipes, conduits, and punctures.
- 6) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.
- 7) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the Facility Safety Officer and the Contracting Officer Representative with thorough cleaning by the VA Environmental Services Dept.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Contain construction waste before transport in tightly covered containers.
- 4) Cover transport receptacles or carts. Tape covering unless solid lid.

- 5) Vacuum work area with HEPA filtered vacuums.
- 6) Wet mop area with cleaner/disinfectant.
- 7) Upon completion, restore HVAC system where work was performed.
- 8) Return permit to the Facility Safety and the Contracting Officer Representative.

Barriers will be erected as required based upon classification (Class III & IV requires barriers) and will be constructed as follows:

1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
 - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the Project Engineer and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping
 - b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
 - c. Class III & IV - Seal all penetrations in existing barrier airtight
 - d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
 - e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
 - f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.

C. Products and Materials:

1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
2. Barrier Doors: Self Closing One-hour fire-rated solid core wood in steel frame, painted
3. Dust proof one-hour fire-rated drywall
4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
7. Disinfectant: Hospital-approved disinfectant or equivalent product
8. Portable Ceiling Access Module

D. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity will be educated and trained in infection prevention measures established by the medical center.

E. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to Project Engineer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

- F. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures will be adopted during construction to keep down dust and prevent mold.
1. Contractor will verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
 2. Exhaust hoses will be exhausted so that dust is not reintroduced to the medical center.
 3. Adhesive Walk-off/Carpet Walk-off Mats will be used at all interior transitions from the construction area to occupied medical center area. These mats will be changed as often as required to maintain clean work areas directly outside construction area at all times.
 4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum will utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
 5. The contractor will not haul debris through patient-care areas without prior approval of the Resident Engineer and the Medical Center. When, approved, debris will be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas will be made free from dust and moisture by vacuuming and wipe down.
 6. There will be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and

dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

I. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts will be cleaned prior to final inspection.

J. Exterior Construction

1. Contractor will verify that dust will not be introduced into the medical center through intake vents, or building openings. HEPA filtration on intake vents is required where dust may be introduced.
2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary
3. All cutting, drilling, grinding, sanding, or disturbance of materials will be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.13 TUBERCULOSIS SCREENING

N/A

1.14 FIRE SAFETY

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer

Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.

- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.
- E. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.
- F. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- G. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- H. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas will be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed will be recorded by the medical center and copies provided to the Project Engineer.

- I. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.
- J. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Project Engineer and facility Safety Officer at least 2 hours in advance.
- K. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer.
- L. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- M. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- N. If required, submit documentation to the COR or other Government Designated Authority that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.15 ELECTRICAL

- A. N/A

1.16 FALL PROTECTION

- N/A

1.17 SCAFFOLDS AND OTHER WORK PLATFORMS

- N/A

1.18 EXCAVATION AND TRENCHES

- N/A

1.19 CRANES

- N/A

1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

- N/A

1.21 CONFINED SPACE ENTRY

- A. All confined space entry will comply with 29 CFR 1910.146 except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].
- B. A site-specific Confined Space Entry Plan (including permitting process) will be developed and submitted to the COR.

1.22 WELDING AND CUTTING

As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Facility Safety Officer and/or other Government Designated Authority. Obtain permits from Facility Safety Officer and/or other Government Designated Authority at least 2 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.23 LADDERS

- A. All Ladder use will comply with 29 CFR 1926 Subpart X.
- B. All portable ladders will be of sufficient length and will be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels will be in place on ladders
- D. Step Ladders will not be used in the closed position
- E. Top steps or cap of step ladders will not be used as a step
- B. Portable ladders, used as temporary access, will extend at least 3 ft (0.9 m) above the upper landing surface.
 - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) will be provided to assist workers in mounting and dismounting the ladder.
 - 2. In no case will the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.
- G. Ladders will be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or

damaged ladders will be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.24 FLOOR & WALL OPENINGS

- A. All floor and wall openings will comply with 29 CFR 1926 Subpart M.
- B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. See 21.F for covering and labeling requirements. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through will be guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole will be protected by a removable guardrail system or will be attended when the guarding system has been removed, or other fall protection system.
 - 1. Covers will be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
 - 2. Covers will be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
 - 3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, will be immediately cut out. No hole or opening will be left unattended unless covered.
 - 4. Non-load-bearing skylights will be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
 - 5. Workers are prohibited from standing/walking on skylights.

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**SECTION 01 42 19
REFERENCE STANDARDS****PART 1 - GENERAL****1.1 DESCRIPTION**

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS

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

DEPARTMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA Aluminum Association Inc.

<http://www.aluminum.org>

AABC Associated Air Balance Council

<http://www.aabchq.com>

AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
AAN	American Nursery and Landscape Association http://www.anla.org
AASHTO	American Association of State Highway and Transportation Officials http://www.aashto.org
AATCC	American Association of Textile Chemists and Colorists http://www.aatcc.org
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org
ACI	American Concrete Institute http://www.aci-int.net
ACPA	American Concrete Pipe Association http://www.concrete-pipe.org
ACPPA	American Concrete Pressure Pipe Association http://www.acppa.org
ADC	Air Diffusion Council http://flexibleduct.org
AGA	American Gas Association http://www.aga.org
AGC	Associated General Contractors of America http://www.agc.org
AGMA	American Gear Manufacturers Association, Inc. http://www.agma.org
AHAM	Association of Home Appliance Manufacturers http://www.aham.org
AISC	American Institute of Steel Construction http://www.aisc.org
AISI	American Iron and Steel Institute http://www.steel.org
AITC	American Institute of Timber Construction http://www.aitc-glulam.org
AMCA	Air Movement and Control Association, Inc. http://www.amca.org
ANLA	American Nursery & Landscape Association http://www.anla.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	The Engineered Wood Association http://www.apawood.org

ARI	Air-Conditioning and Refrigeration Institute http://www.ari.org
ASAE	American Society of Agricultural Engineers http://www.asae.org
ASCE	American Society of Civil Engineers http://www.asce.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org
ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CI	The Chlorine Institute, Inc. http://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPMB	Concrete Plant Manufacturers Bureau http://www.cpmc.org
CRA	California Redwood Association http://www.calredwood.org

CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org
CTI	Cooling Technology Institute http://www.cti.org
DHI	Door and Hardware Institute http://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.etl.com
FAA	Federal Aviation Administration http://www.faa.gov
FCC	Federal Communications Commission http://www.fcc.gov
FPS	The Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.cssinfo.com/info/gana.html/
FM	Factory Mutual Insurance http://www.fmglobal.com
GA	Gypsum Association http://www.gypsum.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org
ICBO	International Conference of Building Officials http://www.icbo.org
ICEA	Insulated Cable Engineers Association Inc. http://www.icea.net
\ICAC	Institute of Clean Air Companies http://www.icac.com
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org/

IMSA	International Municipal Signal Association http://www.imsasafety.org
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association http://www.mbma.com
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. http://www.mss-hq.com
NAAMM	National Association of Architectural Metal Manufacturers http://www.naamm.org
NAPHCC	Plumbing-Heating-Cooling Contractors Association http://www.phccweb.org.org
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors http://www.nationboard.org
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org
NHLA	National Hardwood Lumber Association http://www.natlhardwood.org
NIH	National Institute of Health http://www.nih.gov
NIST	National Institute of Standards and Technology http://www.nist.gov
NLMA	Northeastern Lumber Manufacturers Association, Inc. http://www.nelma.org
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NSF	National Sanitation Foundation http://www.nsf.org
NWWDA	Window and Door Manufacturers Association http://www.nwwda.org
OSHA	Occupational Safety and Health Administration Department of Labor http://www.osha.gov

PCA	Portland Cement Association http://www.portcement.org
PCI	Precast Prestressed Concrete Institute http://www.pci.org
PPI	The Plastic Pipe Institute http://www.plasticpipe.org
PEI	Porcelain Enamel Institute, Inc. http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org
RFCI	The Resilient Floor Covering Institute http://www.rfci.com
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. http://www.rma.org
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Door Institute http://www.steeldoor.org
IGMA	Insulating Glass Manufacturers Alliance http://www.igmaonline.org
SJI	Steel Joist Institute http://www.steeljoist.org
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. http://www.smacna.org
SSPC	The Society for Protective Coatings http://www.sspc.org
STI	Steel Tank Institute http://www.steeltank.com
SWI	Steel Window Institute http://www.steelwindows.com
TCA	Tile Council of America, Inc. http://www.tileusa.com
TEMA	Tubular Exchange Manufacturers Association http://www.tema.org
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200 Madison, WI 53719 (608) 833-5900

UBC The Uniform Building Code
 See ICBO

UL Underwriters' Laboratories Incorporated
 <http://www.ul.com>

ULC Underwriters' Laboratories of Canada
 <http://www.ulc.ca>

WCLIB West Coast Lumber Inspection Bureau
 6980 SW Varns Road, P.O. Box 23145
 Portland, OR 97223
 (503) 639-0651

WRCLA Western Red Cedar Lumber Association
 P.O. Box 120786
 New Brighton, MN 55112
 (612) 633-4334

WWPA Western Wood Products Association
 <http://www.wwpa.org>

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SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

1.2 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - T27-06.....Sieve Analysis of Fine and Coarse Aggregates
 - T96-02 (R2006).....Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - T99-01 (R2004).....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
 - T104-99 (R2003).....Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
 - T180-01 (R2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
 - T191-02(R2006).....Density of Soil In-Place by the Sand-Cone Method
- C. American Concrete Institute (ACI):
 - 506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete
- D. American Society for Testing and Materials (ASTM):
 - A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - A370-07.....Definitions for Mechanical Testing of Steel Products
 - A416/A416M-06.....Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
 - A490-06.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
 - C31/C31M-06.....Making and Curing Concrete Test Specimens in the Field
 - C33-03.....Concrete Aggregates

Repair Roads, Catch Basins and Other Underground Structures
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06-15

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

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

E. American Welding Society (AWS):

D1.1-07.....	Structural Welding Code-Steel
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1.3 REQUIREMENTS:

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Project Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Project Engineer to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to Project Engineer, Contractor, unless other arrangements are agreed to in writing by the Project Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to Project Engineer immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Project Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Project Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 2. Provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:
1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
 2. Make field density tests in accordance with the primary testing method following AASHTO T238 wherever possible. Field density tests utilizing AASHTO T191, or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the Project Engineer before the tests are conducted.
 - a. Pavement Subgrade: One test for each 335 m² (400 square yards), but in no case fewer than two tests.
 - b. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
 - c. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.

- C. Testing Materials: Test suitability of on-site and off-site borrow as directed by Project Engineer.

3.2 ASPHALT CONCRETE PAVING:

A. Aggregate Base Course:

1. Determine maximum density and optimum moisture content for aggregate base material in accordance with AASHTO T180, Method D.
2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with AASHTO T191.
3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.

B. Asphalt Concrete:

1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.3 SITE WORK CONCRETE:

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

3.4 POST-TENSIONING OF CONCRETE:

- A. Inspection Prior to Concreting: Inspect tendons, drape of tendons, and anchorage components for compliance prior to concreting.
- B. Concrete Testing: As required in Article, CONCRETE of this section except make three test cylinders representing each area to be tensioned and cylinders shall be cured in same manner as concrete they represent. Make compression test prior to determining minimum specified strength required for post-tensioning.
- C. Post-tensioning: Witness post-tensioning operation and record actual gauge pressures and elongations applied to each tendon.
- D. Submit reports in quadruplicate of the following:
1. Inspection of placement and post-tensioning of all tendons.
 2. Size, number, location, and drape of tendons.

3. Calculated elongations, based upon the length, modulus of elasticity, and cross-sectional area of the tendons used.
4. Actual field elongations. Check elongation of tendons within ranges established by manufacturer.
5. Calculated gauge pressure and jacking force applied to each tendon.
6. Actual gauge pressures and jacking force applied to each tendon.
7. Required concrete strength at time of jacking.
8. Actual concrete strength at time of jacking.
9. Do not cut or cover the tendon ends until the Contractor receives the Project Engineer's written approval of the post-tensioning records.

3.5 CONCRETE:

A. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of Project Engineer with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by Project Engineer.
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to Project Engineer.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the

site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.

3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m³ (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. After good concrete quality control has been established and maintained as determined by Project Engineer make three cylinders for each 80 m³ (100 cubic yards) or less of each concrete type, and at least three cylinders from any one day's pour for each concrete type. Label each cylinder with an identification number. Project Engineer may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m³ (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m³ (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24

hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.

11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
 12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
 13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
 14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
 15. Observe preparations for placement of concrete:
 - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.
 16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
 17. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
 18. Measure concrete flatwork for levelness and flatness as follows:
 - a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the Project Engineer with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
 19. Other inspections:
 - a. Grouting under base plates.
 - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as

directed by Project Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.

2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to Project Engineer. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in MPa (psi).
 - e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).
 - f. Weather conditions during placing.
 - g. Temperature of concrete in each test cylinder when test cylinder was molded.
 - h. Maximum and minimum ambient temperature during placing.
 - i. Ambient temperature when concrete sample in test cylinder was taken.
 - j. Date delivered to laboratory and date tested.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely effect human health or welfare,
 2. Unfavorably alter ecological balances of importance to human life,
 3. Effect other species of importance to humankind, or;
 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

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 basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor will meet with the Project Engineer to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor will prepare and submit to the Project Engineer and the Contracting Officer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.
 - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
 - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
 - h. Permits, licenses, and the location of the solid waste disposal area.
 - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
 - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the Project Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
 - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence

- isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
 3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
 - a. Reuse or conserve the collected topsoil sediment as directed by the Project Engineer. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
 - b. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
 5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor will be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
 6. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

7. Manage and control spoil areas on Government property to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the Project Engineer.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
 3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Indiana Air Pollution Statute, Rule, or Regulation and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental

Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
 2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Project Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the Project Engineer. Repetitive impact noise on the property will not exceed the following dB limitations:
- | Time Duration of Impact Noise | Sound Level in dB |
|-------------------------------------|-------------------|
| More than 12 minutes in any hour | 70 |
| Less than 30 seconds of any hour | 85 |
| Less than three minutes of any hour | 80 |
| Less than 12 minutes of any hour | 75 |
2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
 - a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING

MATERIALS HANDLING

FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	--
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Use shields or other physical barriers to restrict noise transmission.
 - c. Provide soundproof housings or enclosures for noise-producing machinery.
 - d. Use efficient silencers on equipment air intakes.
 - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - f. Line hoppers and storage bins with sound deadening material.
 - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the Project Engineer noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor will restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.

