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DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01025

MEASUREMENT AND PAYMENT

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SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SUBMITTALS (Not Used)

1.2 RELATED REQUIREMENTS

1.2.1 Contract Clauses

Payments under fixed price construction contracts.

1.2.2 Special Clauses (Not Used)

1.3 LUMP SUM PAYMENT ITEMS

1.3.1 General

Payment items for the work of this contract for which contract lump sum payments will be made are listed in the BIDDING SCHEDULE and described below. All costs for items of work, which are not specifically mentioned to be included in a particular lump sum or unit price payment item, shall be included in the listed lump sum item most closely associated with the work involved. The lump sum price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided.

1.3.2 Lump Sum Items

(1) "Mobilization and Demobilization"

a. Payment for mobilization and demobilization will be made at the contract lump sum price for "Mobilization and Demobilization," as defined in Special Contract Requirement PAYMENT FOR MOBILIZATION AND DEMOBILIZATION, and shall include payment for project signs and barricades, and traffic control signs as specified in section 01452.

b. Unit of measure: Lump Sum (LS).

(2) "Clearing and Grubbing"

a. Payment for clearing and grubbing will be made at the contract lump sum price for "Clearing and Grubbing," which price and payment shall constitute full compensation for furnishing all plant, labor, material and equipment and performing all operations necessary for clearing of the areas specified in Section 02110 or as indicated on the drawings; for removing and disposing of all cleared materials, and for filling holes resulting from clearing operations. No reduction of the contract quantity will be made for areas within the specified cleared areas that require no clearing or that are partly cleared.

b. Unit of measure: Lump Sum (LS).

(3) "Excavation and Backfilling"

a. Payment for all costs associated with excavation and backfilling will be made at the contract lump sum price for "Excavation and Backfilling" as described in the drawings and specifications, and in particular in SECTION 02225.

b. Unit of Measure: Lump Sum (LS).

(4) "Epoxy Mortar/Concrete Repair"

a. Payment for all costs associated with epoxy mortar and concrete repair will be made at the contract lump sum price for "Epoxy Mortar/Concrete Repair" as described in the drawings and specifications, and in particular SECTION 04100.

b. Unit of Measure: Lump Sum (LS).

(5) "Environmental Protection"

a. Payment for costs associated with operations necessary for environmental protection will be made at the contract lump sum price for "Environmental Protection" as described in the drawings and specifications, and in particular SECTION 01130.

b. Unit of measure: Lump Sum (LS).

(6) "Floodwall Closures"

a. Payment for all costs associated with constructing the floodwall closures will be made at the contract lump sum price for "Floodwall Closures" as described in the drawings and specifications, and in particular Section 03308.

b. Unit of measure: Each (LS).

(7) "Street Lighting"

a. Payment for all costs associated with street lighting will be made at the contract lump sum price for "Street Lighting" which price and payment shall constitute full compensation for furnishing all plant, labor, material and equipment and performing all operations necessary for installing street lighting as specified in SECTIONS 16050, 16120, 16302, and 16528 or as indicated on the drawings.

b. Unit of measure: Lump Sum (LS).

(8) "Miscellaneous Metals"

a. Payment for miscellaneous metals will be made at the contract lump sum price for "Miscellaneous Metals" which price and payment shall constitute full compensation for furnishing all plant, labor, material and equipment and performing all operations necessary for installing all miscellaneous metal items as specified in SECTION ,05505 or as indicated elsewhere in the specifications and on the drawings.

b. Unit of measure: Lump Sum (LS).

1.4 UNIT PRICE PAYMENT ITEMS

1.4.1 General

Payment items for the work of this contract on which the contract progress payments will be based are listed in the BIDDING SCHEDULE and described below. The unit price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

1.4.2 Unit Price Items

(1) "Concrete Cap and Steps"

a. Payment for the concrete cap and steps will be made at the contract unit price per cubic yard for "Concrete Cap and Steps", which price and payment shall constitute full compensation for placing and finishing concrete for the concrete cap, and concrete steps as specified in SECTION 03308 or as indicated elsewhere in the specifications or on the drawings.

b. Measurement shall be made in the field by determining the surface area times

the concrete thickness required in the drawings.

- c. Unit of measure: Cubic Yard (CY).

(2) “Aggregate Base Course”

- a. Payment for aggregate base course will be made at the contract unit price per ton for “Aggregate Base Course” for the quantity of acceptable material measured, that is delivered to the site and incorporated in the work in full conformance with the provisions of these specifications, which price and payment shall constitute full compensation for preparing subgrade; furnishing, transporting, placing, dressing and compacting material; maintaining and final dressing of surfacing; and performing all other operations incidental to the work as described in the drawings and specifications, and in particular SECTION 02722.

- b. “Aggregate Base Course” will be measured for payment by the ton (2,000 pounds).

- c. Unit of measure: Cubic Yard (TN).

(3) “Painting”

- a. Payment for painting will be made at the contract unit price per square foot for “Painting”, which price and payment shall constitute full compensation for all costs associated with painting operations as described in the drawings and specifications, and in particular SECTION 09965.

- b. Measurement shall be made in the field by determining the painted surface area.

- c. Unit of measure: Square Foot (SF)

(4) “Non-Vapor Barrier Coating”

- a. Payment for non-vapor barrier coating will be made at the contract unit price for “Non-Vapor Barrier Coating”, which price and payment shall constitute full compensation for all costs associated non-vapor barrier coating operations as described in the drawings and specifications, and in particular SECTION 07180.

- b. Measurement shall be made in the field by determining the coated surface area.

- c. Unit of Measure: Square Foot (SF).

(5) "Joint Sealers"

a. Payment for joint sealers will be made at the contract unit price for "Joint Sealers", which price and payment shall constitute full compensation for all costs associated with joint sealer operations as described in the drawings and specifications, and in particular SECTION 07900.

b. Measurement shall be made in the field by determining the length of sealed joints.

c. Unit of Measure: Linear Foot (LF).

(6) "Cementitious Coating"

a. Payment for cementitious coating will be made at the contract unit price for "Cementitious Coating", which price and payment shall constitute full compensations for all costs associated with the cementitious coating operations as described in the drawings and specifications, and in particular SECTION 09820.

b. Measurement shall be made in the field by determining the coated surface area.

c. Unit of Measure: Square Foot (SF).

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

-- End of Section --

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01130

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SECTION 01130

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 DEFINITIONS

For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.

1.2 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, and noise pollution.

1.2.1 Environmental Protection Plan

Within 15 days after receipt of Notice of Award of the contract, the Contractor shall submit in writing an Environmental Protection Plan and, prior to starting work, meet with representatives of the Contracting Officer to develop mutual understanding relative to compliance with this provision and administration of the environmental protection program. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures. The Government reserves the right to make changes in his environmental protection plan and operations as necessary to maintain satisfactory environmental protection performance. The Environmental Protection Plan shall include but not be limited to the following:

1.2.1.1 Protection of Features

The Contractor shall determine methods for the protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection, i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological and cultural resources.

1.2.1.2 Procedures

The Contractor shall implement procedures to provide the required environmental protection and to comply with the applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes or failure to follow the procedures set out in accordance with the Environmental Protection Plan.

1.2.1.3 Permit or License

The Contractor shall obtain all needed permits or licenses.

1.2.1.4 Drawings

The Contractor shall include drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, stockpiles of earth materials, and disposal areas for excess earth material and unsatisfactory earth materials.

1.2.1.5 Environmental Monitoring Plans

The Contractor shall include environmental monitoring plans for the job site which incorporate land, water, air and noise monitoring.

1.2.1.6 Traffic Control Plan

The Contractor shall include a traffic control plan for the job site.

1.2.1.7 Surface and Ground Water

The Contractor shall establish methods of protecting surface and ground water during construction activities.

1.2.1.8 Work Area Plan

The Contractor shall include a work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. The plan shall include measures for marking the limits of use areas.

1.3 SUBCONTRACTORS

Assurance of compliance with this section by subcontractors will be the responsibility of the Contractor.

1.4 PERMITS

The Contractor shall obtain all needed permits or licenses.

1.5 REGULATORY REQUIREMENTS

The Contractor shall comply with all state regulatory and statutory requirements.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 PROTECTION OF ENVIRONMENTAL RESOURCES

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the contract drawings or specifications. Environmental protection shall be as stated in the following subparagraphs.

3.1.1 Protection of Land Resources

Prior to the beginning of any construction, the Contracting Officer will identify all land resources to be preserved within the Contractor's work area. The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without special permission from the Contracting Officer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

3.1.1.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas where no work is to be performed under this contract. Isolated areas within the general work area that are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence and during all construction operations. Where construction operations are to be conducted during darkness, the markers shall be visible during darkness. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

3.1.1.2 Protection of Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features to be preserved, indicated and defined on the drawings submitted by the Contractor as a part of the Environmental Protection Plan, shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

3.1.1.3 Reduction of Exposure of Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in instances where the constructed feature obscures borrow areas, quarries and waste material areas, these areas shall not initially be cleared in total. Clearing of such areas shall progress in reasonably sized increments as needed to use the areas as approved by the Contracting Officer.

3.1.1.4 Temporary Protection of Disturbed Areas

Such methods as necessary shall be utilized to effectively prevent erosion and control sedimentation, including but not limited to the following:

a. Retardation and Control of Runoff

Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses, and the Contractor shall also utilize any measures required by area-wide plans approved under Paragraph 208 of the Clean Water Act.

3.1.1.5 Erosion and Sedimentation Control Devices

The Contractor shall construct or install all temporary and permanent erosion sedimentation control features. Temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basin, grassing and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operable.

3.1.1.6 Location of Contractor Facilities

The Contractor's field offices, staging areas, stockpiles, storage, and temporary buildings shall be placed in areas approved by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only on approval by the Contracting Officer.

3.1.1.7 Disposal Areas on Government Property

Disposal areas on Government property shall be managed and controlled to limit material to areas designated on the contract drawings and prevent erosion of soil or sediment from entering nearby watercourses or lakes.

3.1.1.8 Temporary Excavation and Embankments

Temporary excavation and embankments shall be controlled to protect adjacent areas from contamination.

3.1.1.9 Disposal of Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. All handling and disposal shall be conducted to prevent contamination. The Contractor shall transport all solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.

3.1.1.10 Disposal of Chemical Wastes

Chemical wastes shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State, and local regulations.

3.1.1.11 Disposal of Discarded Materials

Discarded materials other than those that can be included in the solid waste category shall be handled as directed by the Contracting Officer.

3.2 HISTORICAL, ARCHAEOLOGICAL AND CULTURAL RESOURCES

Existing historical, archaeological and cultural resources within the Contractor's work area will be so designated by the Contracting Officer and precautions shall be taken by the Contractor to preserve all such resources as they existed at the time they were pointed out to the Contractor. The Contractor shall install all protection for these resources so designated on the contract drawings and shall be responsible for their preservation during this contract. If during construction items of apparent archaeological or historical interest are discovered, they shall be left undisturbed and the Contractor shall report the find immediately to the Contracting Officer.

3.3 PROTECTION OF WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management and control to avoid pollution of surface and ground waters. Special management techniques as set out below shall be implemented to control water pollution by the listed construction activities that are included in this contract.

3.3.1 Cofferdam and Diversion Operations

The Contractor shall plan his operations and perform all work necessary to minimize adverse impact or violation of the water quality standard. Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to limit impact of water turbidity on the habitat for wildlife and impacts on water quality for downstream use.

3.3.2 Stream Crossings

Stream crossings shall be controlled during construction. Crossings shall not violate water pollution control standards of the Federal, State or local government.

3.3.3 Monitoring of Water Areas Affected by Construction Activities

Monitoring of water areas affected by construction activities shall be the responsibility of the Contractor. The Contractor shall monitor all water areas affected by construction activities.

3.4 PROTECTION OF FISH AND WILDLIFE RESOURCES

The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife. Species that require specific attention shall be listed by the Contractor prior to beginning of construction operations.

3.5 PROTECTION OF AIR RESOURCES

The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the laws of the State or States in which the work is being performed and all Federal emission and performance laws and standards. Special management techniques as set out below shall be implemented to control air pollution by the construction activities which are included in the contract.

3.5.1 Particulates

Dust particles, aerosols, gaseous by-products from all construction activities, processing and preparation of materials, such as from asphaltic batch plants, shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall 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 the air pollution standards mentioned in the paragraph "PROTECTION OF AIR RESOURCES" to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

3.5.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

3.5.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

3.5.4 Monitoring Air Quality

Monitoring of air quality shall be the responsibility of the Contractor. The Contractor shall monitor all air areas affected by the construction activities.

3.6 INSPECTION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or costs or damages allowed to the Contractor for any such suspension.

3.7 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all area(s) used for construction.

3.8 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plans submitted for approval by the Contracting Officer.

3.9 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain all constructed facilities and temporary pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.10 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL

The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers and instruments required for monitoring purposes) to insure adequate and continuous environmental pollution control.

-- End of Section --

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01330

SUBMITTAL PROCEDURES

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SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUBMITTAL CLASSIFICATION

Submittals are identified with submittal description (SD) numbers and are classified as follows:

1.1.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.1.2 For Information Only (FIO)

All submittals not requiring Government approval will be for information only. These items are tagged FIO in the submittal register. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.2 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory.

Approval will not relieve the Contractor of the responsibility for any error, which may exist, as the Contractor under the CQC requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

After submittals have been approved by the Contracting Officer, no re-submittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.3 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal.

If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.4 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Prior to submittal, all items {GA and FIO} shall be checked and approved by the Contractor's Quality Control (CQC) representative and each item shall be stamped, signed, and dated by the CQC representative indicating action taken.

Proposed deviations from the contract requirements shall be clearly identified.

Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby.

Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3.2 SUBMITTAL REGISTER (ENG FORM 4288R)

At the end of this section is one set of ENG Form 4288R listing items of equipment and materials for which submittals are required by the specifications; this list may not be all-inclusive and additional submittals may be required.

The Contractor will also be given the submittal register as a diskette containing the computerized ENG Form 4288R and instructions on the use of the diskette. Columns "d" through "r" have been completed by the Government; the Contractor shall complete columns "a" and "s" through "u" and submit the forms (hard copy plus associated electronic file) to the Contracting Officer for approval within 30 calendar days after Notice to Proceed.

The Contractor shall keep this diskette up-to-date and shall submit it to the Government together with the monthly payment request. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated.

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently.

All submittals for all interior finishes (wall, floor, ceiling), all base, casework, toilet partitions, window treatments and all other similar items requiring coordinated color selection shall be submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled.

The contractor shall allow 30 calendar days, exclusive of mailing time, and this period shown on the submittal register and NAS schedule for submittals requiring Government review and approval.

No delay damages or time extensions will be allowed for time lost in late submittals or resubmittals.

An additional 10 calendar days shall be allowed and shown on the register and NAS schedule for the review and approval of submittals for food service equipment and refrigeration and HVAC control systems.

3.4 TRANSMITTAL FORM (ENG FORM 4025R)

The sample transmittal form (ENG Form 4025R) attached to this section shall be used for submitting both Government approved and for information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Procedures

The Contractor shall be responsible for the scheduling and control of all submittals.

The Contractor is responsible for confirming that the submittal register includes all submittals required by the contract documents.

In addition to those items listed on ENG Form 4288R, the Contractor will furnish submittals for any deviation from the plans or specifications. The scheduled need dates must be recorded on the document for each item for control purposes and critical items must be tied to the contractor's approved schedule where applicable.

The Contractor will submit to the Contracting Officer for approval five (5) copies of all GA level and for all FIO level submittals. This number of copies of submittals specified in this portion of the contract shall be as specified in lieu of the number as specified by FAR 52.236-21.

Where ENG Form 4025R must be submitted prior to approval of the Construction Progress Schedule, the Contractor shall submit an initial annotated ENG Form 4288R upon which dates for submittal, approval and delivery of procurement items shall be included for the first 60 days of the work.

Upon approval of the Construction Progress Schedule, or no later than 60 days after Notice to Proceed, the Contractor shall submit final annotated copies of ENG Form 4288R-Submittal Register. Dates shall be coordinated with the approved Construction Progress Schedule to logically interface with the sequence of construction.

Furnishing the schedule shall not be interpreted as relieving the Contractor of his obligation to comply with all the specification requirements for the items on the schedule.

Contractor's Quality Control representative shall review the listing at least every 30 days and take appropriate action to maintain an effective system.

The Contractor shall furnish a list each 30 days of all submittals on which either Government's or Contractor's action is past due. This monthly list of delayed items shall also be annotated by the Contractor to show what corrective action he is taking with regard to slippages in submittal schedule that are attributable to actions by him, his subcontractors, or suppliers.

The Contractor shall provide updated submittal register data, electronically or on floppy disk, to the contracting Officer, monthly, indicating the current status and codes of all submittals in

order update the master submittal register maintained by the Contracting Officer and to assure that the contractor's schedule is being maintained.

He shall also furnish revised due dates in those cases when the original submittal schedule is no longer realistic.

The Contractor shall certify that each submittal is correct and in strict conformance with the contract drawings and specifications. All submittals not subject to the approval of the Contracting Officer will be submitted for Information purposes only, (FIO).

No Corps of Engineers action will be required for FIO submittals prior to incorporating these items into the work, but the submittal shall be furnished to the Area/Resident Engineer not less than 2 weeks prior to procurement of Contractor certified material, equipment, etc.

These Contractor approved submittals (FIO), will be used to verify that material received and used in the job is the same as that described and approved and will be used as record copies.

All samples of materials submitted as required by these specifications shall be properly identified and labeled for ready identification, and upon being certified by the Contractor and reviewed by the Contracting Officer, shall be stored at the site of the work for job site use until all work has been completed and accepted by the Contracting Officer.

Delegation of this approval authority to Contractor Quality Control does not relieve the Contractor from the obligation to conform to any contract requirement and will not prevent the Contracting Officer from requiring removal and replacement of construction not in contract conformance; nor does it relieve the Contractor from the requirement to furnish "samples" for testing by the Government Laboratory or check testing by the Government in those instances where the technical specifications so prescribe.

Contractor certified drawings will be subject to quality assurance review by the Government at any time during the duration of the contract.

No adjustment for time or money will be allowed for corrections required as a result of noncompliance with plans and specifications.

Submittals Requiring Government Approval (GA Level). Where the review authority is designated to the Government, the Contractor is required to sign the certification on ENG Form 4025R in the box beside the remarks block in Section I. The Government will code the items in block h and sign the approval action block in Section II as the approving authority.

3.5.2 Deviations

For submittals, which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025R shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal.

The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

The contractor is not authorized to take action on an approved deviation until the deviation is included in a final contract modification.

3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated.

The Contracting Officer will retain three (3) copies of the GA submittals and two (2) copies of the submittal will be returned to the Contractor-within the time specified-with action code.

Submittals requiring re-submittal to the Government are due within 15 calendar days by the contractor to avoid contractor delay to the project.

3.8 INFORMATION ONLY SUBMITTALS

Three (3) copies of the submittal will be retained by the Contracting Officer and two (2) copies returned to the contractor.

Not all FIO submittals will be reviewed by the Government. This Government review will be a quality assurance review only of a sample of the entire number of submittals. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

FIO submittals noted for re-submittal to the Government for clarification or additional data are due within 14 calendar days.

3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR
(Firm Name)

_____ Approved

_____ Approved with corrections as noted on submittal data and/or
attached sheets(s)

SIGNATURE: _____

TITLE: _____

DATE: _____

--End of Section--

1. Section 1 will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals, mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288 for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS
SUBMITTED

- | | |
|---|---|
| A -- Approved as submitted. | E -- Disapproved (See attached). |
| B -- Approved, except as noted on drawings. | F -- Receipt acknowledge. |
| C -- Approved, except as noted on drawings.
Refer to attached sheet resubmission required. | FX -- Receipt acknowledged, does not comply
as noted with contract requirements. |
| D -- Will be returned by separate correspondence. | G -- Other (<i>Specify</i>) |

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

SUBMITTAL REGISTER (ER 415-1-10)														CONTRACT NO.											
TITLE AND LOCATION CAIRO FLOODWALL RENOVATIONS														CONTRACTOR		SPECIFICATION SECTION 03308									
ACTIVITY NO.	TRANSMITTAL NO.	ITEM NO.	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL										CONTRACTOR SCHEDULE DATES		CONTRACTOR ACTION		GOVERNMENT ACTION		REMARKS				
					DRAWINGS	INSTRUMENTALS	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION	GOVERNMENT	REVIEWER	DATE	DATE	DATE	DATE	DATE	DATE					
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
			1.3	Records & Tests										X	X	C									
			1.3	Concrete Mixture Proportions	X			X	X						X	C									
			1.3	Certificates of Compliance (Cement)							X				X	C									
			1.3	Formwork				X							X	C									
			1.3	Aggregates						X					X	C									
			1.3	Certificate of Compliance (Impervious Sheet Curing Material)							X				X	C									
			1.3	Certificate of Compliance (Air-Entraining Admixture)							X				X	C									
			2.1.4	Certificate of Compliance (Water-Reducing Admixture)							X				X	C									
			2.1.5	Certificate of Compliance (Curing Compound)							X				X	C									
			2.1.7	Certified Test Reports (If Required) Scales						X					X	C									

SUBMITTAL REGISTER
(ER 415-1-10)

CONTRACT NO.

TITLE AND LOCATION CAIRO FLOODWALL RENOVATIONS CONTRACTOR SPECIFICATION SECTION 16050

ACTIVITY NO. a	TRANS-MITTAL NO. b	ITEM NO. c	SPECIFICATION PARAGRAPH NUMBER d	DESCRIPTION OF ITEM SUBMITTED e	TYPE OF SUBMITTAL										CLASSIFICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		GOVERNMENT ACTION		REMARKS z	
					DRAWINGS f	INSTALLATIONS g	INSTRUCTIONS h	SCHEMATIC i	STATEMENTS j	REPORTS k	CERTIFICATES l	SAMPLES m	RECORDS n	FORMS o	INFORMATION p	GOVERNMENT REVIEW q	APPROVAL NEEDED BY r	MATERIAL NEEDED BY t	DATE v	SUBMIT TO GOVERNMENT w	DATE y					
																						CONTRACTOR SCHEDULE DATES	CONTRACTOR ACTION	GOVERNMENT ACTION		
			1.5.1	Manufacturer's Catalog Data for all manufactured items	X								X													
			1.5.2	Installation Procedure Instructions		X							X													
			1.5.3	Manufacturer's Certifications for products, materials, finishes, and equipment							X		X													
			1.5.4	Operating Instructions for systems and equipment		X							X													

SUBMITTAL REGISTER
(ER 415-1-10)

CONTRACT NO.