H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor will leave the construction area in a clean condition satisfactory to the Project Engineer. Cleaning will include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 03 30 53
(SHORT-FORM) CAST-IN-PLACE CONCRETE

PART 1 - GENERAL**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and material and mixes for other concrete.

1.2 RELATED WORK:

N/A

1.3 TOLERANCES:

- A. ACI 117.
- B. Slab Finishes: ACI 117, F-number method in accordance with ASTM E1155.

1.4 REGULATORY REQUIREMENTS:

- A. ACI SP-66 ACI Detailing Manual
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Concrete Mix Design.
- C. Shop Drawings: Reinforcing steel: Complete shop drawings.
- D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
 - 117-10.....Specification for Tolerances for Concrete Construction, Materials and Commentary
 - 211.1-91(R2009).....Standard Practice for Proportions for Normal, Heavyweight, and Mass Concrete
 - 211.2-98(R2004).....Standard Practice for Selecting Proportions for Structural Lightweight Concrete
 - 301-10.....Specifications for Structural Concrete
 - 305.1-06.....Specification for Hot Weather Concreting
 - 306.1-90(R2002).....Standard Specification for Cold Weather Concreting
 - SP-66-04ACI Detailing Manual
 - 318-11.....Building Code Requirements for Structural Concrete and Commentary

- 347-04.....Guide to Formwork for Concrete
- C. American Society for Testing And Materials (ASTM):
- A185/A185M-07.....Standard Specification for Steel Welded Wire
Reinforcement, Plain, for Concrete Reinforcement
- A615/A615M-09.....Standard Specification for Deformed and Plain
Carbon Steel Bars for Concrete Reinforcement
- A996/A996M-09.....Standard Specification for Rail Steel and Axle
Steel Deformed Bars for Concrete Reinforcement
- C31/C31M-10.....Standard Practice for Making and Curing Concrete
Test Specimens in the Field
- C33/C33M-11a.....Standard Specification for Concrete Aggregates
- C39/C39M-12.....Standard Test Method for Compressive Strength of
Cylindrical Concrete Specimens
- C94/C94M-12.....Standard Specification for Ready Mixed Concrete
- C143/C143M-10.....Standard Test Method for Slump of Hydraulic
Cement Concrete
- C150-11.....Standard Specification for Portland Cement
- C171-07.....Standard Specification for Sheet Material for
Curing Concrete
- C172-10.....Standard Practice for Sampling Freshly Mixed
Concrete
- C173-10.....Standard Test Method for Air Content of Freshly
Mixed Concrete by the Volumetric Method
- C192/C192M-07.....Standard Practice for Making and Curing Concrete
Test Specimens in the Laboratory
- C231-10.....Standard Test Method for Air Content of Freshly
Mixed Concrete by the Pressure Method
- C260-10.....Standard Specification for Air-Entraining
Admixtures for Concrete
- C330-09.....Standard Specification for Lightweight
Aggregates for Structural Concrete
- C494/C494M-11.....Standard Specification for Chemical Admixtures
for Concrete
- C618-12.....Standard Specification for Coal Fly Ash and Raw
or Calcined Natural Pozzolan for Use in Concrete
- D1751-04(R2008)Standard Specification for Preformed Expansion
Joint Fillers for Concrete Paving and Structural
Construction (Non-extruding and Resilient
Bituminous Types)

D4397-10.....Standard Specification for Polyethylene Sheeting
for Construction, Industrial and Agricultural
Applications

E1155-96(2008).....Standard Test Method for Determining F_F Floor
Flatness and F_L Floor Levelness Numbers

PART 2 - PRODUCTS

2.1 FORMS:

N/A

2.2 MATERIALS:

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 300 mm (12 inches) thick. Coarse aggregate for applied topping and metal pan stair fill will be Size 7.
- D. Fine Aggregate: ASTM C33.
- E. Lightweight Aggregate for Structural Concrete: ASTM C330, Table 1
- F. Mixing Water: Fresh, clean, and potable.
- G. Air-Entraining Admixture: ASTM C260.
- H. Chemical Admixtures: ASTM C494.
- I. Vapor Barrier: ASTM D4397, 0.38 mm (15 mil).
- J. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See structural drawings for grade.
- K. Welded Wire Fabric: ASTM A185.
- L. Expansion Joint Filler: ASTM D1751.
- M. Sheet Materials for Curing Concrete: ASTM C171.
- N. Abrasive Aggregates: Aluminum oxide grains or emery grits.
- O. Liquid Hardener and Dustproofer: Fluosilicate solution or magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer.
- P. Liquid Densifier/Sealer: 100 percent active colorless aqueous silicate solution.
- Q. Grout, Non-Shrinking: Premixed ferrous or non-ferrous, mixed and applied in accordance with manufacturer's recommendations. Grout will show no settlement or vertical drying shrinkage at 3 days or thereafter based on initial measurement made at time of placement, and produce a compressive strength of at least 18mpa (2500 psi) at 3 days and 35mpa (5000 psi) at 28 days.

2.3 CONCRETE MIXES:

- A. Design of concrete mixes using materials specified will be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days will be not less than 4000 psi.
- C. Maximum slump for vibrated concrete is 100 mm (4 inches) tested in accordance with ASTM C143.
- D. Cement and water factor (See Table I):

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio
35 (5000) ^{1,3}	375 (630)	0.45	385 (650)	0.40
30 (4000) ^{1,3}	325 (550)	0.55	340 (570)	0.50
25 (3000) ^{1,3}	280 (470)	0.65	290 (490)	0.55
25 (3000) ^{1,2}	300 (500)	*	310 (520)	*

- 1. If trial mixes are used, the proposed mix design will achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design will achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
- 2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
- 3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
- 4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

2.4 BATCHING & MIXING:

- A. Store, batch, and mix materials as specified in ASTM C94.
 - 1. Job-Mixed: Concrete mixed at job site will be mixed in a batch mixer in manner specified for stationary mixers in ASTM C94.
 - 2. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer will furnish, in duplicate, certification as required by ASTM C94.

3. Mixing structural lightweight concrete: Charge mixer with 2/3 of total mixing water and all of the aggregate. Mix ingredients for not less than 30 seconds in a stationary mixer or not less than 10 revolutions at mixing speed in a truck mixer. Add remaining mixing water and other ingredients and continue mixing. Above procedure may be modified as recommended by aggregate producer.

PART 3 - EXECUTION

3.1 FORMWORK:

N/A

3.2 REINFORCEMENT:

Details of concrete reinforcement, unless otherwise shown, in accordance with ACI 318 and ACI SP-66. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

3.3 VAPOR BARRIER:

- A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.
- B. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
- C. Lap joints 150 mm (6 inches) and seal with a compatible pressure-sensitive tape.
- D. Patch punctures and tears.

3.4 PLACING CONCRETE:

- A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval of Project Engineer before placing concrete. Provide screeds at required elevations for concrete slabs.
- B. Before placing new concrete on or against concrete which has set, existing surfaces will be roughened and cleaned free from all laitance, foreign matter, and loose particles.
- C. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Vibration will be carried on continuously with placing of concrete.

- D. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- E. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly, except that use of calcium chloride will not be permitted without written approval from Project Engineer.

3.5 PROTECTION AND CURING:

Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method will be subject to approval by Project Engineer.

3.6 FORM REMOVAL:

N/A

3.7 SURFACE PREPARATION:

Immediately after forms have been removed and work has been examined and approved by Project Engineer, remove loose materials, and patch all stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 to 3 parts sand.

3.8 FINISHES:

A. Slab Finishes:

1. Scratch Finish: Slab surfaces to receive a bonded applied cementitious application will all be thoroughly raked or wire broomed after partial setting (within 2 hours after placing) to roughen surface to insure a permanent bond between base slab and applied cementitious materials.
2. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled. Do not sprinkle dry cement on surface to absorb water.
3. Float Finish: Ramps, stair treads, and platforms, both interior and exterior, equipment pads, and slabs to receive non-cementitious materials, except as specified, will be screened and floated to a smooth dense finish. After first floating, while surface is still soft, surfaces will be checked for alignment using a straightedge or template. Correct high spots by cutting down with a trowel or similar tool and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections on

- floated finish by rubbing or dry grinding. Refloat the slab to a uniform sandy texture.
4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and all monolithic concrete floor slabs exposed in finished work and for which no other finish is shown or specified will be steel troweled. Final steel troweling to secure a smooth, dense surface will be delayed as long as possible, generally when the surface can no longer be dented with finger. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure on trowel to compact cement paste and form a dense, smooth surface. Finished surface will be free of trowel marks, uniform in texture and appearance.
 5. Broom Finish: Finish all exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after the surfaces have been floated.
 6. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:

Slab on grade & Shored suspended slabs		Unshored suspended slabs	
Specified overall value	F _F 25/F _L 20	Specified overall value	F _F 25
Minimum local value	F _F 17/F _L 15	Minimum local value	F _F 17

3.9 SURFACE TREATMENTS:

- A. Surface treatments will be mixed and applied in accordance with manufacturer's printed instructions.
- B. Liquid Densifier/Sealer: Use on all exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.
- C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of all concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Aggregate will be broadcast uniformly over concrete surface. Trowel concrete surface to smooth dense finish. After curing, rub the treated surface with abrasive brick and water sufficiently to slightly expose abrasive aggregate.

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**SECTION 07 92 00
JOINT SEALANTS****PART 1 - GENERAL****1.1 DESCRIPTION:**

Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK:

A. N/A

1.3 QUALITY CONTROL:

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
 - 1. Caulking compound
 - 2. Primers
 - 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS:

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE:

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 5° C (40° F) or less than 32° C (90° F).

1.7 DEFINITIONS:

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.8 WARRANTY:

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period will be extended to two years.
- B. General Warranty: Special warranty specified in this Article will not deprive Government of other rights Government may have under other provisions of Contract Documents and will be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material.
 - C612-04.....Mineral Fiber Block and Board Thermal Insulation.

- C717-07.....Standard Terminology of Building Seals and Sealants.
- C834-05.....Latex Sealants.
- C919-02.....Use of Sealants in Acoustical Applications.
- C920-05.....Elastomeric Joint Sealants.
- C1021-08.....Laboratories Engaged in Testing of Building Sealants.
- C1193-05.....Standard Guide for Use of Joint Sealants.
- C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
- D1056-07.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
- E84-08.....Surface Burning Characteristics of Building Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

S-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

2.2 CAULKING COMPOUND:

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR:

- A. Sealants used with exposed masonry will match color of mortar joints.
- B. Sealants used with unpainted concrete will match color of adjacent concrete.
- C. Color of sealants for other locations will be light gray or aluminum, unless specified otherwise.
- D. Caulking will be light gray or white, unless specified otherwise.

2.4 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER:

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POURIOUS SURFACES:

Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION**3.1 INSPECTION:**

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.

- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
 - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
 - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 - 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION:

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.

- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY:

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

- A. General:
 - 1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
 - 2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
 - 3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
 - 4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
 - 5. Avoid dropping or smearing compound on adjacent surfaces.
 - 6. Fill joints solidly with compound and finish compound smooth.
 - 7. Tool joints to concave surface unless shown or specified otherwise.
 - 8. Finish paving or floor joints flush unless joint is otherwise detailed.
 - 9. Apply compounds with nozzle size to fit joint width.
 - 10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.
- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all

cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 CLEANING:

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

3.7 LOCATIONS:

- A. Exterior Building Joints, Horizontal and Vertical:
 1. Metal to Metal: Type S-1, S-2
 2. Metal to Masonry or Stone: Type S-1
 3. Masonry to Masonry or Stone: Type S-1
 4. Stone to Stone: Type S-1
 5. Cast Stone to Cast Stone: Type S-1
 6. Threshold Setting Bed: Type S-1, S-3, S-4
 7. Masonry Expansion and Control Joints: Type S-6
 8. Wood to Masonry: Type S-1
- B. Metal Reglets and Flashings:
 1. Flashings to Wall: Type S-6
 2. Metal to Metal: Type S-6
- C. Sanitary Joints:
 1. Walls to Plumbing Fixtures: Type S-9

2. Counter Tops to Walls: Type S-9

3. Pipe Penetrations: Type S-9

D. Horizontal Traffic Joints:

1. Concrete Paving, Unit Pavers: Type S-11 or S-12

---END---

**SECTION 09 91 00
PAINTING**

PART 1-GENERAL**1.1 DESCRIPTION**

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

N/A

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
 - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
 - 2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
 - 3. Attach labels to panel stating the following:
 - a. Federal Specification Number or manufacturers name and product number of paints used.
 - b. Product type and color.
 - c. Name of project.
 - 4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
- D. Sample of identity markers if used.
- E. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. Intumescent clear coating or fire retardant paint.
5. Plastic floor coating.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 1. Name of manufacturer.
 2. Product type.
 3. Batch number.
 4. Instructions for use.
 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 1. Federal Specification Number, where applicable, and name of material.
 2. Surface upon which material is to be applied.
 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
ACGIH TLV-BKLT-2008.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
ACGIH TLV-DOC-2008.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. American National Standards Institute (ANSI):
A13.1-07.....Scheme for the Identification of Piping Systems
- D. American Society for Testing and Materials (ASTM):
D260-86.....Boiled Linseed Oil
- E. Commercial Item Description (CID):
A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)

A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)

F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For
Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

No. 1-07.....Aluminum Paint (AP)

No. 4-07.....Interior/ Exterior Latex Block Filler

No. 5-07.....Exterior Alkyd Wood Primer

No. 7-07.....Exterior Oil Wood Primer

No. 8-07.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)

No. 9-07.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)

No. 10-07.....Exterior Latex, Flat (AE)

No. 11-07.....Exterior Latex, Semi-Gloss (AE)

No. 18-07.....Organic Zinc Rich Primer

No. 22-07.....Aluminum Paint, High Heat (up to 590° - 1100F)
(HR)

No. 26-07.....Cementitious Galvanized Metal Primer

No. 27-07.....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)

No. 31-07.....Polyurethane, Moisture Cured, Clear Gloss (PV)

No. 36-07.....Knot Sealer

No. 43-07.....Interior Satin Latex, MPI Gloss Level 4

No. 44-07.....Interior Low Sheen Latex, MPI Gloss Level 2

No. 45-07.....Interior Primer Sealer

No. 46-07.....Interior Enamel Undercoat

No. 47-07.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)

No. 48-07.....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)

No. 49-07.....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)

No. 50-07.....Interior Latex Primer Sealer

No. 51-07.....Interior Alkyd, Eggshell, MPI Gloss Level 3

No. 52-07.....Interior Latex, MPI Gloss Level 3 (LE)

No. 53-07.....Interior Latex, Flat, MPI Gloss Level 1 (LE)

No. 54-07.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)

No. 59-07.....Interior/Exterior Alkyd Porch & Floor Enamel, Low
Gloss (FE)

No. 60-07.....Interior/Exterior Latex Porch & Floor Paint, Low
Gloss

No. 66-07.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC
Approved) (FC)

No. 67-07.....Interior Latex Fire Retardant, Top-Coat (ULC
Approved) (FR)

- No. 68-07.....Interior/ Exterior Latex Porch & Floor Paint,
Gloss
- No. 71-07.....Polyurethane, Moisture Cured, Clear, Flat (PV)
- No. 74-07.....Interior Alkyd Varnish, Semi-Gloss
- No. 77-07.....Epoxy Cold Cured, Gloss (EC)
- No. 79-07.....Marine Alkyd Metal Primer
- No. 90-07.....Interior Wood Stain, Semi-Transparent (WS)
- No. 91-07.....Wood Filler Paste
- No. 94-07.....Exterior Alkyd, Semi-Gloss (EO)
- No. 95-07.....Fast Drying Metal Primer
- No. 98-07.....High Build Epoxy Coating
- No. 101-07.....Epoxy Anti-Corrosive Metal Primer
- No. 108-07.....High Build Epoxy Coating, Low Gloss (EC)
- No. 114-07.....Interior Latex, Gloss (LE) and (LG)
- No. 119-07.....Exterior Latex, High Gloss (acrylic) (AE)
- No. 135-07.....Non-Cementitious Galvanized Primer
- No. 138-07.....Interior High Performance Latex, MPI Gloss Level 2
(LF)
- No. 139-07.....Interior High Performance Latex, MPI Gloss Level 3
(LL)
- No. 140-07.....Interior High Performance Latex, MPI Gloss Level 4
- No. 141-07.....Interior High Performance Latex (SG) MPI Gloss
Level 5
- H. Steel Structures Painting Council (SSPC):
- SSPC SP 1-04 (R2004)....Solvent Cleaning
- SSPC SP 2-04 (R2004)....Hand Tool Cleaning
- SSPC SP 3-04 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cementitious Paint (CEP): TT-P-1411A [Paint, Copolymer-Resin, Cementitious (CEP)], Type 1 for exterior use, Type II for interior use.
- B. Wood Sealer: MPI 31 (gloss) or MPI 71 (flat) thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.
- C. Plastic Tape:
1. Pressure sensitive adhesive back.
 2. Widths as shown.
- D. Identity markers options:
1. Pressure sensitive vinyl markers.
 2. Snap-on coil plastic markers.

- E. Aluminum Paint (AP): MPI 1.
- F. Exterior Alkyd Wood Primer: MPI 5.
- G. Exterior Oil Wood Primer: MPI 7.
- H. Exterior Alkyd Enamel (EO): MPI 9.
- I. Organic Zinc rich Coating (HR): MPI 22.
- J. High Heat Resistant Coating (HR): MPI 22.
- K. Cementitious Galvanized Metal Primer: MPI 26.
- L. Exterior/ interior Alkyd Floor Enamel, Gloss (FE): MPI 27.
- M. Knot Sealer: MPI 36.
- N. Wood Filler Paste: MPI 91.
- O. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- P. Fast Drying Metal Primer: MPI 95.
- Q. High Build Epoxy Coating: MPI 98.
- R. Epoxy Anti-Corrosive Metal Primer: MPI 101.
- S. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.
- T. Waterborne Galvanized Primer: MPI 134.
- U. Non-Cementitious Galvanized Primer: MPI 135.

2.2 PAINT PROPERTIES

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

- A. Paint materials will conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC): VOC content of paint materials will not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
 - 2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - c. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
 - 3. Asbestos: Materials will not contain asbestos.

4. Chromate, Cadmium, Mercury, and Silica: Materials will not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Materials will not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints, where possible.
7. VOC content for solvent-based paints will not exceed 250g/l and will not be formulated with more than one percent aromatic hydro carbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.
- B. Atmospheric and Surface Conditions:
 1. Do not apply coating when air or substrate conditions are:
 - a. Less than 3 degrees C (5 degrees F) above dew point.
 - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances will application conditions exceed manufacturer recommendations.
 2. Maintain interior temperatures until paint dries hard.
 3. Do no exterior painting when it is windy and dusty.
 4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
 5. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
 - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
 6. Varnishing:
 - a. Apply in clean areas and in still air.
 - b. Before varnishing vacuum and dust area.
 - c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
 - 1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
 - 2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
 - 3. See other sections of specifications for specified surface conditions and prime coat.
 - 4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.
- C. Wood:
 - 1. Sand to a smooth even surface and then dust off.
 - 2. Sand surfaces showing raised grain smooth between each coat.
 - 3. Wipe surface with a tack rag prior to applying finish.
 - 4. Surface painted with an opaque finish:
 - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
 - b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
 - 5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
 - 6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
 - a. Thin filler in accordance with manufacturer's instructions for application.
 - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.
- D. Ferrous Metals:
 - 1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).

2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
 3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
 - a. This includes flat head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
 4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
 5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- E. Zinc-Coated (Galvanized) Metal, Aluminum, Copper and Copper Alloys Surfaces Specified Painted:
1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
 2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non- Cementitious Galvanized Primer) depending on finish coat compatibility.
- F. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
 2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
- G. Gypsum Plaster and Gypsum Board:
1. Remove efflorescence, loose and chalking plaster or finishing materials.
 2. Remove dust, dirt, and other deterrents to paint adhesion.
 3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm

(1-inch) in diameter as specified in Section for plaster or gypsum board.

3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, or roller, (NO-Spray), except as otherwise specified.
- G. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.5 PRIME PAINTING

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.

E. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.
 - a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5 (Exterior Alkyd Wood Primer) for repainting bare wood primer.
2. Apply two coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
5. Apply MPI 67 (Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR) to wood for fire retardant finish.

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:

1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer. Use MPI 101 (Cold Curing Epoxy Primer) where, Gloss (EC)) MPI 98 (High Build Epoxy Coating) finish is specified.
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer).
3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
4. Terne Metal: MPI 79 (Marine Alkyd Metal Primer).
5. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
6. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).
7. Asphalt coated metal: MPI 1 (Aluminum Paint (AP)).
8. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).

G. Hardboard:

1. Surfaces scheduled to have MPI 11 (Exterior Latex, Semi-Gloss (AE)) MPI 119 (Exterior Latex, High Gloss (acrylic), (AE)) MPI 11 (Exterior Latex, Semi-Gloss (AE)) MPI 119 (Exterior Latex, High Gloss (acrylic)(AE))
4. Use MPI 101 (Cold Curing Epoxy Primer) for surfaces scheduled to receive MPI 77 (Epoxy Cold Cured, Gloss (EC)) MPI 108 (High Build Epoxy Marine Coating (EC)) finish.

H. Concrete Masonry Units except glazed or integrally colored and decorative units:

1. Prime exterior surface as specified for exterior finishes.

I. Cement Plaster or stucco Concrete Masonry, Brick Masonry and Cement board

3.6 EXTERIOR FINISHES

A. Wood:

1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors and sash, or on edges of wood framed insect screens.

2. Portion of sash runs of double hung wood windows, concealed by sash when in a closed position: Apply two coats of ASTM D260 mixed with not more than 0.12L (1/4 pint) of dryer per 3.89L (gallon).

3. Two coats of MPI 11 (Exterior Latex, Semi-Gloss (AE)) on exposed surfaces.

B. Steel and Ferrous Metal:

1. Two coats of MPI 8 (Exterior Alkyd, Flat (EO)) MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).

2. One coat of MPI 22 (High Heat Resistant Coating (HR)) on surfaces over 94 degrees K (200 degrees F) and on surfaces of engine exhaust pipes.

C. Concrete Masonry Units Brick Cement Plaster Concrete :

1. General:

a. Mix as specified in manufacturer's printed directions.

b. Do not mix more paint at one time than can be used within four hours after mixing. Discard paint that has started to set.

c. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.

d. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.

2. Use two coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious (CEP)), unless specified otherwise.

3.7 INTERIOR FINISHES - (NOT USED)

3.8 REFINISHING EXISTING PAINTED SURFACES

A. Clean, patch and repair existing surfaces as specified under surface preparation.

B. Remove and reinstall items as specified under surface preparation.

- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. (not used)
- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

- A. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- B. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.
 - 2. Color of body coat: Lighter than finish coat.
 - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- C. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
 - 1. Paint to match color of casework where casework has a paint finish.
 - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.10 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. Paint after tests have been completed.
- C. Omit prime coat from factory prime-coated items.
- D. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

- E. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.
- F. Color:
1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
- G. Apply paint systems on properly prepared and primed surface as follows:
1. Exterior Locations:
 - a. Apply two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) to the following ferrous metal items:
Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
 - b. Apply two coats of MPI 11 (Exterior Latex, Semi Gloss (AE)) to the following metal items:
Galvanized and zinc-copper alloy metal.
 - c. Apply one coat of MPI 22 (High Heat Resistant Coating (HR)), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
 2. Interior Locations:
 - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
 - 1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
 - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
 - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
 - b. Ferrous metal exposed in hydrotherapy equipment room and chlorinator room of water and sewerage treatment plants: One coat of MPI 101 (Cold Curing Epoxy Primer) and one coat of MPI 77 (Epoxy Cold Cured, Gloss (EC) MPI 108 (High Build Epoxy Marine coating (EC))).
 - c. (not used)
 - d. (not used)
 - e. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 9 (Exterior Alkyd Enamel (EO)) MPI 94 (Exterior Alkyd, Semi-gloss (EO)) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

3. Other exposed locations:

- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two coats of MPI 1 (Aluminum Paint (AP)).
- b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 11 (Exterior Latex Semi-Gloss (AE)).

3.11 BUILDING AND STRUCTURAL WORK FIELD PAINTING

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
 1. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
 2. Painting of ferrous metal and galvanized metal.
 3. (not used)
 4. Identity painting and safety painting.
- B. Building and Structural Work not Painted:
 1. Prefinished items:
 - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
 - b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
 2. Finished surfaces:
 - a. Hardware except ferrous metal.
 - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
 - c. Signs, fixtures, and other similar items integrally finished.
 3. Galvanized metal:
 - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
 - b. Gas Storage Racks.
 - c. Except where specifically specified to be painted.