TITLE AND LOCATION CAIRO FLOODWALL RENOVATIONS														CONTRACTOR			SPECIFICATION SECTION 16302								
ACTIVITY NO.	TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL										CLASSIFICATION		CONTRACTOR SCHEDULE DATES		CONTRACTOR ACTION		GOVERNMENT ACTION		REMARKS		
					DRAWINGS	INSTALLATIONS	SCHEMATIC	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	FORMS	INFORMATION	GOVERNMENT REVIEW	APPROVAL NEEDED BY	MATERIAL NEEDED BY	DATE	SUBMIT TO GOVERNMENT	DATE	REMARKS				
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
			1.3	Product data for 600 volt wires and cables	X										X										
			1.3	Test Reports for acceptance checks and tests						X					X										
			1.3	Manufacturer's Field Reports for factory engineered heat shrinkable joint kit						X					X										

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01451

CONTRACTOR QUALITY CONTROL

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SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM E 329 Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause entitled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both on-site and off-site, and shall be keyed to the proposed construction sequence.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review by the Government, not later than 15 calendar days after receipt of Notice of Award of the contract, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause entitled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 15 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2 Content of the CQC Plan

The CQC plan shall include, as a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC system manager and an alternate CQC system manager. Each shall report to the project manager or someone higher in the Contractor's organization. Project manager in this context shall mean the individual with responsibility for the overall management of the project including quality and production. Both the CQC system manager and the alternate CQC system manager shall have completed, within the last five years, the Corps sponsored course on Construction Quality Management for Contractors and shall submit copies of certificates as part of the CQC plan. No work shall be performed on this contract without the presence of the CQC system manager or the alternate CQC system manager at the job site.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager and to the alternate CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authority to adequately perform the functions of the CQC System Manager or the alternate CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager or the alternate CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with SPECIAL CONTRACT REQUIREMENT entitled "Submittals"

e. Control, verification, and acceptance testing procedures for each specific test to include

the test name, specification paragraph requiring test, feature of work to be tested, test frequency, testing laboratory , and person responsible for each test.

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the QC plan, the Contractor shall notify the Contracting Officer in writing a minimum of seven calendar days prior to any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, but before start of construction, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both on-site and off-site work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 CQC System Manager

The Contractor shall identify an individual within his organization at the worksite who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. This CQC System Manager shall be subject to acceptance by the Contracting Officer. The CQC System Manager shall be assigned as System Manager but may have other duties in addition to quality control.

3.4.2 CQC Staff

A staff shall be maintained under the direction of the CQC System Manager to perform all CQC activities. An alternate will be identified to serve in the absence of the CQC System Manager. The staff must be of sufficient size to ensure adequate CQC coverage of all work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned CQC responsibilities and must be allowed sufficient time to carry out these responsibilities. The CQC plan will clearly state the duties and responsibilities of each staff member. All CQC Staff members or replacements shall be subject to acceptance by the Contracting Officer.

3.4.3 Additional Requirement

In addition to the above requirements, the CQC System Manager and alternate shall have completed, within the last 5 years, the course entitled "Construction Quality Management for Contractors". This course is generally offered every quarter starting with the month of February. This course is periodically offered by the Memphis District as well as other Corps Districts. For further details and for the actual class schedule see the following website: http://155.76.117.11/conops/const_quality.htm.

3.5 SUBMITTALS

Submittals shall be in accordance with SPECIAL CONTRACT REQUIREMENT entitled "Submittals". The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

3.6 CONTROL

The controls shall include at least three phases of control to be conducted by the CQC System Manager for all definable features of work, as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work and shall include:

- a. A review of each paragraph of applicable specifications.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. A check to assure that provisions have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for constructing the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that phase of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. The Government shall be notified at least 24 hours in advance of beginning any of the required action of the preparatory phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of preliminary work to ensure that it is in compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verification of full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work on-site, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

As determined by the Government, additional preparatory and initial phases may be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the applicable CQC staff, on-site production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site, in accordance with paragraph 3.7.2 below. The Contractor shall perform the following activities and record and provide the following data

:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, will be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an off-site or commercial test facility will be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing at Validated Laboratories

3.7.2.1 Laboratory Validation.

All testing of soil, gravel, aggregate, stone, concrete, and asphalt shall be performed by a testing laboratory validated by the Material Testing Center (MTC) of the Corps of Engineers. Refer to the MTC website <http://www.wes.army.mil/SL/MTC/ValStatesTbl.htm> for a complete and current list of validated commercial laboratories. If the Contractor proposes to use a commercial laboratory that is not validated or set up an on-site laboratory, he shall make arrangements for validation by contacting the Material Testing Center at Waterways Experiment Station, Vicksburg, Mississippi, telephone number: 601-634-3974, <http://www.wes.army.mil/SL/MTC/inspection.htm>. The Government will not be responsible for any cost associated with the validation of laboratories that are not currently validated. The validation process could take 60 to 90 days or more. The Contractor shall be responsible for determining the amount of time required for the validation of the proposed laboratory and accounting for this event in his progress schedule. If the Contractor elects to use a non-validated laboratory, work requiring testing shall not commence until the laboratory has been validated by MTC.

3.7.2.2 Capability Check

The Contracting Officer reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck.

If the selected laboratory fails the capability check, the Contractor will be assessed a charge to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor. There will be no extension of time allowed due to necessity to perform capability rechecks.

3.7.3 On-Site Laboratory

The Contracting Officer reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered by the Contractor to a location specified by the Contracting Officer.

3.8 COMPLETION INSPECTION

At the completion of all work or any increment thereof established by a completion time stated in the Special Contract Requirements entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Government. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network

Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals reviewed, with contract reference, by whom, and action taken.
- g. Off-site surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and/or specifications.
- j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01452

PROJECT SIGNS, BARRICADES, AND TRAFFIC CONTROL SIGNS

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SECTION 01452

PROJECT SIGNS, BARRICADES, AND TRAFFIC CONTROL SIGNS

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing, erecting, maintaining, and removing project sign, barricades, and traffic control signs.

1.2 PROJECT SIGNS

The Contractor shall furnish, erect, and maintain two single faced project signs at the floodwall site, at the specific locations designated by the Contracting Officer. The signs shall be constructed of 3/4-inch A-C exterior plywood or 22 gage metal, mounted on a substantial framework of 2-inch material. Size, lettering, color and paint shall conform to the details shown on the drawing "Temporary Project Sign" included at the end of this section. Upon request, the Government will furnish without cost to the Contractor one decal of the Engineer Castle. The signs shall be erected as soon as practicable, but not later than 15 calendar days after the date established for commencement of work. The signs shall be removed upon completion of all other construction work under the contract and will become the property of the Contractor.

1.3 BARRICADES AND TRAFFIC CONTROL SIGNS

Any barricades and/or traffic control signs deemed necessary by the Contracting Officer shall conform to the "Manual on Uniform Traffic Control Devices for Streets and Highways," Current Edition.

1.4 PAYMENT

No separate payment will be made for erecting, maintaining and removing barricades and traffic control signs, and all costs in connection therewith will be considered an incidental obligation of the Contractor and included in Item 0001 – Mobilization and Demobilization.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

--End of Section--

DIVISION 2 - SITE WORK

SECTION 02110

CLEARING AND GRUBBING

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SECTION 02110

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all plant, labor, equipment, and materials, and performing all operations necessary for the clearing and grubbing of the areas specified herein; for the disposal of debris from clearing and grubbing; and for the filling of grubbing holes, all as specified herein and/or indicated on the drawings.

1.2 QUALITY CONTROL

The Contractor shall establish and maintain quality control for the work specified in this section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including but not limited to the following:

(1) Clearing

Location and limits.

(2) Grubbing

Location, limits, depths, refill of holes and compaction.

(3) Disposition of Debris

Location and limits.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

Clearing shall consist of the complete removal above the ground surface and/or excavated surface, as applicable, of all trees, stumps, down timber, fencing, snags, brush, vegetation, and other debris. Areas to be cleared shall include all specific areas where any work is required; the area at the top of the floodwall where the concrete cap is to be placed; all areas within 20 ft. along the wall; and all other areas within the right-of-way limits which are necessary for construction operations and operation of the Contractor's equipment. Unnecessary removal of trees or damage to trees to be left

standing will not be allowed. If regrowth of vegetation or trees occurs after clearing and before applicable construction, the Contractor will be required to clear the area again prior to construction operations and no payment will be made therefor.

3.2 GRUBBING

Grubbing shall consist of the removal of all stumps; tap roots, buried logs, and other projections. The areas to be grubbed are those specific areas within the limits specified hereinabove from which trees, stumps, down timber, fencing, snags, and other projections have been removed as specified in 3.1 above. All objectionable matter shall be removed from excavated materials that will subsequently be used in the embankments or backfills. All holes caused by grubbing, except in excavations, shall be filled with suitable material meeting the requirements of Section 02225 in 12-inch layers to the elevation of the adjacent ground surface or excavated surface, as applicable, and each layer compacted to a density at least equal to that of the adjoining undisturbed material.

3.3 DISPOSAL OF DEBRIS

3.3.1 General

All debris resulting from clearing and grubbing operations on this contract shall be disposed of by removal from the site.

3.3.2 Removal from Site

The Contractor shall remove from the site all debris resulting from clearing and grubbing operations for disposal off-site. Such disposal shall comply with all applicable Federal, State and local laws. The Contractor may, at his option retain for his own use or disposal by sale or otherwise any such materials of value. The Government assumes no responsibility for the protection or safekeeping of any materials retained by the Contractor. Such materials shall be removed from the site of the work before the date of completion of the work. The locations and manner of placement of clearing and grubbing debris on the right-of-way by the Contractor for his convenience prior to removal of the debris from the site of the work shall be subject to the approval of the Contracting Officer. If debris from clearing operations is placed on adjacent property, the Contractor shall obtain, without cost to the Government, additional right-of-way for such purposes. Such material shall be so placed as not to interfere with roads, drainage or other improvements and in such a manner as to eliminate the possibility of its entering into channels, ditches, or streams. The Contractor shall furnish written evidence to the Contracting Officer of permission from the property owner, for disposal of material on the owner's property. The written evidence shall consist of an authenticated copy of the conveyance under which the Contractor acquired the property rights and access thereto, prepared and executed in accordance with the laws of the State of Illinois. If temporary rights are obtained by the Contractor, then the period of time shall coincide with SECTION 00800 paragraph 1.1 thereof, plus a reasonable time for any extension granted for completion of the work.

--End of Section--

DIVISION 2 - SITE WORK

SECTION 02225

EARTHWORK

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SECTION 02225

EARTHWORK

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all plant, labor, materials, equipment, and performing all operations necessary for excavation, backfilling, and all other operations incidental thereto.

1.2 QUALITY CONTROL

The Contractor shall establish and maintain quality control for the work specified in this section to assure compliance with the contract requirements and maintain record of his quality control for all construction operations including but not limited to the following:

1.2.1 Excavation

Layout, bottom width, grades, and slopes along the floodwall.

1.2.2 Fill Limits, Compaction, and Tolerances

A copy of these records and tests, as well as the records of corrective action taken, shall be furnished the Government.

1.3 REFERENCE STANDARDS

The following publication of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS.

D 698-91

Laboratory Compaction Characteristics of Soil Using
Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))

D 1556-90	Density and Unit Weight of Soil in Place by the Sand-Cone Method Cmt 1
D 2216-92	Water (Moisture) Content of Soil and Rock
D 2922-91	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXCAVATION

3.1.1 General

The Contractor shall excavate and remove all material of whatever nature encountered as may be necessary to provide a stable base for the aggregate base course, or to provide access for repair of expansion joints, spalls, cracks, and any defective areas on the floodwall, as specified herein. Side slopes of the excavation shall be made as indicated on the drawings and/or as directed. The contractor shall excavate material from the top of the floodwall to the elevations required on the drawings and/or as directed, and shall keep earthen material separate from gravel material.

3.2 BACKFILLING

3.2.1 Materials

Materials for backfilling shall be those materials resulting from the required excavation. No unsuitable organic or inorganic matter, sticks, trash, building debris, brush, trees, tree roots, stumps, rubbish, sod, mulch, frozen material or any other objectionable matter shall be placed therein. The Contractor shall, when directed, remove any materials that the Contracting Officer considers to be objectionable. No backfill shall be placed on or against concrete or other repair materials less than 14 days old without prior approval of the Contracting Officer.

3.2.2 Placement of Fill

Any approved equipment may spread the fill materials, and each layer shall be compacted as specified in 3.2.3 below. Crawler-type tractors, tamping rollers, and self-propelled vibratory equipment shall not be used within 2 feet of the floodwall. Fill within 2 feet of the floodwall shall be placed in maximum layer of 6 inches in thickness before compaction and compacted by means of hand-operated mechanical tampers. All fill shall be kept thoroughly drained, and no fill shall be placed on frozen ground. When, in the opinion of the Contracting Officer, the surface of any layer is too smooth to bond properly with the succeeding layer, it shall be adequately scarified before the original grade will be permitted in the final dressing.

3.2.3 Compaction

Each layer of the embankment shall be compacted to a density of at least 95 percent of the laboratory density obtained by the standard density test (ASTM D 698). The field density determination shall be by the Sand-Cone Method (ASTM D 1556) or the Nuclear Method (ASTM D 2922, Method B). The moisture content after compaction shall be within the limits of 2 percentage points below optimum moisture content as determined by the Contractor in accordance with ASTM D 698. The field moisture content after compaction shall be performed in accordance with ASTM D 2216. The materials may require moistening or aerating as necessary to provide the above-specified moisture content. The Contractor will perform standard density tests as specified in ASTM D 698 for each type of material used in the fill to determine optimum water content and maximum densities and will perform field density and water content tests. The Contractor shall perform field density and water content tests on each layer of material to assure that proper compaction is being achieved. The location where the Contractor is to take the field density and water content tests shall be as specified by the Contracting Officer.

3.2.4 Excess Material

Any excess excavated material shall remain the property of the City of Cairo and shall be hauled to various off-site dumping locations within the city limits of Cairo IL as determined in the field and directed by the Contracting Officer. Upon delivery to the dumping locations, all environmental requirements for storage shall become the responsibility of the City of Cairo.

-End of Section-

DIVISION 2 – SITE WORK

SECTION 02722

AGGREGATE BASE COURSE

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SECTION 02722

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop
AASHTO T 224	(1996) Correction for Coarse Particles in the Soil Compaction Test

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(1988; R 1993e1) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(1997) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in AASHTO T 180, Method D and corrected with AASHTO T 224.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools;

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

Waybills and Delivery Tickets;

Copies of waybills and delivery tickets during the progress of the work. Before the final statement is allowed, the Contractor shall file certified waybills and certified delivery tickets for all aggregates actually used.

SD-06 Test Reports

Sampling and testing;
Field Density Tests;

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 5 days before material is required for the work.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with AASHTO T 180, Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

1.4.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 2167.

1.4.2.5 Wear Test

Wear tests shall be made on ABC course material in conformance with ASTM C 131.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis .
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.

1.4.3.2 In Place Tests

Each of the following tests shall be performed on samples taken from the placed and compacted ABC. Samples shall be taken and tested at the rates indicated.

- a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.
- b. Sieve Analysis shall be performed for every 500 tons, or portion thereof, of material placed.
- c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

1.4.4 Approval of Material

The source of the material shall be selected 15 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted ABC.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 AGGREGATES

The ABC shall consist of clean, sound, durable particles of crushed stone, crushed gravel, angular sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregate

Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.

2.1.1.1 Aggregate Base Course

ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In

the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

2.1.2.1 Aggregate Base Course

ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 1.5 inches and shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	% Passing

2 inch	----
1-1/2 inch	100
1 inch	60-100
1/2 inch	30-65
No. 4	20-50
No. 10	15-40
No. 40	5-25
No. 200	0-8

NOTE 1: Particles having diameters less than 0.0008 inch shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with hand brooms. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from offsite sources.

3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated by the Contracting Officer. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the ABC, the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the ABC, the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 02225 EARTHWORK. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein

shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the ABC. Stabilization shall be accomplished by mixing ABC into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the ABC is placed.

3.5 INSTALLATION

3.5.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make adjustments in mixing procedures or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory ABC meeting all requirements of this specification.

3.5.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness. When a compacted layer 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 6 inches or less than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the ABC is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable ABC.

3.5.3 Grade Control

The finished and completed ABC shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required ABC thickness so that the finished ABC with the subsequent concrete cap will meet the designated grades.

3.5.4 Compaction

Each layer of the ABC shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 5 percent of the optimum water content determined from laboratory tests as specified in

paragraph SAMPLING AND TESTING. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 95 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory ABC. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.5.5 Thickness

Compacted thickness of the aggregate course shall be as indicated. No individual layer shall exceed 6 inches nor be less than 3 inches in compacted thickness. The total compacted thickness of the ABC course shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the ABC course shall be measured at intervals in such a manner as to ensure one measurement for each 100 square yards of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

3.5.6 Finishing

The surface of the top layer of ABC shall be finished after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of ABC is 1/2 inch or more below grade, then the top layer should be scarified to a depth of at least 3 inches and new material shall be blended in and compacted to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

3.5.7 Smoothness

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by

removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.6 MAINTENANCE

The ABC shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any ABC that is not paved over with the concrete cap prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of ABC that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.7 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of as directed. No additional payments will be made for materials that must be replaced.

DIVISION 03 - CONCRETE

SECTION 03308

CONCRETE

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CONCRETE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE (ACI)

- ACI 308 (1992) Standard Practice for Curing Concrete
- ACI 318 (1992; Errata) Building Code Requirements for Reinforced Concrete
- ACI 347 (1989) Formwork for Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A185 (1990a) Steel Welded Wire Fabric. Plain, for Concrete Reinforcement
- ASTM A615 (1992b) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- ASTM C 31 (1991) Making and Curing Concrete Test Specimens in the Field
- ASTM C 33 (1992a) Concrete Aggregates
- ASTM C 39 (1986) Compressive Strength of Cylindrical Concrete Specimens
- ASTM C 94 (1992a) Ready-Mixed Concrete
- ASTM C 143 (1990a) Slump of Hydraulic Cement Concrete
- ASTM C150 (1997) Specification for Portland Cement
- ASTM C172 (1990) Practice for Sampling Freshly Mixed Concrete

ASTM C231	(1997) Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	(1993) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 595	(1993) Blended Hydraulic Cements
ASTM C 618	(1993) Fly Ash and Raw or Calcined Natural Pozzolan For Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 685	(1992a) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 1107	(1997) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

CORPS OF ENGINEERS (COE)

COE CRD-C 400	(1963) Water for Use in Mixing or Curing Concrete
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinyl chloride Waterstop
COE CRD-C 621	(1993) Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink)

1.2 SYSTEM DESCRIPTION

1.2.1 Design Requirements

1.2.1.1 Concrete Mixture Proportions

Compressive strength f_c for wall closures shall be 4,000-lb/sq in. at 28 days (90 days if Pozzolan is used). Compressive strength f_c for all other concrete shall be 3,000-lb/sq in. at 28 days (90 days if Pozzolan is used). The maximum nominal size coarse aggregate

shall be $\frac{3}{4}$ in. The air content shall be between 4.5 and 7.5 percent. The slump shall be between 2 and 5 in. The maximum water cement ratio shall be 0.50.

1.2.2 Performance Requirements

1.2.2.1 Strength

Acceptance test results will be the average strengths of two specimens tested at 28 days (90 days if Pozzolan is used). The strength of the concrete will be considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f_c , and no individual acceptance test result falls below f_c by more than 500 lb/sq in.

1.2.2.2 Construction Tolerances

A Class "C" finish shall apply to all surfaces except those specified to receive a Class "D" finish. A Class "D" finish shall apply to all surfaces that will be permanently concealed after construction. The surface requirements for the classes of finish required shall be as specified in ACI 347.

1.2.3 Construction Testing

The Contractor shall provide facilities and labor as may be necessary for procurement and testing of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Concrete will be sampled in accordance with ASTM C 172. Slump and air content will be determined in accordance with ASTM C 143 and ASTM C 231, respectively, when cylinders are molded. Compression test specimens will be made, cured, and transported in accordance with ASTM C 31. Compression test specimens will be tested in accordance with ASTM C 39. Samples for strength tests will be taken not less than once each shift in which concrete is produced from each class of concrete required. A minimum of three specimens will be made from each sample, two will be tested at 28 days (90 days if Pozzolan is used) for acceptance, and one will be tested at 7 days for information.

1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES.

SD-01 Data

Air-entraining Admixture; FIO. Concrete Mixture Proportions; FIO. Curing Materials; FIO.

The Contractor shall submit manufacturer's literature from suppliers that demonstrate compliance with applicable specifications for all equipment and materials.

SD-07 Schedules

Placing; FIO.

The methods and equipment for transporting, handling, depositing, and consolidating the concrete shall be submitted to the Contracting Officer prior to the first concrete placement.

SD-08 Statements

Formwork; FIO. Concrete Mixture Proportions; FIO.

Formwork design shall be submitted to the Contracting Officer prior to the first concrete placement.

Concrete mixture proportions shall be the responsibility of the Contractor and shall be designed in accordance with the criteria in PART 2 PRODUCTS. Ten days prior to placement of concrete, the Contractor shall submit to the Contracting Officer the mixture proportions that will produce concrete of the qualities required. Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. All materials included in the mixture proportions shall be of the same type and from the same source as will be used on the project.

SD-09 Reports

Aggregates; FIO. Concrete Mixture Proportions; FIO. Tests; FIO.

Aggregates will be accepted on the basis of test reports that show the material meeting the requirements of the specifications under which it is furnished.

Applicable test reports shall be submitted to verify that the concrete mixture proportions selected will produce concrete of the quality specified.

The results of all tests and inspections conducted at the project site shall comply with SECTION 01451, CONTRACTOR QUALITY CONTROL.

SD-13 Certificates

Cement; FIO.

Cementitious Material will be accepted on the basis of a manufacturer's certificate of compliance.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cement

Cement shall be Portland cement and shall conform to appropriate specifications listed below:

2.1.1.1 Portland Cement

ASTM C 150, Type I, low alkali.

2.1.2 Pozzolan

Pozzolan shall conform to ASTM C 618, Class C or F, including requirements of Tables 1A and 2A.

2.1.3 Aggregates

Aggregates shall meet the quality and grading requirements of ASTM C 33 Class Designations 4M and equal or exceed state statutory and/or regulatory requirements specified in paragraph REGULATORY REQUIREMENTS.

2.1.4 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed below. Chemical admixtures that have been in storage at the project site for longer than 6 months or that have been subjected to freezing shall be retested at the expense of the contractor, at the request of the Contracting Officer, and shall be rejected if test results are not satisfactory.

2.1.4.1 Air-Entraining Admixture

ASTM C 260

2.1.4.2 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D.

2.1.5 Curing Materials

Curing materials shall comply with the following:

2.1.5.1 Impervious Sheet Materials

ASTM C 171, type optional, except polyethylene film, if used, shall be white opaque.

2.1.5.2 Membrane - Forming Curing Compound

ASTM C 309, Type 1-D or 2, Class A.

2.1.6 Water

Water for mixing and curing shall be fresh, clean, potable, and free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

2.1.7 Reinforcement Steel

Reinforcing steel bar shall conform to the requirements of ASTM A 615, Grade 60. Welded steel wire fabric shall conform to the requirements of ASTM A 185-94. Details of reinforcement not shown on drawings shall be in accordance with ACI 318, Chapters 7 and 12.

2.1.8 Formwork

Forms shall be of wood, steel, or other approved material. The type, size, shape, quality, and strength of all materials of which the forms are made shall be subject to approval by the Contracting Officer. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor.