3.12 IDENTITY PAINTING SCHEDULE

N/A

3.13 PROTECTION CLEAN UP, AND TOUCH-UP

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
A112.14.1-2003.....Backwater Valves
- C. American Society of Sanitary Engineering (ASSE):
1001-2008.....Performance Requirements for Atmospheric Type
Vacuum Breakers
1003-2009.....Performance Requirements for Water Pressure
Reducing Valves for Domestic Water Distribution
Systems
1011-2004.....Performance Requirements for Hose Connection
Vacuum Breakers
1013-2011.....Performance Requirements for Reduced Pressure
Principle Backflow Preventers and Reduced
Pressure Principle Fire Protection Backflow
Preventers
1015-2011.....Performance Requirements for Double Check
Backflow Prevention Assemblies and Double Check
Fire Protection Backflow Prevention Assemblies
1017-2009.....Performance Requirements for Temperature
Actuated Mixing Valves for Hot Water
Distribution Systems
1020-2004.....Performance Requirements for Pressure Vacuum
Breaker Assembly

- 1035-2008.....Performance Requirements for Laboratory Faucet
Backflow Preventers
- 1069-2005.....Performance Requirements for Automatic
Temperature Control Mixing Valves
- 1070-2004.....Performance Requirements for Water Temperature
Limiting Devices
- 1071-2012.....Performance Requirements for Temperature
Actuated Mixing Valves for Plumbed Emergency
Equipment
- D. American Society for Testing and Materials (ASTM):
- A126-2004(R2009).....Standard Specification for Gray Iron Castings
for Valves, Flanges, and Pipe Fittings
- A276-2013a.....Standard Specification for Stainless Steel Bars
and Shapes
- A536-1984(R2009).....Standard Specification for Ductile Iron
Castings
- B62-2009.....Standard Specification for Composition Bronze
or Ounce Metal Castings
- B584-2013.....Standard Specification for Copper Alloy Sand
Castings for General Applications
- E. International Code Council (ICC):
- IPC-2012.....International Plumbing Code
- F. Manufacturers Standardization Society of the Valve and Fittings
Industry, Inc. (MSS):
- SP-25-2008.....Standard Marking Systems for Valves, Fittings,
Flanges and Unions
- SP-67-2011.....Butterfly Valves
- SP-70-2011.....Gray Iron Gate Valves, Flanged and Threaded
Ends
- SP-71-2011.....Gray Iron Swing Check Valves, Flanged and
Threaded Ends
- SP-80-2013.....Bronze Gate, Globe, Angle, and Check Valves
- SP-85-2011.....Gray Iron Globe & Angle Valves, Flanged and
Threaded Ends
- SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder
Joint, Grooved and Flared Ends

G. National Environmental Balancing Bureau (NEBB):

7th Edition 2005 Procedural Standards for Testing, Adjusting,
Balancing of Environmental Systems

H. NSF International (NSF):

61-2012.....Drinking Water System Components - Health
Effects

372-2011.....Drinking Water System Components - Lead Content

I. University of Southern California Foundation for Cross Connection
Control and Hydraulic Research (USC FCCCHR):

9th Edition.....Manual of Cross-Connection Control

1.4 SUBMITTALS

A. Submittals, including number of required copies, will be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section will be marked "SUBMITTED UNDER SECTION 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Ball Valves.

2. Gate Valves.

3. Butterfly Valves.

4. Balancing Valves.

5. Check Valves.

6. Globe Valves.

7. Water Pressure Reducing Valves and Connections.

8. Backwater Valves.

9. Backflow Preventers.

10. Chainwheels.

11. Thermostatic Mixing Valves.

D. Test and Balance reports for balancing valves.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

1. Include complete list indicating all components of the systems.

2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams will have their terminals identified to facilitate installation, operation and maintenance.
4. Piping diagrams of thermostatic mixing valves to be installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Valves will be prepared for shipping as follows:
 1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set angle, gate, and globe valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Valves will be prepared for storage as follows:
 1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature.
- C. A sling will be used for large valves. The sling will be rigged to avoid damage to exposed parts. Hand wheels or stems will not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

- A. Asbestos packing and gaskets are prohibited.
- B. Bronze valves will be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc will not be permitted.
- C. Valves in insulated piping will have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops will be fully adjustable after insulation is applied.
- D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 m (12 feet) will have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.
- E. All valves used to supply potable water will meet the requirements of NSF 61 and NSF 372.

F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

2.2 SHUT-OFF VALVES

A. Cold, Hot and Re-circulating Hot Water:

1. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-110, Ball valve will be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve will have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4138 kPa (600 psig). The body material will be Bronze ASTM B584, Alloy C844. The ends will be non-lead solder.
2. Less than 100 mm DN100 (4 inches): Butterfly will have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve will meet MSS SP-67, type I standard. The butterfly valve will have a SWP rating of 1380 kPa (200 psig). The valve design will be lug type suitable for bidirectional dead-end service at rated pressure. The body material will meet ASTM A536, ductile iron.
3. 100 mm DN100 (4 inches) and larger:
 - a. Class 125, OS&Y, Cast Iron Gate Valve. The gate valve will meet MSS SP-70 type I standard. The gate valve will have a CWP rating of 1380 kPa (200 psig). The valve materials will meet ASTM A126, grey iron with bolted bonnet, flanged ends, bronze trim, and positive-seal resilient solid wedge disc. The gate valve will be gear operated for sizes under 200 mm or DN200 (8 inches) and crank operated for sizes 200 mm or DN200 (8 inches) and above.
 - b. Single flange, ductile iron butterfly valves: The single flanged butterfly valve will meet the MSS SP-67 standard. The butterfly valve will have a CWP rating of 1380 kPa (200 psig). The butterfly valve will be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material will comply with ASTM A536 ductile iron. The seat will be EPDM with stainless steel disc and stem.
 - c. Grooved end, ductile iron butterfly valves. The grooved butterfly valve will meet the MSS SP-67 standard. The grooved butterfly valve will have a CWP rating of 1380 kPa (200 psig). The valve

materials will be epoxy coated ductile iron conforming to ASTM A536 with two piece stainless steel stem, encapsulated ductile iron disc, and EPDM seal. The butterfly valve will be gear operated.

- B. Reagent Grade Water: Valves for reagent grade, reverse osmosis, or deionized water service will be ball type of same material as used for pipe.

2.3 BALANCING VALVES

- A. Hot Water Re-circulating, 75 mm or DN75 (3 inches) and smaller manual balancing valve will be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve will have differential pressure read-out ports across the valve seat area. The read out ports will be fitting with internal EPT inserts and check valves. The valve body will have 8 mm or DN8 NPT (1/4 inch NPT) tapped drain and purge port. The valves will have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves will have calibrated nameplates to assure specific valve settings.
- B. Larger than 75 mm or DN75 (3 inches): Manual balancing valves will be of heavy duty cast iron flanged construction with 861 kPa (125 psig) flange connections. The flanged manual balancing valves will have either a brass ball with glass and carbon filled TFE seal rings or fitted with a bronze seat, replaceable bronze disc with EPDM seal insert and stainless steel stem. The design pressure will be 1200 kPa (175 psig) at 121 degrees C (250 degrees F).

2.4 CHECK VALVES

- A. 75 mm or DN75 (3 inches) and smaller will be Class 125, bronze swing check valves with non-metallic disc suitable for type of service. The check valve will meet MSS SP-80 Type 4 standard. The check valve will have a CWP rating of 1380 kPa (200 psig). The check valve will have a Y pattern horizontal body design with bronze body material conforming to ASTM B62, solder joints, and PTFE or TFE disc.
- B. 100 mm or DN100 (4 inches) and larger:
1. Check valves will be Class 125, iron swing check valve with lever and weight closure control. The check valve will meet MSS SP-71 Type I standard. The check valve will have a CWP rating of 1380 kPa (200 psig). The check valve will have a clear or full waterway body

design with gray iron body material conforming to ASTM A126, bolted bonnet, flanged ends, bronze trim.

2. All check valves on the discharge side of submersible sump pumps will have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

2.5 GLOBE VALVES

- A. 75 mm or DN75 (3 inches) or smaller: Class 150, bronze globe valve with non-metallic disc. The globe valve will meet MSS SP-80, Type 2 standard. The globe valve will have a CWP rating of 2070 kPa (300 psig). The valve material will be bronze with integral seal and union ring bonnet conforming to ASTM B62 with solder ends, copper-silicon bronze stem, PTFE or TFE disc, and malleable iron hand wheel.
- B. Larger than 75 mm or DN75 (3 inches): Similar to above, except with cast iron body and bronze trim, Class 125, iron globe valve. The globe valve will meet MSS SP-85, Type 1 standard. The globe valve will have a CWP rating of 1380 kPa (200 psig). The valve material will be gray iron with bolted bonnet conforming to ASTM A126 with flanged ends, bronze trim, and malleable iron handwheel.

2.6 WATER PRESSURE REDUCING VALVE AND CONNECTIONS

- A. 75 mm or DN75 (3 inches) or smaller: The pressure reducing valve will consist of a bronze body and bell housing, a separate access cover for the plunger, and a bolt to adjust the downstream pressure. The pressure reducing valve will meet ASSE 1003. The bronze bell housing and access cap will be threaded to the body and will not require the use of ferrous screws. The assembly will be of the balanced piston design and will reduce pressure in both flow and no flow conditions. The assembly will be accessible for maintenance without having to remove the body from the line.
- B. 100 mm or DN100 (4 inches) and larger: The pressure reducing valve will consist of a flanged cast iron body and rated to 1380 kPa (200 psig). The valve will have a large elastomer diaphragm for sensitive response. The pressure reducing valve will meet ASSE 1003.
- C. The regulator will have a tap for pressure gauge.
- D. The regulator will have a temperature rating of 100 degrees C (212 degrees F) for hot water or hot water return service. Pressure regulators will have accurate pressure regulation to 6.9 kPa (+/- 1 psig).

- E. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements will be as shown on the drawings.
- F. Connections Valves and Strainers: Shut off valves will be installed on each side of reducing valve and a bypass line equal in size to the regulator inlet pipe will be installed with a normally closed globe valve. A strainer will be installed on inlet side of, and same size as pressure reducing valve. A pressure gage will be installed on the inlet and outlet of the valve.

2.7 BACKWATER VALVE

- A. The backwater valve will have a cast iron body, automatic thermoplastic type valve seat and flapper suited for water service. The flapper will be slightly open during periods of non-operation. The pressure reducing valve will meet ASME A112.14.1. The cleanout will be extended to the finish floor and fit with a threaded countersunk plug. A clamping device will be included when the cleanout extends through the waterproofing membrane.
- B. When the backwater valve is installed greater than 600 mm (24 inches) below the finish floor elevation, a pit or manhole large enough for a repair person can enter to service the backwater valve will be installed.

2.8 BACKFLOW PREVENTERS

- A. A backflow prevention assembly will be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly will be approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCC).
- B. The reduced pressure principle backflow prevention assembly will be ASSE listed 1013 with full port OS&Y positive-seal resilient gate valves and an integral relief monitor switch. The main body and access cover will be epoxy coated ductile iron conforming to ASTM A536 grade 4. The seat ring and check valve will be the thermoplastic type suited for water service. The stem will be stainless steel conforming to ASTM A276. The seat disc will be the elastomer type suited for water service. The checks and the relief valve will be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections will be installed on the inlet. Reduced pressure backflow preventers will be installed in the following applications.

1. Deionizers.
 2. Sterilizers.
 3. Stills.
 4. Dialysis, Deionized or Reverse Osmosis Water Systems.
 5. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.
 6. Water service entrance from loop system.
 7. Dental equipment.
 8. Power washer.
 9. Medical equipment.
 10. Process equipment.
 11. Autopsy, on each hot and cold water outlet at each table or sink.
 12. Reclaimed water systems.
- C. The pipe applied or integral atmospheric vacuum breaker will be ASSE listed 1001. The main body will be cast bronze. The seat disc will be the elastomer type suited for water service. The device will be accessible for maintenance without removing the device from the service line. The installation will not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Atmospheric vacuum breakers will be installed in the following applications.
1. Hose bibs and sinks with threaded outlets.
 2. Disposers.
 3. Showers (telephone/handheld type).
 4. Hydrotherapy units.
 5. All kitchen equipment, if not protected by air gap.
 6. Ventilating hoods with wash down system.
 7. Film processor.
 8. Detergent system.
 9. Fume hoods.
 10. Glassware washers.
 11. Service sinks (integral with faucet only).
 12. Laundry tubs (integral with faucet only).
 13. Sitz baths.
- D. The hose connection vacuum breaker will be ASSE listed 1011. The main body will be cast brass with stainless steel working parts. The diaphragm and disc will be the elastomer type suited for water service. The device will permit the attachment of portable hoses to hose thread

outlets. Hose connection vacuum breakers will be installed in the following locations requiring non-continuous pressure:

1. Hose bibbs and wall hydrants.

E. The pressure vacuum breaker will be ASSE listed 1020. The main body will be brass. The disc and O-ring seal will be the elastomer type. The valve seat and disc float will be the thermoplastic type. Tee handle or lever handle shut-off ball valves. Test cocks for testing and draining where freezing conditions occur. All materials will be suitable for water service. The device will be accessible for maintenance without removing the device from the service line. The installation will not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Pressure vacuum breakers will be installed in the following locations requiring continuous pressure and no backpressure including equipment with submerged inlet connections:

1. Lawn Irrigation.

F. The laboratory faucet vacuum breaker will be ASSE listed 1035. The main body will be cast brass. Dual check valves with stainless steel working parts. The diaphragm and disc will be the elastomer type suited for water service. The device will permit the attachment of portable hoses to laboratory faucets for non-continuous pressure applications.

G. The double check backflow prevention assembly will be ASSE listed 1015 and supply with full port, OS&Y, positive-seal, resilient gate valves. The main body and access cover will be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve will be the thermoplastic type suited for water service. The stem will be stainless steel conforming to ASTM A276. The seat disc will be the elastomer type suited for water service. The first and second check valve will be accessible for maintenance without removing the device from the line. Double check valves will be installed in the following location requiring continuous pressure subject to backpressure and backsiphonage conditions.

1. Lawn Irrigation.
2. Food Processing Equipment.
3. Laundry equipment.

2.9 CHAINWHEELS

A. Valve chain wheel assembly with sprocket rim brackets and chain will be constructed according to the following:

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to ballvalve stem.
3. Sprocket rim with chain guides: Ductile or cast iron of type and size required for valve with zinc coating.
4. Chain: Stainless steel of size required to fit sprocket rim.

2.10 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valves will comply with the following general performance requirements:

1. Will meet ASSE requirements for water temperature control.
2. The body will be cast bronze or brass with corrosion resistant internal parts preventing scale and biofilm build-up. Provide chrome-plated finish in exposed areas.
3. No special tool will be required for temperature adjustment, maintenance, replacing parts and disinfecting operations.
4. Valve will be able to be placed in various positions without making temperature adjustment or reading difficult.
5. Valve finish will be chrome plated in exposed areas.
6. Valve will allow easy temperature adjustments to allow hot water circulation. Internal parts will be able to withstand disinfecting operations of chemical and thermal treatment of water temperatures up to 82°C (180°F) for 30 minutes or 50 mg/L (50 ppm) chlorine residual concentration for 24 hours.
7. Parts will be easily removed or replaced without dismantling the valves, for easy scale removal and disinfecting of parts.
8. Valve will have a manual adjustable temperature control with locking mechanism to prevent tampering by end user. Outlet temperature will be visible to ensure outlet temperature does not exceed specified limits, particularly after thermal eradication procedures.
9. Provide mixing valves with integral check valves with screens and stop valves.