2.1.9 Form Coatings

Forms for exposed surfaces shall be coated with nonstaining form oil, which shall be applied shortly before concrete is placed.

2.1.10 Waterstop

Waterstops shall be polyvinyl chloride and shall meet requirements of U.S. Army Corps of Engineers Handbook for Concrete and Cement (CRD) Specifications CRD-C 572. The waterstops shall be of the size and shape as shown on the drawings. Butt-Splices shall be made by heat-sealing in accordance with the manufacturer's recommendations. All other splices shall be performed by the manufacturer.

2.1.11 Epoxy Grout

Epoxy grout for embedment of waterstop material and new reinforcing steel into existing concrete shall meet requirements of ASTM C 1107, Grade A, and U.S. Army Corps of Engineers Handbook for Concrete and Cement (CRD) Specifications CRD-C 621.

2.1.12 Preformed Joint Filler

Preformed joint filler shall be a premolded, nonextruding material meeting the requirements of ASTM D 1751 and of the thickness and shape shown on the drawings.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 General

Construction joints shall be prepared to expose coarse aggregate, and the surface shall be clean, damp, and free of laitance. Ramps and walkways, as necessary, shall be constructed to allow safe and expeditious access for concrete and workmen. Snow, ice, standing or flowing water, loose particles, debris, and foreign matter shall have been removed. Earth foundations shall be satisfactorily compacted. Spare vibrators shall be available. Prior to placing, the entire preparation shall be accepted by the Government.

3.1.2 Embedded Items

Reinforcement shall be secured in place; joints, anchors, and other embedded items shall have been positioned. Internal ties shall be arranged so that when the forms are removed all metal will be not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matter such as loose coating or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

3.1.3 Formwork Installation

3.1.3.1 General

Forms shall be properly aligned, adequately supported, and mortar-tight. The form surfaces shall be smooth, free from irregularities, dents, sags, or holes when used for permanently exposed faces. All exposed joints and edges shall be chamfered, unless otherwise indicated.

3.1.4 Production of Concrete

3.1.4.1 Ready-Mixed Concrete

Ready-mixed concrete shall conform to ASTM C 94, except as otherwise specified.

3.1.4.2 Volumetric Batching and Continuous Mixing

Volumetric batching and continuous mixing shall conform to ASTM C 685.

3.1.4.3 On-Site Batching and Mixing

The Contractor shall have the option of using an on-site batching and mixing facility. The facility shall provide sufficient capacity to prevent cold joints. The method of measuring materials, batching operation, and mixer shall be submitted by the Contractor for review by the Contracting Officer. On-site plant shall conform to the requirements of either ASTM C 94 or ASTM C 685.

3.2 PLACING

3.2.1 General

Concrete placement shall not be permitted when, in the opinion of the Contracting Officer, weather conditions prevent proper placement and consolidation. When concrete is mixed and/or transported by a truck mixer, the concrete shall be delivered to the site of the work and discharge shall be completed within 1-1/2 hours or 45 minutes when the placing temperature is 85 degrees F or greater unless a retarding admixture is used. Concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Concrete shall be deposited as close as possible to its final position in the form and be so regulated, that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. The placement shall be carried on at such a rate that formation of cold joints will be prevented. Concrete to be poured as a cap to the floodwall shall be in a layer of approximately 4 inches. The fill material on the top of the floodwall shall be excavated as described in SECTION 02225 prior to placing the concrete cap. Sand may be used to level the material that forms the base for the concrete cap.

3.2.2 Cold-Weather Requirements

No concrete placement shall be made when the ambient temperature is below 35 degrees F, nor if the ambient temperature is below 40 degrees F and falling. Suitable covering and other means, as approved by the Contracting Officer, shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Salt, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing. Any concrete damaged by freezing shall be removed and replaced at the expense of the Contractor.

3.2.3 Hot-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI 308, is expected to exceed 1.2 lb. per square foot per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material, shall be made in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow.

3.3 FORM REMOVAL

Forms shall not be removed before the expiration of 24 hours after concrete placement, except where otherwise specifically authorized. Supporting forms and shoring shall not be removed until the concrete has cured for at least 5 days. When conditions on the work are such as to justify the requirement, forms will be required to remain in place for longer periods.

3.4 FINISHING

3.4.1 General

No finishing or repair will be done when either the concrete or the ambient temperature is below 50 degrees F.

3.4.2 Finishing Formed Surfaces

3.4.2.1 General

All fins and loose materials shall be removed, and surface defects including tie holes shall be filled. All honeycomb areas and other defects shall be repaired. All unsound concrete shall be removed from areas to be repaired. Surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. The prepared area shall be brush-coated with an approved epoxy resin or latex-bonding compound or with a neat cement grout after dampening and filled with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of Portland cement and white cement, so that the final color when cured will be the same as adjacent concrete.

3.4.3 Finishing Unformed Surfaces

All unformed surfaces that are not to be covered by additional concrete or backfill shall be float finished, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown on the drawings and left as a true and regular surface. Exterior surfaces shall be sloped for drainage unless otherwise shown on the drawings. Joints shall be carefully made with a jointing tool. Unformed surfaces shall be finished to a tolerance of 3/8 inch for a float finish as determined by a 10 foot

straightedge placed on surfaces shown on the plans to be level or having a constant slope. No water or cement shall be added to the surface during finishing.

3.4.3.1 Float Finish

Surfaces to be float finished shall be screed and darried or bull floated to eliminate the ridges and to fill in the voids left by the screed. In addition, the derby or bull float shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete will support a person's weight without deep imprint, floating should be completed. Floating should embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

3.5 CURING AND PROTECTION

Beginning immediately after placement and continuing for at least 7 days, except for concrete made with Type III cement, at least 3 days, all concrete shall be cured and protected from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to the rain or flowing water. All materials and equipment needed for adequate curing and protection shall be available and at the site of placement prior to the start of concrete placement. Preservation of moisture for concrete surfaces not in contact with forms shall be accomplished by one of the following methods:

- a. Continuous sprinkling or ponding.
- b. Application of absorptive mats or fabric kept continuously wet.
- c. Application of sand kept continuously wet.
- d. Application of impervious sheet material conforming to ASTM C 171.
- e. Application of membrane forming curing compound conforming to ASTM C 309, Type 1-D on surfaces permanently exposed to view, and Type 2 on other surfaces shall be accomplished in accordance with manufacturer's instruction.

The preservation of moisture for concrete surfaces placed against wooden forms shall be accomplished by keeping the forms continuously wet for 7 days, except for concrete made with Type III cement, 3 days. If forms are removed prior to end of the required curing period, other curing methods shall be used for the balance of the curing period. During the period of protection removal, the temperature of the air in contact with the concrete shall be not be allowed to drop more than 25 degrees F within a 24 hour period.

3.6 TESTS

3.6.1 General

The individuals who sample and test concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to ACI minimum guidelines for certification of concrete Field Testing Technicians, Grade I.

3.6.2 Frequency of Testing

3.6.2.1 Air Content

Air content will be checked at least once during each shift that concrete is placed. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 231.

3.6.2.2 Slump

Slump shall be checked once during each shift that concrete is produced. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 143.

-End of Section -

DIVISION 04 – MASONRY

SECTION 04100

EPOXY MORTAR

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DIVISION 4 – MASONRY

SECTION 04100

EPOXY MORTAR

PART 1 GENERAL

1.1 SCOPE

Where indicated on the contract drawings, this item shall consist of furnishing all materials, labor, tools, equipment, and incidentals necessary for repairing spalls or popouts and in accordance with the contract drawings and these specifications.

1.2 REFERENCE STANDARDS

American Society for Testing and Materials (ASTM)

C 33-92A Concrete Aggregate

C 881-90 Epoxy-Resin-Base bonding Systems for Concrete

PART 2 PRODUCTS

2.1 MATERIALS

The epoxy mortar shall consist of an epoxy resin meeting the requirements of ASTM C 881, Type 1, mixed with dry concrete sand conforming to ASTM C 33, in proportions specified by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Spalls and Popouts

A chipping hammer shall remove all unsound concrete. Concrete around reinforcement is to be removed at least 1 inch beyond reinforcement to be able to remove rust. The area should be thoroughly cleaned per manufacturer's recommended method to remove all loose particles and rust. The epoxy mortar shall be mixed and installed in accordance with the manufacturer's written instructions.

3.1.2 Cracks

All unsound concrete shall be removed by routing the cracks. Concrete around reinforcement should be removed until clean uncorroded steel is reached. All rust and scale must be removed from the reinforcement. The area should be thoroughly cleaned per manufacturer's recommended method to remove all loose particles. The epoxy mortar shall be mixed and installed in accordance with the manufacturer's written instructions.

3.2 CURING

The epoxy mortar shall be cured in accordance with the manufacturer's written instructions.

-End of Section-

DIVISION 5 – METALS: STRUCTURAL AND MISCELLANEOUS

SECTION 05505

MISCELLANEOUS METALS

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DIVISION 5 – METALS: STRUCTURAL AND MISCELLANEOUS

SECTION 05505

MISCELLANEOUS METALS

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all shop drawings, plants, labor, materials, and equipment, and installing all miscellaneous metal items as specified herein and/or as shown on the drawings.

1.2 QUALITY CONTROL

The Contractor shall establish and maintain quality control for the work specified in this section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including but not limited to the following:

(1) Materials

Suitability for use in the work, adherence to specification standards, timely submission of certifications.

(2) Fabrication

Adherence to applicable specification standards; shapes, dimensions and assembly in conformance with approved shop drawings or brochures, timely submission of item listings with governing codes.

(3) Installation

Coatings, handling, positioning, alignment, elevations, anchoring, painting, adjustments, hoist capacity, clearances.

(4) Shop Drawings and Submittals

Review of all submittals for accuracy prior to submission.

A copy of these records and tests, as well as the records of corrective action taken, will be furnished the Government.

1.3 APPLICABLE PUBLICATIONS

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 53-96	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A 307-94	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
F 883-97	Standard Performance Specification for Padlocks

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Fabricated Metal Items; FIO

The Contractor shall prepare and submit to the Contracting Officer for approval shop drawings for all metalwork and structural steel requiring fabrication. Where materials are standard, data including specifications and descriptions shall be submitted. All welds shall be indicated by standard welding symbols of the AWS. Shop drawings and data shall be submitted in accordance with the requirements of Section 00800, paragraph 1.16.

SD-03 Product Data

Product brochures; FIO

Brochures describing the padlocks shall be submitted to the Contracting Officer.

SD-07 Certificates

Welder's qualification; FIO

Certification that each welder is qualified in accordance with AWS Code D1.1 shall be provided. Any welder shall be retested and recertified when the work of the welder creates a reasonable doubt as to his proficiency. Tests, when required, shall be conducted at no additional expense to the Government. Recertification of the welder shall be submitted only after the welder has taken and passed the required retest.

PART 2 PRODUCTS

2.1 PADLOCKS

Padlocks shall conform to **ASTM F883** Grade 4, Size 1 3/4 inch. Padlocks shall be keyed alike and each lock shall be furnished with four (4) keys. One (1) padlock per stoplog storage bin shall be provided by the Contractor.

PART 3 EXECUTION

3.1 FABRICATION

Miscellaneous metal items not covered by nationally recognized codes, shall be fabricated in accordance with the applicable provisions of the AISC Specification. The miscellaneous items, which are fabricated under national codes other than AISC Specifications, shall be listed and a list of those items along with the governing codes shall be furnished to the Contracting Officer in accordance with the requirements pertaining to Shop Drawings. All fabrication and assembly shall be done in the shop to the greatest extent possible. The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural steel and miscellaneous metal items.

3.2 STORAGE OF MATERIALS

Material shall be stored out of contact with the ground in such manner and location as will minimize contamination and deterioration.

3.3 HANDRAILS

The Contractor shall furnish and install handrails at the locations as shown on the drawings. The handrails and posts shall be fabricated of pipe conforming to ASTM A 53, Type S, Grade A, Schedule 40 for rails and Schedule 80 for posts. The handrails and posts shall be of welded construction and hot dipped galvanized after fabrication. The size of the rails and posts shall be as shown on the drawings and they shall be erected to proper line and grade and attached in the manner and at the locations shown on the drawings.

--End of Section--

DIVISION 6 – WOOD

(NOT USED)

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07180

NON-VAPOR-BARRIER COATING

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DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07180

NON-VAPOR-BARRIER COATING

PART 1 GENERAL

1.1 SCOPE

This item shall consist of furnishing all materials, labor, tools, equipment, and incidentals necessary for coating all monolith surfaces in accordance with the contract drawings and these specifications.

PART 2 PRODUCTS

2.1 MATERIALS

The non-vapor-barrier coating shall be Thoroglaze, by Thoro System Products, or Sikagard 70, by Silka, or approved equal.

PART 3 EXECUTION

3.1 APPLICATION

The non-vapor-barrier coating shall not be applied until the cementitious coating has been allowed to cure. The non-vapor-barrier coating shall be applied in two coats in accordance with the manufacturer's written instructions.

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DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07900

JOINT SEALERS

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DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SCOPE

This item shall consist of furnishing all materials, labor, tools, equipment, and incidentals necessary for sealing all joints in accordance with the contract drawings and these specifications.

1.2 REFERENCE STANDARDS

American Society for Testing and Materials (ASTM)

C 920-87 Elastomeric Joint Sealants

PART 2 PRODUCTS

2.1 MATERIALS

The joint sealer used shall conform to ASTM C 920, Type S or M and shall be grade NS.

PART 3 EXECUTION

3.1 PREPARATION

Expansion joints shall be cleaned free of existing joint material. Any spalls adjacent to the joint shall be repaired and allowed to cure before installation of the joint sealant.

3.2 INSTALLATION OF JOINT SEALER

Joint sealer shall be installed in all joints in floodwall surfaces as shown on the joint sealer detail on the contract drawings and in accordance with the manufacturer's written instruction.

-End of Section-

DIVISION 8 – DOORS AND WINDOWS

(NOT USED)

DIVISION 9 – FINISHES
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PART 1 GENERAL

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3.4 CURING

3.5 MONOLITH NUMBERS

DIVISION 9 – FINISHES
SECTION 09820
CEMENTITIOUS COATINGS

PART 1 GENERAL

1.1 SCOPE

This item shall consist of furnishing all materials, labor, tools, equipment, and incidentals necessary for coating and numbering the monolith surfaces in accordance with the contract drawings and these specifications.

PART 2 PRODUCTS

2.1 MATERIALS

The cementitious wall coating material shall be Thoroseal, by Thorosystem Products, or Sikatop 144, by Sika, or approved equal. Cementitious wall coating material color shall be gray. Paint for monolith numbers shall be black and shall be compatible with the cementitious and non-vapor-barrier coating.

PART 3 EXECUTION

3.1 SIGNS AND PLAQUES

All signs and plaques attached to the wall shall be removed prior to surface preparation of the monolith to which they are attached, and shall be reinstalled at the end of all construction operations for that monolith.

3.2 SURFACE PREPARATION

All painted wall surfaces shall be sandblasted to remove all paint. All wall surfaces shall be clean and free of laitance, dust, dirt, oil, coatings, and other contaminants. Cleaning shall be accomplished using a high-pressure water jet.

3.3 APPLICATION OF CEMENTITIOUS COATING

The cementitious coating shall be mixed and applied in accordance with the manufacturer's written instructions. The coating shall be applied by brush in two coats, the first coat applied with horizontal brush strokes and the second coat with vertical brush strokes. The cementitious coating shall not be applied over the expansion joint sealer.

3.4 CURING

The cementitious coating shall be cured in accordance with the manufacturers written instructions.

3.5 MONOLITH NUMBERS

After curing the cementitious coating, the numbers shall be painted at each end of both the riverside and landside faces of the floodwall monoliths. The numbers shall be located 1 foot from the end of the wall and 2 feet from the top. The monolith numbers shall be 3 inches high and painted with a stencil.

-End of Section-

DIVISION 09 - FINISHES

SECTION 09965

PAINTING: HYDRAULIC STRUCTURES

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DIVISION 09 - FINISHES

SECTION 09965

PAINTING: HYDRAULIC STRUCTURES

PART 1 GENERAL

1.1 SCOPE

This item shall consist of furnishing all materials, equipment, and labor required to repair and paint all ladders, stop log guides, doors, the river gage sign frame, and all other exposed metal surfaces along the floodwall to like-new condition both structurally and aesthetically in accordance with this section.

1.2 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z87.1 (1989; R 1998) Occupational and Educational Eye and Face Protection

ASTM INTERNATIONAL (ASTM)

ASTM D 1186 (2001) Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base

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

29 CFR 1910 Occupational Safety and Health Standards
29 CFR 1910.20 Access to Employee Exposure and Medical Records
29 CFR 1910.94 Ventilation
29 CFR 1910.134 Respiratory Protection
29 CFR 1910.146 Permit-required Confined Spaces
29 CFR 1910, Subpart I Personal Protective Equipment
29 CFR 1926 Safety and Health Regulations for Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; R 2000) Power Tool Cleaning

SSPC SP 7 (2000) Brush-Off Blast Cleaning

1.3 SUBMITTALS

Government approval is required for all submittals with a “GA” designation; submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Safety and Health Provisions; FIO

The Contractor shall submit an Accident Prevention Plan in accordance with the requirements of Section 01 of EM 385-1-1. The plan shall include, but is not limited to, each of the topic areas listed in Appendix A therein and the requirements of paragraph SAFETY AND HEALTH PROVISIONS; each topic shall be developed in a concise manner to include management and operational aspects.

SD-06 Test Reports

Inspection; FIO

The Contractor shall submit records of inspections and operations performed in accordance with paragraph INSPECTION. Submittals shall be made on a daily basis.

SD-07 Certificates

Qualifications; FIO

The Contractor shall submit certification pursuant to paragraph QUALIFICATIONS for all job sites. Submittal of the qualifications and experience

of any additional qualified and competent persons employed to provide on-site environmental, safety, and health shall also be provided.

Coating Thickness Gage Qualification; FIO

Documentation of manufacturer's certification shall be submitted for all coating thickness gages.

1.4 QUALIFICATIONS

Qualifications and experience shall comply with the following.

1.4.1 Coating Thickness Gage Qualification

Documentation of certification shall be submitted for all coating thickness gages. Magnetic flux thickness gages as described in ASTM D 1186 shall be used to make all coating thickness measurements on ferrous metal substrates. Gages shall have an accuracy of 3 percent or better. Gages to be used on the job shall be certified by the manufacturer as meeting these requirements.

1.5 SAFETY AND HEALTH PROVISIONS

Work shall be performed in accordance with the requirements of 29 CFR 1910, 29 CFR 1926, EM 385-1-1, and other references as listed herein. Matters of interpretation of the standards shall be submitted to the Contracting Officer for resolution before starting work. Where the regulations conflict, the most stringent requirements shall apply. Paragraph SAFETY AND HEALTH PROVISIONS supplements the requirements of EM 385-1-1, paragraph (1). In any conflict between Section 01 of EM 385-1-1 and this paragraph, the provisions herein shall govern.

1.5.1 Abrasive Blasting

The Contractor shall comply with the requirements in Section 06.H of EM 385-1-1.

1.5.1.1 Hoses And Nozzles

In addition to the requirements in Section 20 of EM 385-1-1, hoses and hose connections of a type to prevent shock from static electricity shall be used. Hose lengths shall be joined together by approved couplings of a material and type designed to prevent erosion and weakening of the couplings. The couplings and nozzle attachments shall fit on the outside of the hose and shall be designed to prevent accidental disengagement.

1.5.1.2 Workers Other Than Blasters

Workers other than blasting operators working in close proximity to abrasive blasting operations shall be protected by utilizing MSHA/NIOSH-approved half-face or full-face air

purifying respirators equipped with high-efficiency particulate air (HEPA) filters, eye protection meeting or exceeding ANSI Z87.1 and hearing protectors (ear plugs and/or ear muffs) providing a noise reduction rating of at least 20 dBA or as needed to provide adequate protection.

1.5.2 Cleaning with Compressed Air

Cleaning with compressed air shall be in accordance with Section 20.B.5 of EM 385-1-1 and personnel shall be protected as specified in 29 CFR 1910.134.

1.5.3 Cleaning with Solvents

1.5.3.1 Ventilation

Ventilation shall be provided where required by 29 CFR 1910.146 or where the concentration of solvent vapors exceeds 10 percent of the Lower Explosive Limit (LEL). Ventilation shall be in accordance with 29 CFR 1910.94, paragraph (c)(5).

1.5.3.2 Personal Protective Equipment

Personal protective equipment shall be provided where required by 29 CFR 1910.146 and in accordance with 29 CFR 1910, Subpart I.

1.5.4 Paint Application

1.5.4.1 Further Precautions

- a. Workers shall wear nonsparking safety shoes.
- b. Solvent drums taken into the spraying area shall be placed on nonferrous surfaces and shall be grounded. Metallic bonding shall be maintained between containers and drums when materials are being transferred.
- c. Insulation on all power and lighting cables shall be inspected to ensure that the insulation is in excellent working condition and is free of all cracks and worn spots. Cables shall be further inspected to ensure that no connections are within 50 feet of the operation, that lines are not overloaded, and that they are suspended with sufficient slack to prevent undue stress or chafing.

1.5.4.3 Ignition Sources

Ignition sources, to include lighted cigarettes, cigars, pipes, matches, or cigarette lighters shall be prohibited in area of solvent cleaning, paint storage, paint mixing, or paint application.

1.5.5 Health Protection

1.5.5.1 Air Sampling

The Contractor shall perform air sampling and testing as needed to assure that workers are not exposed to contaminants above the permissible exposure limit. In addition, the Contractor shall provide the Contracting Officer with a copy of the test results from the laboratory within five working days of the sampling date and shall provide results from direct-reading instrumentation on the same day the samples are collected.

1.5.5.2 Respirators

During all spray painting operations, spray painters shall use approved SCBA or SAR (air line) respirators, unless valid air sampling has demonstrated contaminant levels to be consistently within concentrations that are compatible with air-purifying respirator Assigned Protection Factor (APF). Persons with facial hair that interferes with the sealing surface of the facepiece to face seal or interferes with respirator valve function shall not be allowed to perform work requiring respiratory protection. Air-purifying chemical cartridge/canister half- or full-facepiece respirators that have a particulate prefilter and are suitable for the specific type(s) of gas/vapor and particulate contaminant(s) may be used for nonconfined space painting, mixing, and cleaning (using solvents). These respirators may be used provided the measured or anticipated concentration of the contaminant(s) in the breathing zone of the exposed worker does not exceed the APF for the respirator and the gas/vapor has good warning properties or the respirator assembly is equipped with a NIOSH-approved end of service life indicator for the gas(es)/vapor anticipated or encountered. Where paint contains toxic elements such as lead, cadmium, chromium, or other toxic particulates that may become airborne during painting in nonconfined spaces, air-purifying half- and full-facepiece respirators or powered air-purifying respirators equipped with appropriate gas vapor cartridges, in combination with a high-efficiency filter, or an appropriate canister incorporating a high-efficiency filter, shall be used.