B. Master Thermostatic Water Mixing Valves:

1. Application: Tempered water distribution from hot water source.
2. Standard: ASSE 1017.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Exposed-mounting or Cabinet-type, as indicated, thermostatically controlled water mixing valve.
5. Connections: Flanged or threaded union inlets and outlet.

6. Valve Finish: Chrome plated.
 7. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.
 8. Thermometers will be provided to indicate mixed water temperature.
- C. Hi-Lo Water-Mixing-Valve Assemblies:
1. Application: Tempered water distribution from hot water source covering a wide range of flow.
 2. Description: Factory-fabricated, cabinet-type or exposed-mounting, thermostatically controlled, water-mixing-valve assembly in two-valve parallel arrangement including pressure regulators, pressure gages and thermometer.
 3. Large-Flow Parallel: Master thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
 4. Small-Flow Parallel: Master thermostatic water mixing valve.
 5. Master Thermostatic Mixing Valves: Comply with ASSE 1017.
 6. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
 7. Component Pressure Ratings: 861 kPa (125 psig) minimum, unless otherwise indicated.
 8. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.
 9. Connections: Soldered or threaded union inlets and outlet.
 10. Thermometers will be provided to indicate mixed water temperature.
 11. Provide a high temperature alarm device to detect mixing valve failure.
- D. Automatic Water Temperature Control Mixing Valves:
1. Application: Gang plumbing fixtures point-of-use when no other mixing at fixtures occurs.
 2. Standard: ASSE 1069.
 3. Pressure Rating: 861 kPa (125 psig).
 4. Type: Thermostatically controlled water mixing valve set at 43 degrees C (110 degrees F).
 5. Connections: Threaded union or soldered inlets and outlet.
 6. Thermometers will be provided to indicate mixed water temperature.
 7. Upon cold water supply failure the hot water flow will automatically be reduced to 0.5 gpm maximum.

E. Water Temperature Limiting Devices:

1. Application: Single plumbing fixture point-of-use such as sinks or lavatories.
2. Standard: ASSE 1070.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Thermostatically controlled water mixing valve set at 43 degrees C (110 degrees F).
5. Connections: Threaded union, compression or soldered inlets and outlet.
6. Upon cold water supply failure the hot water flow will automatically be reduced to 0.2 gpm maximum.

F. Temperature Activated Mixing Valves:

1. Application: Emergency eye/face/drench shower equipment.
2. Standard: ASSE 1071.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Thermostatically controlled water mixing valve set at 24-30 degrees C (75-85 degrees F).
5. Connections: Soldered or threaded union inlets and outlet.
6. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.
7. Thermometers will be provided to indicate mixed water temperature.
8. Upon cold water supply failure the hot water flow will automatically be reduced to 0.5 gpm maximum.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Valve interior will be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials will be removed, such as blocks, used to prevent disc movement during shipping and handling.
- B. Valves will be operated in positions from fully open to fully closed. Guides and seats will be examined and made accessible by such operations.
- C. Threads on valve and mating pipe will be examined for form and cleanliness.
- D. Mating flange faces will be examined for conditions that might cause leakage. Bolting will be checked for proper size, length, and material. Gaskets will be verified for proper size and that its material composition is suitable for service and free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Valves will be located for easy access and will be provide with separate support. Valves will be accessible with access doors when installed inside partitions or above hard ceilings.
- C. Valves will be installed in horizontal piping with stem at or above center of pipe.
- D. Valves will be installed in a position to allow full stem movement.
- E. Install chain wheels on operators for ball and globe valves NPS 100 mm or DN100 (4 inches) and larger and more than 3.6 m (12 feet) above floor. Chains will be extended to 1524 mm (60 inches) above finished floor.
- F. Check valves will be installed for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level and on top of valve.
- G. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment or system.
 - 1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
- H. Install pressure gages on outlet of backflow preventers.
- I. Do not install bypass piping around backflow preventers.
- J. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets.
 - 1. Install thermometers if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- K. If an installation is unsatisfactory to the COR, the Contractor will correct the installation at no cost to the Government.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Calibrated balancing valves.
 - 2. Master, thermostatic, water mixing valves.
 - 3. Manifold, thermostatic, water-mixing-valve assemblies.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.4 ADJUSTING

- A. Valve packing will be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Valves will be replaced if persistent leaking occurs.
- B. Set field-adjustable flow set points of balancing valves and record data. Ensure recorded data represents actual measured or observed conditions. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.
- D. Testing and adjusting of balancing valves will be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report will be submitted to the VA Contracting Officer's Representative (COR).

- - E N D - - -

**SECTION 31 20 00
EARTHWORK**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
1. Site preparation.
 2. Excavation.
 3. Underpinning.
 4. Filling and backfilling.
 5. Grading.
 6. Soil Disposal.
 7. Clean Up.

1.2 DEFINITIONS:

- A. Unsuitable Materials:
1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D 698.
 2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proof rolling, or similar methods.
 3. Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to Resident Engineer's approval.
- B. Building Earthwork: Earthwork operations required in area enclosed by a line located 1500 mm (5 feet) outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.
- C. Trench Earthwork: Trench work required for utility lines.
- D. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.

- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D2922.
- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the Project Engineer. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the Project Engineer based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course will extend up to the springline of the pipe.
- O. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.
- P. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- Q. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and will include but not be limited to items like vehicles, equipment, appliances, building

materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.

- R. Contaminated soils: Soil that contains contaminants as defined and determined by the Resident Engineer or the Government's testing agency.

1.3 RELATED WORK:

- A. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Paving sub-grade requirements: Section 32 12 16, ASPHALT PAVING.

1.4 CLASSIFICATION OF EXCAVATION:

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.
- B. Classified Excavation: Removal and disposal of all material except that material not defined as Rock.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Excavation Report:
1. Excavation method.
 2. Labor.
 3. Equipment.
 4. Land Surveyor's or Civil Engineer's name and official registration stamp.
 5. Plot plan showing elevation.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- T99-01(2004).....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
- T180-01(2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop
- C. American Society for Testing and Materials (ASTM):
- D448-03a.....Standard Classification for Sizes of Aggregate for Road and Bridge Construction

- D698-00a1.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft³ (600 kN m/m³))
- D1556-00.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
- D1557-02e1.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN m/m³))
- D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- D2487-06.....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)
- D2922-05.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Willow Depth)
- D2940-03.....Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- D. Society of Automotive Engineers (SAE):
- J732-92.....Specification Definitions - Loaders
- J1179-02.....Hydraulic Excavator and Backhoe Digging Forces

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.
- B. Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 75 mm (3 inches) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material approved from on site or off site sources having a minimum dry density of 1760 kg/m³ (110 pcf), a maximum Plasticity Index of 15, and a maximum Liquid Limit of 40.
- C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-inch) sieve and not more than 12 percent passing a 75-µm (No. 200) sieve, per ASTM D2940;.
- D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except

with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75- μ m (No. 200) sieve.

- E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.

F. Granular Fill:

1. Under concrete slab, crushed stone or gravel graded from 25 mm (1 inch) to 4.75 mm (No. 4), per ASTM D 2940.
2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No 4), per ASTM D 2940.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center.
- B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.
- C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by Project Engineer. Remove materials from Medical Center.
- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil will be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil will be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by Project Engineer. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 0.014 m³ (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work will not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.
- E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be

removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Medical Center.

F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, will establish lines and grades.

1. Grades will conform to elevations indicated on plans within the tolerances herein specified. Generally grades will be established to provide a smooth surface, free from irregular surface changes. Grading will comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade will be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
2. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.

G. Disposal: All materials removed from the property will be disposed of at a legally approved site, for the specific materials, and all removals will be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the Project Engineer, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.

1. Design of the temporary support of excavation system is the responsibility of the Contractor.
2. Construction of the support of excavation system will not interfere with the permanent structure and may begin only after a review by the Project Engineer.
3. Extend shoring and bracing to a minimum of 1500 mm (5 feet) below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor will provide a concrete fill support under disturbed foundations, as directed by

- Project Engineer, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by Project Engineer.
- B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from Project Engineer. Approval by the Project Engineer is also required before placement of the permanent work on all subgrades.
- C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the Project Engineer.
- D. Proofrolling:
1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
 2. Proofrolling will consist of at least two complete passes with one pass being in a direction perpendicular to preceding one. Remove any areas that deflect, rut, or pump excessively during proof rolling, or that fail to consolidate after successive passes to suitable soils and replaced with compacted fill. Maintain subgrade until succeeding operation has been accomplished.
- E. Trench Earthwork:
1. Utility trenches (except sanitary and storm sewer):
 - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
 - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
 - c. Support piping on undisturbed earth unless a mechanical support is shown.
 - d. Length of open trench in advance of piping laying will not be greater than is authorized by Project Engineer.
 2. Sanitary and storm sewer trenches:
 - a. Trench width below a point 150 mm (6 inches) above top of pipe will be 600 mm (24 inches) maximum for pipe up to and including

300 mm (12 inches) diameter, and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (12 inches). Width of trench above that level will be as necessary for sheeting and bracing and proper performance of the work.

- b. Bed bottom quadrant of pipe on undisturbed soil or granular fill.
 - 1) Undisturbed: Bell holes will be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe will be clean earth placed and tamped by hand.
 - 2) Granular Fill: Depth of fill will be a minimum of 75 mm (3 inches) plus one sixth of pipe diameter below pipe to 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.
 - c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
 - d. Use granular fill for bedding where rock or rocky materials are excavated.
- F. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation will be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by Project Engineer as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the contractor will obtain samples of the material, under the direction of the Project Engineer, and the materials will be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.
- 1. Site Grading:
 - a. Provide a smooth transition between adjacent existing grades and new grades.
 - b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

- c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
 - 1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
 - 2) Walks: Plus or minus 25 mm (1 inch).
 - 3) Pavements: Plus or minus 13 mm (1 inch).
- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

3.3 FILLING AND BACKFILLING:

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by Project Engineer.
- B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact with approved tamping rollers, sheepfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of Project Engineer. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:
 - 1. Fills, Embankments, and Backfill

- a. Under proposed structures, building slabs, steps, and paved areas, scarify and recompact top 300 mm (12 inches) of existing subgrade and each layer of backfill or fill material in accordance with ASTM D698.
 - c. Under Sidewalks, scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with ASTM D698. Landscaped areas, top 400 mm (16 inches), 85 percent.
 - e. Landscaped areas, below 400 mm (16 inches) of finished grade, 90 percent.
2. Natural Ground (Cut or Existing)
- a. Under building slabs, steps and paved areas, top 150 mm (6 inches), ASTM D698.
 - b. Curbs, curbs and gutters, top 150 mm (6 inches), ASTM D698.
 - c. Under sidewalks, top 150 mm (6 inches), ASTM D698.

3.4 GRADING:

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside building away from building walls for a minimum distance of 1800 mm (6 feet).
- D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.
- E. Finished grade will be at least 150 mm (6 inches) below bottom line of window or other building wall openings unless greater depth is shown.
- F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill will be 150 mm (6 inches) unless otherwise shown.
- G. Finish subgrade in a condition acceptable to Project Engineer at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.

- H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Medical Center property. Stockpile or spread soil as directed by Project Engineer. Completely remove excess from Medical Center property and legally dispose of it upon completion of project.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- C. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- D. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- E. Segregate all excavated contaminated soil designated by the Project Engineer from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area will be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.6 CLEAN UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Medical Center Property.

----- E N D -----

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

This work will cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement will consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course will be constructed to the depth, section, or elevation required by the drawings and will be rolled, finished, and approved before the placement of the next course.

1.2 RELATED WORK

- A. Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Paragraph 3.3 and Section 31 20 00, EARTH MOVING.

1.3 ALIGNMENT AND GRADE CONTROL

The Contractor's Registered Professional Land Surveyor will establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Data and Test Reports:
 - 1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.
 - 2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.
 - 3. Job-mix formula.
- C. Certifications:
 - 1. Asphalt tack coat material certificate of conformance to State Highway Department requirements.
 - 2. Asphalt cement certificate of conformance to State Highway Department requirements.
 - 3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification.

- D. One copy of State Highway Department Specifications.
- E. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Aggregate base and asphalt concrete materials will conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it will mean the VA Project Engineer or VA Contracting Officer.

2.2 AGGREGATES

- A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.
- B. Subbase aggregate (where required) maximum size: 38mm(1-1/2").
- C. Base aggregate maximum size:
 - 1. Base course over 152mm(6") thick: 38mm(1-1/2");
 - 2. Other base courses: 19mm(3/4").
- D. Asphaltic base course:
 - 1. Maximum particle size not to exceed 25.4mm(1").
 - 2. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications will control.
- E. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

<u>Sieve Sizes</u>	<u>Percentage Passing</u>
19mm(3/4")	100
9.5mm(3/8")	67 to 85
6.4mm(1/4")	50 to 65
2.4mm(No. 8 mesh)	37 to 50
600µm(No. 30 mesh)	15 to 25
75µm(No. 200 mesh)	3 to 8

plus 50/60 penetration liquid asphalt at 5 percent to 6-1/2 percent of the combined dry aggregates.