1.5.5.3 Protective Clothing and Equipment

All workers shall wear safety shoes or boots, appropriate gloves to protect against the chemical to be encountered, and breathable, protective, full-body covering during spray-painting applications. Where necessary for emergencies, protective equipment such as life lines, body harnesses, or other means of personnel removal shall be used during confined-space work.

1.6 MEDICAL STATUS

Prior to the start of work and annually thereafter, all Contractor employees working with or around paint systems, thinners, blast media, those required to wear respiratory protective equipment, and those who will be exposed to high noise levels shall be medically evaluated for the particular type of exposure they may encounter. Medical records shall be maintained as required by 29 CFR 1910.20. The evaluation shall include:

- a. Audiometric testing and evaluation of employees who will work in a noise environment with a time weighted average greater than or equal to 90 dBA.
- b. Vision screening (employees who use full-facepiece respirators shall not wear contact lenses).
- c. Medical evaluation shall include, but shall not be limited to, the following:
 - (1) Medical history including, but not limited to, alcohol use, with emphasis on liver, kidney, and pulmonary systems, and sensitivity to chemicals to be used on the job.
 - (2) General physical examination with emphasis on liver, kidney, and pulmonary system.
 - (3) Determination of the employee's physical and psychological ability to wear respiratory protective equipment and to perform job-related tasks.
 - (4) Determination of baseline values of biological indices for later comparison to changes associated with exposure to paint systems and thinners or blast media, which include: liver function tests to include SGOT, SGPT, GGPT, alkaline phosphates, bilirubin, complete urinalysis, EKG (employees over age 40), blood urea nitrogen (bun), serum creatinine, pulmonary function test, FVC, and FEV, chest x-ray (if medically indicated), blood lead and ZPP (for individuals where it is known there will be an exposure to materials containing lead), other criteria that may be deemed necessary by the Contractor's physician, and Physician's statements for individual employees that medical status would permit specific task performance.

1.7 CHANGE IN MEDICAL STATUS

Any employee whose medical status has changed negatively due to work related chemical and/or physical agent exposure while working with or around paint systems and thinners, blast media, or other chemicals shall be evaluated by a physician, and the Contractor shall obtain a physicians statement as described in paragraph MEDICAL STATUS prior to allowing the employee to return to those work tasks. The Contractor shall notify the Contracting Officer in writing of any negative changes in employee medical status and the results of the physicians reevaluation statement.

1.8 ENVIRONMENTAL PROTECTION

In addition to the requirements of section 01130 the Contractor shall comply with the following environmental protection criteria.

1.8.1 Waste Classification, Handling, and Disposal

The Contractor shall be responsible for assuring the proper disposal of all hazardous and nonhazardous waste generated during the project. Nonhazardous waste shall be stored in closed containers separate from hazardous waste storage areas. All nonhazardous waste shall be transported in accordance with local regulations regarding waste transportation.

1.9 PAINT PACKAGING, DELIVERY, AND STORAGE

Paints shall be processed and packaged to ensure that within a period of one year from date of manufacture, they will not gel, liver, or thicken deleteriously, or form gas in the closed container. Paints, unless otherwise specified or permitted, shall be packaged in standard containers not larger than 5 gallons, with removable friction or lug-type covers. Each container of paint or separately packaged component thereof shall be labeled to indicate the purchaser's order number, date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name, and formula or specification number of the paint together with special labeling instructions, when specified. Paint shall be delivered to the job in unbroken containers. Paints that can be harmed by exposure to cold weather shall be stored in ventilated, heated shelters. All paints shall be stored under cover from the elements and in locations free from sparks and flames.

PART 2 PRODUCTS

2.1 PAINT

Paint shall be a full-gloss alkyd enamel. Total dry film thickness shall not be less than 3.0 mils. Finishes listed by manufacturer's name are for identification only. The listing is not intended to limit selection of finishes with similar colors and characteristics from other manufacturers. The color of the finish coats shall be yellow, which shall be as selected by the Contracting Officer from a set of yellow paint swatches submitted by the Contractor.

(1) Primer: synthetic rust-inhibiting primer.

- a. Devco: 14920 Bar-Ox Quick Dry Metal Primer, Red.
- b. Glidden: 5210 Glid-Guard Universal Fast-Dry Metal Primer.
- c. Moore: IronClad Retardo Rust-Inhibitive Paint #163.
- d. S-W: Kem Kromik Metal Primer B50N2/B50W1.

(2) First and Second coats: Gloss alkyd enamel.

- a. Devco: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
- b. Glidden: 4500 Glid-Guard Industrial Enamel.
- c. Moore: Impervo High-floss Enamel #133
- d. S-W: Industrial Enamel B-54 Series.

PART 3 EXECUTION

3.1 CLEANING AND PREPARATION OF METAL SURFACES TO BE PAINTED

3.1.1 General Requirements

Surfaces to be painted shall be cleaned before applying paint or surface treatments. Doors, hinges and latches shall be repaired to working condition as needed. Deposits of grease or oil shall be removed in accordance with SSPC SP 1, prior to mechanical cleaning. Solvent cleaning shall be accomplished with mineral spirits or other low toxicity solvents having a flash point above 100 degrees F. Clean cloths and clean fluids shall be used to avoid leaving a thin film of greasy residue on the surfaces being cleaned. Items not to be prepared or coated shall be protected from damage by the surface preparation methods. Cleaning and painting shall be so programmed that dust or other contaminants from the cleaning process do not fall on wet, newly painted surfaces, and surfaces not intended to be painted shall be suitably protected from the effects of cleaning and painting operations. Welding of, or in the vicinity of, previously painted surfaces shall be conducted in a manner to prevent weld spatter from striking the paint and to otherwise reduce coating damage to a minimum; paint damaged by welding operations shall be restored to original condition. Surfaces to be painted that will be inaccessible after construction, erection, or installation operations are completed shall be painted before they become inaccessible.

3.1.2 Ferrous Surfaces Subject to Atmospheric Exposures

Ferrous surfaces that are to be continuously in exterior or interior atmospheric exposure and other surfaces as directed shall be cleaned by means of power tools or by dry blasting to the brush-off grade. Power tool cleaning shall conform to the requirements of SSPC SP 3. Brush-off blast cleaning shall conform to the requirements of SSPC SP 7. Welds and adjoining surfaces within a few inches thereof shall be cleaned of weld flux, spatter, and other harmful deposits by blasting, power impact tools, power wire brush, or such combination of these and other methods as may be necessary for complete removal of each type of deposit. The combination of cleaning methods need not include blasting when preparation of the overall surfaces is carried out by the power tool method. However, brush scrubbing and rinsing with clean water, after mechanical cleaning is completed, will be required unless the latter is carried out with thoroughness to remove all soluble alkaline deposits. Wetting of the surfaces during water-washing operations shall be limited to the weld area required to be treated, and such areas shall be dry before painting. Welds and adjacent surfaces cleaned thoroughly by blasting alone will be considered adequately prepared provided that weld spatter not dislodged by the blast stream shall be removed with impact or grinding tools. All surfaces shall be primed as soon as practicable after cleaning but prior to contamination or deterioration of the prepared surfaces. To the greatest degree possible, steel surfaces shall be cleaned (and primed) prior to lengthy outdoor storage.

3.2 PAINT APPLICATION

3.2.1 General

Two finish coats shall be applied over one coat of primer. The finished coating shall be free from holidays, pinholes, bubbles, runs, drops, ridges, waves, laps, excessive or unsightly brush marks, and variations in color, texture, and gloss. Application of initial or subsequent coatings shall not commence until the Contracting Officer has verified that atmospheric conditions and the surfaces to be coated are satisfactory. Each paint coat shall be applied in a manner that will produce an even, continuous film of uniform thickness. Edges, corners, crevices, seams, joints, welds, rivets, corrosion pits, and other surface irregularities shall receive special attention to ensure that they receive an adequate thickness of paint. Spray equipment shall be equipped with traps and separators and where appropriate, mechanical agitators, pressure gauges, pressure regulators, and screens or filters. Air caps, nozzles, and needles shall be as recommended by the spray equipment manufacturer for the material being applied. Airless-type spray equipment may be used only on broad, flat, or otherwise simply configured surfaces, except that it may be employed for general painting if the spray gun is equipped with dual or adjustable tips of proper types and orifice sizes. Airless-type equipment shall not be used for the application of vinyl paints.

3.2.2 Mixing and Thinning

Paints shall be thoroughly mixed, strained where necessary, and kept at a uniform composition and consistency during application. Paste or dry-powder pigments specified to be added at the time of use shall, with the aid of powered stirrers, be incorporated into the vehicle or base paint in a manner that will produce a smooth, homogeneous mixture free of lumps and dry particles. Where necessary to suit conditions of the surface temperature, weather, and method of application, the paint may be thinned immediately prior to use. Thinning shall generally be limited to the addition of not more than 1 pint per gallon of the proper thinner; this general limitation shall not apply when more specific thinning instructions are provided. Paint that has been stored at low temperature, shall be brought up to at least 70 degrees F before being mixed and thinned, and its temperature in the spray tank or other working container shall not fall below 60 degrees F during the application. Paint that has deteriorated in any manner to a degree that it cannot be restored to essentially its original condition by customary field-mixing methods shall not be used and shall be removed from the project site. Paint and thinner that is more than 1 year old shall be sampled and submitted for testing to determine its suitability for application.

3.2.3 Atmospheric and Surface Conditions

Paint shall be applied only to surfaces that are above the dew point temperature and that are completely free of moisture as determined by sight and touch. Paint shall not be applied to surfaces upon which there is detectable frost or ice. Except as otherwise specified, the temperature of the surfaces to be painted and of air in contact therewith shall be not less than 45 degrees F during paint application nor shall paint be applied if the surfaces can be expected to drop to 32 degrees F or lower before the film has dried to a reasonably firm condition. During periods of inclement weather, painting may be continued by enclosing the surfaces and applying artificial heat, provided the minimum temperatures and surface dryness requirements prescribed previously are maintained. Paint shall not be applied to surfaces heated by direct

sunlight or other sources to temperatures that will cause detrimental blistering, pinholing, or porosity of the film.

3.2.4 Time Between Surface Preparation and Painting

Surfaces that have been cleaned and/or otherwise prepared for painting shall be primed as soon as practicable after such preparation has been completed but, in any event, prior to any deterioration of the prepared surface.

3.2.5 Method of Paint Application

Unless otherwise specified, paint shall be applied by brush or spray. Special attention shall be directed toward ensuring adequate coverage of edges, corners, crevices, pits, rivets, bolts, welds, and similar surface irregularities. Other methods of application to metal surfaces shall be subject to the specific approval of the Contracting Officer.

3.2.6 Coverage and Film Thickness

Film thickness or spreading rates shall be as specified hereinafter. Where no spreading rate is specified, the paint shall be applied at a rate normal for the type of material being used. In any event, the combined coats of a specified paint system shall completely hide base surface and the finish coats shall completely hide undercoats of dissimilar color.

3.2.6.1 Measurement on Ferrous Metal

Where dry film thickness requirements are specified by the paint manufacturer for coatings on ferrous surfaces, measurements shall be made with a gage qualified in accordance with paragraph Coating Thickness Gage Qualification. They shall be calibrated and used in accordance with ASTM D 1186. They shall be calibrated using plastic shims with metal practically identical in composition and surface preparation to that being coated, and of substantially the same thickness (except that for measurements on metal thicker than 1/4 inch, the instrument may be calibrated on metal with a minimum thickness of 1/4 inch). Frequency of measurements shall be as recommended for field measurements by ASTM D 1186 and reported as the mean for each spot determination. The instruments shall be calibrated or calibration verified prior to, during, and after each use.