2.3 ASPHALTS

- A. Comply with provisions of Asphalt Institute Specification SS2:

1. Asphalt cement: Penetration grade 50/60
2. Tack coat: Uniformly emulsified, grade SS-1H

2.4 SEALER

- A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.
- B. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications will control.

PART 3 - EXECUTION

3.1 GENERAL

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection will conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

- A. Provide hot plant-mixed asphaltic concrete paving materials.
 1. Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.
 2. Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

3.3 SUBGRADE

- A. Shape to line and grade and compact with self-propelled rollers.
- B. All depressions that develop under rolling will be filled with acceptable material and the area re-rolled.
- C. Soft areas will be removed and filled with acceptable materials and the area re-rolled.
- D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it will be reworked to bring to line and grade.
- E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA Project Engineer or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

- A. Subbase (when required)
 1. Spread and compact to the thickness shown on the drawings.
 2. Rolling will begin at the sides and continue toward the center and will continue until there is no movement ahead of the roller.

3. After completion of the subbase rolling there will be no hauling over the subbase other than the delivery of material for the top course.

B. Base

1. Spread and compact to the thickness shown on the drawings.
2. Rolling will begin at the sides and continue toward the center and will continue until there is no movement ahead of the roller.
3. After completion of the base rolling there will be no hauling over the base other than the delivery of material for the top course.

C. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").

D. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).

E. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING

A. Remove all loose materials from the compacted base.

B. Apply the specified tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Project Engineer.

C. Receipt of asphaltic concrete materials:

1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C (290 degrees F).
2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:

1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
 - a. No depressions which will retain standing water.
 - b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.6 APPLICATION OF SEAL COAT

- A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Project Engineer.
- B. Apply one coat of the specified sealer.
- C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

3.7 PROTECTION

Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.8 FINAL CLEAN-UP

Remove all debris, rubbish, and excess material from the work area.

- - - E N D - - -

SECTION 33 30 00**SANITARY SEWER UTILITIES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies materials and procedures for construction of outside, underground sanitary sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- C. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS**1.4 ABBREVIATIONS**

- A. PVC: Polyvinyl chloride plastic
- B. DI: Ductile iron pipe

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store plastic piping protected from direct sunlight and support to prevent sagging and bending. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.
- B. Handle manholes according to manufacturer's written rigging instructions.

1.6 COORDINATION

- A. Coordinate connection to sanitary sewer main with Public Utility company. (Approval from public utility has been obtained indicating that the downstream sanitary systems have sufficient capacity to handle the sanitary discharge from the facility.)
- B. Contractor to obtain approval from the Public Agency that the existing sanitary sewer systems have the capacity to handle the discharge from the facility.
- C. Coordinate exterior utility lines and connections to building lines up to 5 feet of building wall.

D. Coordinate connection to public sewer system with Public Utility Company.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units will be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, will be securely affixed in a conspicuous place on equipment. In addition, the model number will be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

1.8 SUBMITTALS:

A. Manufacturers' Literature and Data will be submitted for the following as one package:

1. Pipe, Fittings, and, Appurtenances.
2. Jointing Material.
3. Manhole and Structure Material.
4. Frames and Covers.
5. Steps and Ladders.
6. Valve Boxes.

1.9 APPLICABLE PUBLICATIONS

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

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

A74-09.....Cast Iron Soil Pipe and Fittings

A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for
Concrete

A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement

A746-99.....Ductile-Iron Gravity Sewer Pipe

C478-09.....Precast Reinforced Concrete Manhole Sections

- C857-11.....Minimum Structural Design Loading for
Underground Precast Concrete Utility Structures
- C890-11.....Minimum Structural Design Loading for
Monolithic or Sectional Precast Concrete Water
and Wastewater Structures
- C913-08.....Precast Concrete Water and Wastewater
Structures
- C923-08.....Resilient Connectors Between Reinforced
Concrete Manhole Structures, Pipes, and
Laterals
- C924-02(2009).....Testing Concrete Pipe Sewer Lines by Low-
Pressure Air Test Method
- C990-09.....Joints for Concrete Pipe, Manholes, and precast
Box Sections using Preformed Flexible Joint
Sealants
- C1173-10.....Flexible Transition Couplings for Underground
Piping Systems
- C1440-08.....Thermoplastic Elastomeric (TPE) Gasket
Materials for Drain, Waste and Vent (DWV),
Sewer, Sanitary and Storm Plumbing Systems
- C1460-08.....Shielded Transition Couplings for Use With
Dissimilar DWV Pipe and Fittings Above Ground
- C1461-08.....Mechanical Couplings Using Thermoplastic
Elastomeric (TPE) Gaskets for Joining Drain,
Waste and Vent (DWV), Sewer, Sanitary and Storm
Plumbing systems for Above and below Ground Use
- D2321-11.....Underground Installation of Thermoplastic Pipe
for Sewers and Other Gravity-Flow Applications
- D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe
and Fittings
- F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic
Pipe

F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter
Plastic Gravity Sewer Pipe and Fittings

F891-10.....Coextruded Poly(vinyl Chloride) (PVC) Plastic
Pipe With a Cellular Core

F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer
Pipe With a Smooth Interior and Fittings

F1417-11.....Standard Test Method for Installation
Acceptance of Plastic Gravity Sewer Lines Using
Low-Pressure Air

F1668-08.....Construction Procedures for Buried Plastic Pipe

C. American Water Works Association (AWWA):

C105/A21.5-10.....Polyethylene Encasement for Ductile-Iron Pipe
Systems

C110-08.....Ductile-Iron and Gray-Iron Fittings

C111/A21.11-06.....Rubber Gasket Joints for Ductile Iron Pressure
Pipe and Fittings

C151/A21.51-09.....Ductile Iron Pipe, Centrifugally Cast

C153/A21.53-06.....Ductile Iron Compact Fittings for Water Service

C219-11.....Bolted, Sleeve-Type Couplings for Plain-End
Pipe

C512-07.....Air Release, Air/Vacuum and Combination Air
Valves for Water Works Service

C600-10.....Installation of Ductile-Iron Mains and Their
Appurtenances

C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and
Fabricated Fittings, 4 In. Through 12 In. (100
mm Through 300 mm), for Water Transmission and
Distribution

D. American Society of Mechanical Engineers:

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

1.10 WARRANTY

- A. The Contractor will remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will provide all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS**2.1 FACTORY-ASSEMBLED PRODUCTS**

- A. Standardization of components will be maximized to reduce spare part requirements.
- B. All pipe and fittings used in the construction of force mains will be rated to meet the system maximum operating pressure with a minimum of 150 psi (1035 kPa).
- C. The Contractor will guarantee performance of assemblies of components, and will repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical Joint Piping
1. Pipe and Fittings: AWWA C151, thickness unless otherwise shown or specified.
 2. Compact Fittings: AWWA C153.
 3. Gaskets: AWWA C111.
 4. Exterior coating: AWWA C151.
 5. Interior lining will be as per ASTM A746.
 6. Pipe and fittings will be polyethylene encased as per AWWA C105.
- B. Push-on-Joint Piping:
1. Pipe: AWWA C151, with bolt holes in bell.
 2. Standard Fittings: AWWA C110.
 3. Compact Fittings: AWWA C153.
 4. Gaskets: AWWA C111.
 5. Exterior coating: AWWA C151.
 6. Interior lining: AWWA C151.
 7. Pipe and fittings will be polyethylene encased as per AWWA C105.

2.3 PVC, GRAVITY SEWER PIPE AND FITTINGS

- A. PVC Gravity Sewer Piping:
1. Pipe and Fittings will conform to ASTM D3034 or ASTM

2. Gaskets: ASTM F477.

B. PVC Cellular-Core Sewer Piping:

1. Pipe and Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.

2. Fittings: ASTM D3034.

C. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F949, corrugated pipe with bell and spigot ends.

2. Fittings: ASTM F949.

3. Gaskets: ASTM F477.

D. PVC Type PSM Sewer Piping:

1. Pipe will conform to ASTM D3034 or ASTM F679.

2. Fittings: ASTM D3034.

3. Gaskets: ASTM F477.

2.4 PVC, PRESSURE PIPE AND FITTINGS

A. PVC:

1. Pipe: AWWA C900, Class 150 PVC pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: AWWA C900, Class 150.

3. Gaskets: ASTM F477.

2.5 GRAVITY FLOW LINES WITH SECONDARY CONTAINMENT (ENCASEMENT)

A. Piping systems conveying hazardous materials will be constructed with a watertight primary (carrier) pipe completely enclosed within a watertight secondary (containment) pipe.

B. Piping and fittings will be as per ASTM D3034.

C. The carrier pipe will be installed with manufactured spacers to maintain a minimum interstitial space of 0.75 inch (19 mm) between the carrier pipe and the containment pipe.

D. The encasement piping will be equipped with adequate monitoring ports and vents to detect the presence of fluids within the containment pipe and for the extraction of fluids from the containment pipe.

E. Encasement pipe will be bell and spigot with adhesive bond.

2.6 PVC PRESSURE (FORCE) MAIN:

A. Joints will be fully restrained with mechanical joints, capable of restraining 50 percent above all loads acting on the joint, but not less than 150 psi (1035 kPa). Thrust blocks will not be permitted.

B. Ductile iron pipe and fittings: AWWA C151.

1. Push-on joints will be restrained by a mechanical restraint and prevent the opening of the joint.

C. Polyvinyl Chloride (PVC) Pipe and Fittings:

1. Pipe: ASTM D3034, SDR 35.
2. Gaskets: ASTM F477.

2.7 NONPRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve type, reducing or transition coupling, for joining underground nonpressure piping. Include ends to match same sizes of main line piping and install corrosion-resistant metal tension bands and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F477, elastomeric seal.
2. For Dissimilar Pipes: PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Couplings will be elastomeric sleeve with stainless steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Couplings will meet ASTM C1460 with rubber sleeve with full-length, corrosion-resistant outer shield with corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Couplings will be elastomeric compression seal with dimensions to fit inside bell of larger mainline pipe and for spigot of smaller main line pipe to fit inside ring.

F. Nonpressure-Type, Rigid Couplings:

1. Coupling will be ASTM C1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.8 PRESSURE-TYPE PIPE COUPLINGS

A. Tubular-Sleeve Couplings:

1. Couplings will meet AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

- B. Metal, bolted, sleeve-type, reducing or transition couplings for joining underground pressure piping:

1. Couplings will meet a 200-psi (1380-kPa) minimum pressure rating and ends of same sizes of the main line piping.

C. Center-Sleeve Material:

1. Sleeve will be Ductile iron.

D. Gasket material: Gaskets will be natural or synthetic rubber.

E. Metal component finish: Finish will be a corrosion-resistant material or coating.

2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:

1. Compound fittings: Fittings will have a combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one gasketed sleeve section rated for 250-psi (1725-kPa) minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:

1. Jointing Material: Joints will be a three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psi (1725-kPa) minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:

1. Jointing Material: Compound coupling fittings with ball joint, flexing section, gaskets, and restrained-joint ends will comply with AWWA C110 or AWWA C153. Include rating for 250-psi (1725-kPa) minimum working pressure and for up to 15 deg of deflection.

2.10 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

1. Valve Material: Valve will be as per ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
2. Horizontal type : Horizontal valve will include a swing check valve and hub-and-spigot ends.
3. Combination horizontal and manual gate-valve type: Valve will include a swing check valve, integral gate valve, and hub-and-spigot ends.
4. Terminal type: Valve will include a bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:

1. PVC valve will be a horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.11 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Cleanouts will be as per ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Valve loadings will be designed for Heavy Duty.
3. Cleanout Riser: Sewer pipe fitting on main line pipe and riser will be as per ASTM A74, service class.

B. PVC Cleanouts:

1. PVC body with PVC threaded plug: Cleanout will be as per ASTM D3034. PVC sewer pipe fitting and riser to cleanout.
2. Cleanout Riser: Sewer pipe fitting on main line sewer and riser will match main line piping.

2.12 MANHOLES

A. Standard precast concrete manholes and vaults will be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections or cast-in-place concrete.

1. Precast Concrete Manholes: Material will be as per ASTM C478, precast, reinforced concrete, of depth indicated, with sealed joints.
2. Concrete Base: Concrete for base of manhole will have a minimum compressive strength of 5000 psi (35 MPa) at 28 days. Thickness to be 8 inches (200 mm), minimum.
3. Riser Section: 4 inch (100 mm) minimum thickness, of lengths to provide the total depth of manhole.
4. Top Section: Eccentric-cone type unless otherwise indicated. Top section to match adjustment ring configurations.
5. Joint Sealant: ASTM C990.
6. Resilient Pipe Connectors: ASTM C923.
7. Steps: If over 60 inches (1500 mm) in depth, individual FRP steps or ladder ASTM A615 deformed, 1/2 inch (13 mm) steel reinforcing rods encased in precast concrete sections with 16 inch (400 mm) minimum width, 12 to 16 inches (300 to 400 mm) center-to-center from top to bottom.

8. Adjusting Rings: Reinforced-concrete rings; 6 to 9 inch (150 to 225 mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Concrete Manholes:

1. Description: ASTM C913; designed according to ASTM C890 for AASHTO HS20-44, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: If over 60 inches (1500 mm) in depth, individual FRP steps or FRP ladder individual FRP steps, FRP ladder, or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in plastic width 16 inches (400 mm) minimum, 12 to 16 inches (300 to 400 mm) center-to-center from top to bottom.
6. Adjusting Rings: Reinforced-concrete rings; 6 to 9 inch (150 to 225 mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Base Channels: Manhole channels will be main line pipe material. Lay main pipe through manhole and cut top of pipe out to be three-fourths of pipe diameter. Slope through manhole to match run slopes of the main pipe.

2.13 CONCRETE

A. Cast-in-place concrete will be 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

B. Reinforcement

1. Reinforcing fabric will be ASTM A185, steel, welded wire fabric, plain.
2. Reinforcing bars will be ASTM A615, Grade 60 (420 MPa) deformed steel.

C. Benches will be concrete, sloped to drain into the channel. Provide 6 inches (150 mm) from the cut section of top of pipe to edge of manhole.

D. Ballast and Pipe Supports will be Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

2.14 WET WELL

A. Fiberglass wet well. Tank will be a single wall fiberglass reinforced plastic (FRP) UL labeled underground storage tanks as shown on the drawings. Size and fittings will be as shown on drawings.

B. Concrete Wet Well:

1. Concrete wet well will be a circular precast vault conforming to ASTM C857.
2. Vault Material: The vault will have a poured concrete base with precast walls, and top poured in place structure.
3. Concrete: Concrete will be 5000 psi (35 MPa) concrete at 28 days.
4. Design Load: The vault will be rated for AASHTO HS20-44 loading and 30 percent impact loads.
5. Joints: Joints in the vault will be tongue and groove. Flexible sealing compound, as recommended by the manufacturer, will be placed in all joints to form a watertight structure.
6. Interior Coating: Concrete coating for the interior of wet wells will consist of an epoxy blended filler sealer, and a cross linked epoxy phenolic cured, resistant protective coating.

C. Tank Design Criteria:

1. Internal Load: Tank will withstand without leakage a 5 psi (34.5 kpa) air pressure test with 5 to 1 safety factor. Contractor will test prior to installation as this is to test for leakage.
2. Vacuum Test: The tank will be tested to 11.5 inches (292 mm) of mercury vacuum by the tank manufacturer to assure structural integrity. Contractor will submit vacuum test certificate if test conducted by manufacturer at plant.
3. Surface Loading: Tank will withstand surface AASHTO HS20-44 axle loads.
4. External Hydrostatic Pressure: Tank will withstand 7 feet (2.1 m) of overburden with the hole fully flooded with a 3 to 1 safety factor against leaking.
5. Threaded fittings will be of a material consistent with the requirements of the UL label and be of the sizes and locations shown on the drawings.

6. Tanks will have nominal capacity as shown on drawings with a minimum of a 36 inch square (900 mm) ID manway riser, a complete cast iron frame and lid at finish grade, steps, and lid that is spring loaded.

PART 3 -

3.1 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

N/A

3.2 AIR RELEASE VALVE FOR FORCE MAINS

- A. Valves will be combination air release and vacuum valve with a single body. The valves will be rated for 150 psi (1025 kPa) working pressure, and conform to AWWA C512. Valve will be provided with threaded connections, and be mounted on a full opening ball valve to isolate the air release valve from the system.

3.3 WARNING TAPE

- A. Warning tape will be standard, 4 mil (0.1 mm) polyethylene 3 inch (76 mm) wide tape detectable type, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW".

PART 4 - EXECUTION

4.1 PIPING INSTALLATION

- A. Drawing plans and details indicate the general location and arrangement of underground sanitary sewer piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at the low point, true to grades and alignment indicated on the drawings, with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- D. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- E. Inspect pipes and fittings for defects before installation. Defective materials will be plainly marked and removed from the site. Cut pipe will have smooth regular ends at right angles to axis of pipe.

- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe will be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 12 inches (300 mm) over the crown of the pipe.
- H. Warning tape will be continuously placed 12 inches (300 mm) above sewer pipe
- I. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- J. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- K. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process or microtunneling.
- L. Install gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 - 2. Install ductile iron, gravity sewer piping according to AWWA C600.
 - 3. Install PVC cellular-core, PVC corrugated sewer, PSM sewer and PVC gravity sewer according to ASTM D2321 and ASTM F1668.
- M. Install force-main, pressure piping according to the following:
 - 1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fittings, or cast-in-place-concrete supports or anchors. Pressure (force) mains will have the bells facing the direction of flow.
 - 2. Sections of piping listed on the drawings will be fully restrained. For devices with twist off nuts, the twist off nuts will be placed on top of the fitting for the Resident Engineer's inspection. The Contractor will torque test all bolts, set screws, identified by the Resident Engineer.
 - 3. Thrust blocks will not be permitted.
- N. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each

joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

O. Gravity Flow Lines with Secondary Containment (Encasement Pipe):

1. Install per manufacturer's recommendations. Install all pipe centering devices to maintain an interstitial space below the invert of the carrier pipe. Both the carrier and containment pipe will be tested for leaks.

4.2 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping according to the following:

1. Join ductile iron, gravity sewer piping according to AWWA C600 for push-on joints.
2. Join PVC piping according to ASTM D2321.
3. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Join force-main, pressure piping according to the following:

1. Join ductile iron pressure piping according to AWWA C600 for push-on joints.
2. Join PVC pressure piping according to manufacturer's recommendations.
3. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.
 - a. Flexible or Rigid couplings for pipes of same or slightly different OD.
 - b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure pipe couplings for force-main joints.

4.3 SEWER AND MANHOLE SUPPORTS, CONCRETE CRADLES WITHIN VAULTS

A. Install reinforced concrete as detailed on the drawings. The concrete will not restrict access for future maintenance of the joints within the piping system.

4.4 BUILDING SERVICE LINES

- A. Install sanitary sewer service lines to point of connection within approximately 5 feet (1500 mm) outside of building(s) where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.

4.5 MANHOLE INSTALLATION

- A. Install manholes complete with appurtenances and accessories indicated.
1. Precast concrete segmental blocks will lay true and plumb. All horizontal and vertical joints will be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
 2. Precast reinforced concrete rings will be installed true and plumb. The joints between rings and between rings and the base and top, will be sealed as per manufacturer's recommendations. Adjust the length of the rings so that the top section will be at the required elevation. Cutting the top section is not acceptable.
 3. Concrete manhole risers and tops: Install as specified.
- B. Designed Concrete Structures:
1. Concrete structures will be installed in accordance with Section 03 30 53, CAST-IN-PLACE CONCRETE.
- C. Do not build structures when air temperature is 32 deg F (0 deg C), or below.
- D. The wall that supports access rungs or ladder will be 90 deg vertical from the floor of structure to manhole cover.
- E. Install steps and ladders per the manufacturer's recommendations. Steps and ladders will not move or flex when used. All loose steps and ladders will be replaced by the Contractor.
- F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. In unpaved areas, the rim elevation will be 2 inches (50 mm) above the adjacent finish grade.
- G. Install manhole frames and covers on a mortar bed, such that frames and covers will not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. Install an 8 inches (200 mm) thick, by 12 inches (300 mm) wide concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

4.6 WET WELLS

- A. Install tank on a concrete pad as recommended by the manufacturer.
- B. Installation of the tank and fittings will be in accordance with the recommendations of the manufacturer.
- C. In areas where the tank is subject to groundwater, the tank will be anchored against floating as recommended by the manufacturer.
- D. After installation, the inlets and outlets will be plugged, and the tank completely filled with water. The tank will have no leakage over a 48 hour period.
- E. Top of wet well should be set a minimum of 6 inches (150 mm) above finish grade, unless in a traffic area, then it must match existing grade.
- F. Install a 12 inches (300 mm) concrete ring around the fiberglass tank if in a grassed area.
- G. All tank walls will be level and plumb.
- H. Seal all joints and depressions in the wet well.
- I. Pipe and fittings entering and within the wet well will be poly-lined ductile iron pipe.
- J. All pipe penetrations through the walls of the wet well will be sealed water tight.

4.7 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

N/A

4.8 ACID NEUTRALIZING TANKS

N/A

4.9 BACKWATER VALVE INSTALLATION

- A. Install horizontal-type backwater valves in piping manholes or pits.
- B. Install combination horizontal and manual gate valves in piping and in manholes.
- C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

4.10 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Cleanouts should be 6 inches (150 mm) in diameter and consist of a ductile iron 45 degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, water tight plug or cap and cast frame and cover flush with finished grade. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
 3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete, 18 by 18 by 12 inches (450 by 450 by 300 mm) 1 inch (25 mm) above surrounding grade.
- C. Where cleanout is in force main, provide a blind flange top connection. The center of the flange will be equipped with a 2 inches (50 mm) base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains will be 24 inches (600 mm) in diameter.
- D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.
- E. The top of the cleanout assembly will be 2 inches (50 mm) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

4.11 CONNECTIONS

- A. Make connections to existing piping and underground manholes by coring and installing the pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.
- B. Connection to an existing manhole: The bench of the manhole will be cleaned and reshaped to provide a smooth flowline for all new pipes connected to the manhole.
- C. Use commercially manufactured wye fittings for piping branch connections. Encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
1. Make branch connections from the side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500), by removing a section of the existing pipe.
 2. Make branch connections from the side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting an opening into existing unit large enough to allow 3 inches (76 mm) of concrete

to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in concrete to provide additional support of collar from connection to undisturbed ground.

3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

4.12 AIR RELEASE VALVES

- A. Set valves in vault or force mains with adequate space for maintenance of the valve. The vault will have a solid floor to prevent all sanitary blowoff from being absorbed into the soils.
- B. Valves will be set plumb and supported to the vault. Maintain accessibility to the isolation valve on the air valve line.
- C. Install the valve after the completion of testing of the pressure (force) main.

4.13 REGRADING

- A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor will install a temporary cover above the bench of the structure or manhole. The temporary cover will be installed above the high flow elevation within the structure, and will prevent debris from entering the wastewater stream.

4.14 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed.
 1. Piping under and within 5 feet (1500 mm) of building areas will be completely removed.
 2. Piping outside of building areas will be completely removed.

B. Excavate around manholes as required and use either procedure below:

1. Manholes and structures outside of building areas: Remove frame and cover, cut and remove the top of an elevation of 2 feet (600 mm) below finished grade. Fill the remaining portion with compacted gravel or crushed rock or concrete.
2. Manholes and structures with building areas: Remove frame and cover and remove the entire structure and the base.

C. Backfill to grade according to Division 31 Section 31 20 00, EARTH MOVING.

D. When the limit of the abandonment terminates in an existing manhole to remain, the flow line in the bench of the manhole to the abandoned line will be filled with concrete and shaped to maintain the flowline of the lines to remain.

4.15 PIPE SEPARATION

A. Horizontal Separation - Water Mains and Sewers:

1. Existing and proposed water mains will be at least 10 feet (3 m) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.
2. Gravity flow mains and pressure (force) mains may be located closer than 10 feet (3 m) but not closer than 6 feet (1.8 m) to a water main when:
 - a. Local conditions prevent a lateral separation of 10 feet (3 m); and
 - b. The water main invert is at least 18 inches (450 mm) above the crown of the gravity sewer or 24 inches (600 mm) above the crown of the pressure (force) main; and the water main is in a separate trench separated by undisturbed earth.
3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main will be constructed of push-on or mechanical joint ductile iron pipe.

B. Vertical Separation - Water Mains and Sewers at Crossings:

1. Water mains will be separated from sewer mains so that the invert of the water main is a minimum of 24 inches (600 mm) above the crown of gravity flow sewer or 48 inches (1200 mm) above the crown of pressure (force) mains. The vertical separation will be maintained within 10 feet (3 m) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.

2. In no case will pressure (force) sanitary main cross above, or within 24 inches (600 mm) of water lines.
3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 18 inches (450 mm) above or 12 inches (300 mm) below the water main, provided that both the water main and sewer will be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 24 inches (600 mm) below the water line provided both the water line and sewer line are constructed of ductile iron pipe.
4. The required vertical separation between the sewer and the water main will extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 10 feet (3 m).

4.16 IDENTIFICATION

- A. Install green warning tape directly over piping and at outside edges of underground manholes.

4.17 FIELD QUALITY CONTROL

- A. All systems will be inspected and obtain the Resident Engineer's approval. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.
- B. To inspect, thoroughly flush out the lines and manholes before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lips at joints on the inside of gravity sewer lines are not acceptable.
 1. Submit separate report for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Re-inspect and repeat procedure until results are satisfactory.

C. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

1. Test plastic gravity sewer piping according to ASTM F1417.
2. Test concrete gravity sewer piping according to ASTM C924.
3. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line will be pressurized to 4 psi (28 kPa) and allowed to stabilize. After pressure stabilization, the pressure will be dropped to 3.5 psi (24 kPa) greater than the average back-pressure of any groundwater above the sewer.
4. For force mains, perform testing after supports and anchors are installed. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa).
5. Testing of Fiberglass Sewage Holding Tanks will show no leakage during a 5 psi (35 kPa) air pressure test with 5:1 safety factor.
6. Testing of Concrete Wet Well will show no leakage with the wet well completely filled with water for a duration of 4 hours.

4.18 CLEANING

A. Clean dirt and superfluous material from interior of piping.

--- E N D ---

SECTION 33 40 00**STORM SEWER UTILITIES****PART 1 - GENERAL****1.1 DESCRIPTION**

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

A. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 53, (Short-Form) CAST-IN-PLACE CONCRETE.

B. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1.3 DEFINITIONS

N/A

1.4 ABBREVIATIONS

A. HDPE: High-density polyethylene

B. PE: Polyethylene

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Handle manholes catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.

B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units will be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, will be securely affixed in a conspicuous place on equipment. In addition, the model number will be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.8 SUBMITTALS

- A. Manufacturers' Literature and Data will be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

1.9 APPLICABLE PUBLICATIONS

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

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

A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for
Concrete

A242/A242M-04(2009).....High-Strength Low-Alloy Structural Steel

A536-84(2009).....Ductile Iron Castings

A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement

A760/A760M-10.....Corrugated Steel Pipe, Metallic-Coated for
Sewers and Drains

A798/A798M-07.....Installing Factory-Made Corrugated Steel Pipe
for Sewers and Other Applications

A849-10.....Post-Applied Coatings, Paving, and Linings for
Corrugated Steel Sewer and Drainage Pipe

A929/A929M-01(2007).....Steel Sheet, Metallic-Coated by the Hot-Dip
Process for Corrugated Steel Pipe

B745/B745M-97(2005).....Corrugated Aluminum Pipe for Sewers and Drains

B788/B788M-09.....Installing Factory-Made Corrugated Aluminum
Culverts and Storm Sewer Pipe

C14-07.....Non-reinforced Concrete Sewer, Storm Drain, and
Culvert Pipe

C33/C33M-08.....Concrete Aggregates

C76-11.....Reinforced Concrete Culvert, Storm Drain, and
Sewer Pipe

C139-10.....Concrete Masonry Units for Construction of
Catch Basins and Manholes

C150/C150M-11.....	Portland Cement
C443-10.....	Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
C478-09.....	Precast Reinforced Concrete Manhole Sections
C506-10b.....	Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
C507-10b.....	Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
C655-09.....	Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
C857-07.....	Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
C891-09.....	Installation of Underground Precast Concrete Utility Structures
C913-08.....	Precast Concrete Water and Wastewater Structures
C923-08.....	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
C924-02(2009).....	Testing Concrete Pipe Sewer Lines by Low- Pressure Air Test Method
C990-09.....	Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
C1103-03(2009).....	Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
C1173-08.....	Flexible Transition Couplings for Underground Piping Systems
C1433-10.....	Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
C1479-10.....	Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

D448-08.....	Sizes of Aggregate for Road and Bridge Construction
D698-07e1.....	Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))
D1056-07.....	Flexible Cellular Materials—Sponge or Expanded Rubber
D1785-06.....	Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D2321-11.....	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
D2751-05.....	Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
D2774-08.....	Underground Installation of Thermoplastic Pressure Piping
D3034-08.....	Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D3350-10.....	Polyethylene Plastics Pipe and Fittings Materials
D3753-05e1.....	Glass-Fiber-Reinforced Polyester Manholes and Wetwells
D4101-11.....	Polypropylene Injection and Extrusion Materials
D5926-09.....	Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
F477-10.....	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F679-08.....	Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
F714-10.....	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

F794-03(2009).....Poly(Vinyl Chloride) (PVC) Profile Gravity
Sewer Pipe and Fittings Based on Controlled
Inside Diameter

F891-10.....Coextruded Poly(Vinyl Chloride) (PVC) Plastic
Pipe With a Cellular Core

F894-07.....Polyethylene (PE) Large Diameter Profile Wall
Sewer and Drain Pipe

F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer
Pipe With a Smooth Interior and Fittings

F1417-11.....Installation Acceptance of Plastic Gravity
Sewer Lines Using Low-Pressure Air

F1668-08.....Construction Procedures for Buried Plastic Pipe

C. American Association of State Highway and Transportation Officials
(AASHTO):

M190-04.....Bituminous-Coated Corrugated Metal Culvert Pipe
and Pipe Arches

M198-10.....Joints for Concrete Pipe, Manholes, and Precast
Box Sections Using Preformed Flexible Joint
Sealants

M252-09.....Corrugated Polyethylene Drainage Pipe

M294-10.....Corrugated Polyethylene Pipe, 12 to 60 In. (300
to 1500 mm) Diameter

D. American Water Works Association(AWWA):

C105/A21.5-10.....Polyethylene Encasement for Ductile iron Pipe
Systems

C110-08.....Ductile-Iron and Gray-Iron Fittings

C219-11.....Bolted, Sleeve-Type Couplings for Plain-End
Pipe

C600-10.....Installation of Ductile iron Mains and Their
Appurtenances

C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and
Fabricated Fittings, 4 In. Through 12 In. (100
mm Through 300 mm), for Water Transmission and
Distribution

M23-2nd ed.....PVC Pipe "Design And Installation"

E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001.....Floor and Trench Drains

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

F. American Concrete Institute (ACI):

318-05.....Structural Commentary and Commentary

350/350M-06.....Environmental Engineering Concrete Structures
and Commentary

G. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for
Erosion and Sediment Control

1.10 WARRANTY

The Contractor will remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components will be maximized to reduce spare part requirements. The Contractor will guarantee performance of assemblies of components, and will repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 STEEL PIPE AND FITTINGS

N/A

2.3 ALUMINUM PIPE AND FITTINGS

N/A

2.4 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: Pipe and fittings will conform to ASTM D2751, with bell-and-spigot ends for gasketed joints.

1. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
2. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.

B. Gaskets: ASTM F477, elastomeric seals.

2.5 PE PIPE AND FITTINGS

A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.

1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.

B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); AASHTO M294, Type S, ASTM F714, SDR 21 for pipes 3 to 24 inches (300 to 600 mm) with smooth waterway for coupling joints. Pipe will be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.

1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.
3. Water tight joints will be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets will conform to ASTM F477. Soil tight joints will conform to requirements in AASHTO HB-17, Division II, for soil tightness and will be as recommended by the manufacturer.

C. Profile Wall PE Pipe: Pipe will comply with ASTM F894, Class 160.

1. Profile Wall PE Plastic Pipe Joints: Joints will be as per ASTM F894, gasket or thermal weld type with integral bell.

D. PVC Pipe And Fittings

1. PVC Cellular-Core Pipe And Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034, SDR 35, PVC socket-type fittings.

E. PVC Corrugated Sewer Piping

1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: ASTM F949, PVC molded or fabricated, socket type.

3. Gaskets: ASTM F477, elastomeric seals.

F. PVC Profile Sewer Piping

1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends.

2. Fittings: ASTM D3034, PVC with bell ends.

3. Gaskets: ASTM F477, elastomeric seals.

G. PVC Type PSM Sewer Piping

1. Pipe: ASTM D3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends.

2. Fittings: ASTM D3034, PVC with bell ends.

3. Gaskets: ASTM F477, elastomeric seals.

H. PVC Gravity Sewer Piping

1. Pipe and fittings will be ASTM F679, T-1 or T-2 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends.

2. Gaskets: ASTM F477, elastomeric seals for gasketed joints.

2.6 CONCRETE PIPE AND FITTINGS

N/A

2.7 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials

1. For concrete pipes: ASTM C443, rubber.

2. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.

3. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Couplings will be an elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, flexible couplings will be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, flexible couplings will be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.8 PRESSURE PIPE COUPLINGS

- A. Couplings: AWWA C219, tubular-sleeve coupling, with center sleeve, gaskets, end rings, and bolt fasteners.
- B. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psi (1035-kPa) Insert value minimum pressure rating and ends sized to match adjoining pipes.
- C. Gasket Material: Natural or synthetic rubber.
- D. Metal Component Finish: Corrosion-resistant coating or material.

2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS

- A. Ductile iron flexible expansion joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psi (1725-kPa) minimum working pressure and for offset and expansion indicated.
- B. Ductile iron expansion joints: Three-piece assemblies of telescoping sleeve with gaskets and restrained-type, ductile iron or steel with protective coating, bell-and-spigot end sections complying with AWWA C110. Include rating for 250-psi (1725-kPa) minimum working pressure and for expansion indicated.
- C. Ductile iron deflection fittings: Compound-coupling fitting, with ball joint, flexing section, gaskets, and restrained-joint ends, complying with AWWA C110. Include rating for 250-psi (1725-kPa) minimum working pressure and for up to 15 deg of deflection.

2.10 BACKWATER VALVES

N/A

2.11 CLEANOUTS

N/A

2.12 DRAINS

N/A

2.13 ENCASEMENT FOR PIPING

N/A

2.14 MANHOLES AND CATCH BASINS

- A. Standard Precast Concrete Manholes:
 - 1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 8 inch (150 mm) minimum thickness for floor slab and 8-inch (102 mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 8 inch (102 mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). Individual FRP steps or FRP ladder Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP, width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C913; designed for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
5. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). Individual FRP steps or FRP ladder Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP ASTM A615

deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D 4101, PP, width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.

6. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24 inch (610 mm) ID by 7 to 9 inch (175 to 225 mm) riser with 4 inch (102 mm) minimum width flange and 26-inch (600 mm) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: iron unless otherwise indicated.

2.15 CONCRETE FOR MANHOLES AND CATCH BASINS

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

B. Concrete Design Mix: 4000 psi (27.6 MPa) minimum, compressive strength in 28 days.

1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Channels will be the main line pipe material. Include benches in all manholes and catch basins.

1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6 inch slope from main line pipe to wall sides.

2.16 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

N/A

2.17 PLASTIC, CHANNEL DRAINAGE SYSTEMS

N/A

2.18 PIPE OUTLETS

N/A

2.19 DRY WELLS

N/A

2.20 STORMWATER DISPOSAL SYSTEMS

N/A

2.21 HEADWALLS

N/A

2.22 FLARED END SECTIONS

N/A

2.23 PRECAST REINFORCED CONCRETE BOX CULVERT

N/A

2.24 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

N/A

2.25 WARNING TAPE

N/A

PART 3 - EXECUTION**3.1 PIPE BEDDING**

A. The bedding surface of the pipe will provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe will be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding will be tamped. Bell holes and depressions for joints will not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements will meet the requirements of ASTM D2321. Bedding, haunching and initial backfill will be either Class IB or Class II material. Corrugated metal pipe bedding requirements will conform to ASTM A798.

3.2 PIPING INSTALLATION

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping with minimum cover as shown on the Drawings.
- C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings

according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
 2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
 3. Inspect pipes and fittings, for defects before installation. Defective materials will be plainly marked and removed from the site. Cut pipe will have smooth regular ends at right angles to axis of pipe.
 4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe will be closed securely to prevent entrance of storm water, dirt or other substances.
 5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe will be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
 6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.
 7. Warning tape will be continuously placed 12 inches (300 mm) above storm sewer piping.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- G. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow.
 2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
 3. Install hub-and-spigot, cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

4. Install ductile iron piping and special fittings according to AWWA C600.
5. Install corrugated steel piping according to ASTM A798.
6. Install corrugated aluminum piping according to ASTM B788.
7. Install ABS sewer piping according to ASTM D2321 and ASTM F1668.
8. Install PE corrugated sewer piping according to ASTM D2321 with gaskets with fused joints.
9. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.
10. Install reinforced concrete sewer piping according to ASTM C1479.
11. Install force-main pressure piping according to the following:
 - a. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
 - b. Install ductile iron pressure piping and special fittings according to AWWA C600.
 - c. Install PVC pressure piping according to AWWA M23, or ASTM D2774 and ASTM F1668.
 - d. Install corrosion-protection piping encasement over the following underground metal piping according to AWWA C105/A21.5.
 - 1) Hub-and-spigot, cast iron soil pipe and fittings.
 - 2) Hubless cast iron soil pipe and fittings.
 - 3) Ductile iron pipe and fittings.
 - 4) Expansion joints and deflection fittings.

3.3 REGRADING

- A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor will install a temporary cover above the bench of the structure or manhole. The temporary cover will be installed above the high flow elevation within the structure, and will prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

- A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

3.5 CONNECTIONS TO EXISTING PUBLIC UTILITY MANHOLES

- A. Comply with all rules and regulations of the public utility.
- B. Backwater Valve Installation
- C. Install combination horizontal and manual gate-valve terminal-type backwater valves in piping where indicated.

3.6 DRAIN INSTALLATION

N/A

3.7 MANHOLE INSTALLATION

- A. Install manholes, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.
- B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops above finished surface elsewhere unless otherwise indicated.
- C. Circular Structures:
 - 1. Precast concrete segmental blocks will lay true and plumb. All horizontal and vertical joints will be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
 - 2. Precast reinforced concrete rings will be installed true and plumb. The joints between rings and between rings and the base and top will be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.
 - 3. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.
- D. Rectangular Structures:
 - 1. Precast concrete structures will be placed on a 8 inch (200 mm) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section will be set on an 8

inch (200 mm) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.

2. Do not build structures when air temperature is 32 deg F (0 deg C), or below.
3. Invert channels will be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
 - a. Forming directly in concrete base of structure.
 - b. Building up with brick and mortar.
4. Floor of structure outside the channels will be smooth and slope toward channels not less than 1 to 12 or more than 1 to 6. Bottom slab and benches will be concrete.
5. The wall that supports access rungs or ladder will be 90 deg vertical from the floor of structure to manhole cover.
6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders will not move or flex when used. All loose steps and ladders will be replaced by the Contractor.
7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers will not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation will be 2 inches (50 mm) above the adjacent finish grade. Install an 8 inch (203 mm) thick, by 12 inch (300 mm) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.8 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.9 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete.
- B. Construct riprap of broken stone.
- C. Install outlets that spill onto grade, anchored with concrete.
- D. Install outlets that spill onto grade, with flared end sections that match pipe.

E. Construct energy dissipaters at outlets.

3.10 DRY WELL INSTALLATION

N/A

3.11 CHANNEL DRAINAGE SYSTEM INSTALLATION

N/A

3.12 STORMWATER DISPOSAL SYSTEM INSTALLATION

N/A

3.13 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section FACILITY STORM DRAINAGE PIPING.
- B. Encase entire connection fitting, plus 6 inch (150 mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
- C. Make connections to existing piping and underground manholes.
1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.
 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

- a. Unshielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.14 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

N/A

3.15 IDENTIFICATION

N/A

3.16 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.
 1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.

3.17 TESTING OF STORM SEWERS:

- A. Submit separate report for each test.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
4. Submit separate report for each test.
5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints will conform to ASTM C1103.
6. Test force-main storm drainage piping. Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa).
 - a. Ductile iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
 - b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
- C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.18 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

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