3.2.7 Progress of Painting Work

Where field painting on any type of surface has commenced, the complete painting operation, including priming and finishing coats, on that portion of the work shall be completed as soon as practicable, without prolonged delays. Sufficient time shall elapse between successive coats to permit them to dry properly for recoating, and this period shall be modified as necessary to suit adverse weather conditions. Paint shall be considered dry for recoating when it feels firm, does not deform or feel sticky under moderate pressure of the finger, and the application of another coat of paint does not cause film irregularities such as lifting or loss of adhesion of the undercoat. All coats of all painted surfaces shall be unscarred and completely

integral at the time of application of succeeding coats. At the time of application of each successive coat, undercoats shall be cleaned of dust, grease, overspray, or foreign matter by means of airblast, solvent cleaning, or other suitable means. Cement and mortar deposits on painted steel surfaces, not satisfactorily removed by ordinary cleaning methods, shall be brush-off blast cleaned and completely repainted as required. Undercoats of high gloss shall, if necessary for establishment of good adhesion, be scuff sanded, solvent wiped, or otherwise treated prior to application of a succeeding coat.

3.2.8 Contacting Surfaces

When riveted or ordinary bolted contact is to exist between surfaces of ferrous or other metal parts of substantially similar chemical composition, such surfaces will not be required to be painted, but any resulting crevices shall subsequently be filled or sealed with paint. Contacting metal surfaces formed by high-strength bolts in friction-type connections shall not be painted. Where a nonmetal surface is to be in riveted or bolted contact with a metal surface, the contacting surfaces of the metal shall be cleaned and given three coats of the specified primer. Unless otherwise specified, corrosion-resisting metal surfaces, including cladding therewith, shall not be painted.

3.2.9 Protection of Painted Surfaces

Items that have been painted shall not be handled, worked on, or otherwise disturbed until the paint coat is fully dry and hard.

3.3 INSPECTION

The Contractor shall inspect, document, and report all work phases and operations on a daily basis. As a minimum the daily report shall contain the following:

- a. Inspections performed, including the area of the structure involved and the results of the inspection.
- b. Surface preparation operations performed, including the area of the structure involved, the mode of preparation, the kinds of solvent, abrasive, or power tools employed, and whether contract requirements were met.
- c. Thinning operations performed, including thinners used, batch numbers, and thinner/paint volume ratios.
- d. Application operations performed, including the area of the structure involved, mode of application employed, ambient temperature, substrate temperature, dew point, relative humidity, type of paint with batch numbers, elapsed time between surface preparation and application, elapsed time for recoat, condition of underlying coat, number of coats applied, and if specified, measured dry film thickness or spreading rate of each new coating.

DIVISION 10 – SPECIALTIES
THRU
DIVISION 15 – MECHANICAL
(NOT USED)

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D 709 (2001) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 100 (2000) Dictionary of Electrical and Electronics Terms (IEEE)

IEEE C2 (2002) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6 (1993; R 2001) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Division 2, "Site Construction." This section applies to all sections of Division 16, "Electrical," of this project specification unless specified otherwise in the individual sections.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.
- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 240/120-V, single phase, three wire, 60 Hz. Final connections to the utility company's power distribution system at the watt-hour meter shall be made by the Contractor as directed by the Contracting Officer.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Submittals required in the sections which refer to this section must also conform to the following additional requirements. Submittals shall include the manufacturer's name, trade name, place of manufacture, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and technical paragraph reference. Submittals shall also include applicable federal, military, industry, and technical society publication references, and years of satisfactory service, and other information necessary to establish contract compliance of each item to be provided. Photographs of existing installations are unacceptable and will be returned without approval.

1.5.1 Manufacturer's Catalog Data

Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts. Handwritten and typed modifications and other notations not part of the manufacturer's preprinted data will result in the rejection of the submittal. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified for certificates of compliance.

1.5.2 Instructions

Where installation procedures or part of the installation procedures are required to be in accordance with manufacturer's instructions, submit printed copies of those instructions prior to installation. Installation of the item shall not proceed until manufacturer's instructions are received. Failure to submit manufacturer's instructions shall be cause for rejection of the equipment or material.

1.5.3 Certificates

Submit manufacturer's certifications as required for products, materials, finishes, and equipment as specified in the technical sections. Certificates from material suppliers are not acceptable. Preprinted certifications and copies of previously submitted documents will not be

acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance.

1.5.3.1 Reference Standard Compliance

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

1.5.3.2 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.4 Operation and Maintenance Manuals

1.5.4.1 Operating Instructions

Submit text of posted operating instructions for each system and principal item of equipment as specified in the technical sections.

1.6 QUALITY ASSURANCE

1.6.1 Material and Equipment Qualifications

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.2 Regulatory Requirements

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70.

1.6.3 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.4 Service Support

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.5 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.6.6 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

1.6.7 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.
- d. The procedure in the event of equipment failure.

- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.8 NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each panelboard, equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.9 CABLE TAGS IN HANDHOLES AND PULL BOXES

Provide tags for each cable or wire located in handholes and pull boxes. Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract. The first position on the tag shall denote the voltage. The second through sixth positions on the tag shall identify the circuit. The next to last position shall denote the line of the circuit. The last position shall denote the cable size. As an example, a tag could have the following designation: "240 NAS 1-8(Line 1)AWG8," denoting that the tagged cable is on the 240-V system circuit number NAS 1-8, underground, Line 1, sized at AWG 8 . Tag legend shall be as indicated. The tags shall be polyethylene or sheet lead. Do not provide handwritten letters.

1.9.1 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 175 pounds. The cable tags shall have black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

1.9.2 Lead Cable Tags

Provide tags of virgin sheet lead, one-piece wraparound strap type, slotted on one end for attaching the strap. Minimum size of tags shall be one inch

wide by 3/64 inch thick and a length sufficient for die stamping the identification on one line and banding around the cable or wire, but not less than 10 inches long. Tags shall be die stamped with numbers, letters, and symbols not less than 0.25 inch high and approximately 0.015 inch deep in normal block style.

1.10 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.10.1 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment.

1.11 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PAINTING OF EQUIPMENT

3.1.1 Factory Applied

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical sections .

3.1.2 Field Applied

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.

3.2 NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two

sheet-metal screws or two rivets.

3.3 CABLE TAG INSTALLATION

Install cable tags in each handhole and pull box as specified, including each splice. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the handholes and pull boxes.

-- End of Section --

SECTION 16120

INSULATED WIRE AND CABLE

PART 1 GENERAL

1.1 REFERENCES

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

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC 8 (1988; Rev 3 1996)
Ethylene-Propylene-Rubber-Insulated Wire
and Cable for the Transmission and
Distribution of Electrical Energy

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

The Contractor shall submit cable manufacturing data.

1.3 DELIVERY, STORAGE, AND HANDLING

Furnish cables on reels or coils. Each cable and the outside of each reel or coil, shall be plainly marked or tagged to indicate the cable length, voltage rating, conductor size, and manufacturer's lot number and reel number. Each coil or reel of cable shall contain only one continuous cable without splices. Cables for exclusively dc applications, as specified in paragraph HIGH VOLTAGE TEST SOURCE, shall be identified as such. Reels shall remain the property of the Contractor.

1.4 PROJECT/SITE CONDITIONS

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Wire and Cable

Wire and cable shall be furnished in accordance with the requirements of these specifications and the plans, and shall conform to the detailed requirements specified herein.

2.1.2 Rated Circuit Voltages

All wire and cable shall have minimum rated circuit voltages in accordance with Table 3-1 of NEMA WC 8.

2.1.3 Conductors

2.1.3.1 Material

Conductors shall conform to all the applicable requirements of Part 2 of NEMA WC 8 and shall be annealed copper. Copper conductors may be bare, or tin- or lead-alloy-coated, if required by the type of insulation used.

2.1.3.2 Size

Minimum wire size shall be No. 8 AWG for power and lighting circuits; No. 10 AWG for current transformer secondary circuits; and No. 14 AWG for potential transformer, relaying, and control circuits.

2.1.3.3 Stranding

Conductor stranding classes cited herein shall be as defined in Appendix L of or NEMA WC 8, as applicable. Lighting conductors No. 8 AWG and smaller shall be solid or have Class B stranding. Any conductors used between stationary and moving devices, such as hinged doors or panels, shall have Class H or K stranding. All other conductors shall have Class B or C stranding, except that conductors shown on the drawings, or in the schedule, as No. 12 AWG may be 19 strands of No. 25 AWG, and conductors shown as No. 10 AWG may be 19 strands of No. 22 AWG.

2.1.3.4 Separator Tape

Where strand filling or other special conductor treatment is not required, a separator tape between conductor and insulation is permitted.

2.1.4 Insulation

2.1.4.1 Insulation Material

Insulation shall be an ethylene-propylene rubber (EPR) type meeting the requirements of Part 3 of NEMA WC 8.

2.1.4.2 Insulation Thickness

The insulation thickness for each conductor shall be based on its rated circuit voltage.

- a. Power Cables/Single-Conductor Control Cables, 2,000 Volts and Below
- The insulation thickness for single-conductor cables rated 2,000 volts and below shall be as required by Table 3-1, Part 3 of NEMA WC 8. NEMA WC 8 ethylene-propylene rubber-insulated conductors shall have a jacket. Column "B" thickness may apply to single-conductor cables that require a jacket and to individual conductors of multiple-conductor

cables with an overall jacket.

b. Multiple-Conductor Control Cables - The insulation thickness of multiple-conductor cables used for control and related purposes shall be as required by Table 7.5.1 of NEMA WC 8.

2.1.5 Jackets

All cables shall have jackets meeting the requirements of Part 4 of NEMA WC 8, as applicable, and as specified herein. Individual conductors of multiple-conductor cables shall be required to have jackets only if they are necessary for the conductor to meet other specifications herein. Jackets of single-conductor cables and of individual conductors of multiple-conductor cables shall be in direct contact and adhere or be vulcanized to the conductor insulation. Multiple-conductor cables shall be provided with a common overall jacket, which shall be tightly and concentrically formed around the core.

2.1.5.1 Jacket Material

The jacket shall be one of the materials listed below. Variations from the materials required below will be permitted only if approved for each specific use, upon submittal of sufficient data to prove that they exceed all specified requirements for the particular application.

a. General Use

(1) Heavy-duty chlorosulfonated polyethylene (NEMA WC 8, paragraph 4.4.10).

b. Accessible Use Only, 2,000 Volts or Less - Cables installed where they are entirely accessible, such as raceways with removable covers, or where they pass through less than 10 feet of exposed conduit only, shall have jackets of one of the materials specified in above paragraph GENERAL USE, or the jackets may be of one of the following:

(1) General-purpose neoprene (NEMA WC 8, paragraph 4.4.4).

(2) Black polyethylene (NEMA WC 8, paragraph 4.4.6).

(3) Thermoplastic chlorinated polyethylene (NEMA WC 8, paragraph 4.4.7).

2.1.5.2 Jacket Thickness

The minimum thickness of the jackets at any point shall be not less than 80 percent of the respective nominal thicknesses specified below.

a. Multiple-Conductor Cables - Thickness of the jackets of the individual conductors of multiple-conductor cables shall be as required by Part 4, Table 4-4 of NEMA WC 8, and shall be in addition to the conductor insulation thickness required by Column B of Table 3-1 of the applicable NEMA publication for the insulation used. Thickness of the outer jackets or sheaths of the assembled multiple-conductor cables

shall be as required by Part 4, Table 4-5, of NEMA WC 8.

b. Single-Conductor Cables - Single-conductor cables, if nonshielded, shall have a jacket thickness as specified in Part 4, Table 4-2 of NEMA WC 8. If shielded, the jacket thickness shall be in accordance with the requirements of Part 4, Table 4-3 of NEMA WC 8.

2.1.6 Identification

2.1.6.1 Color-coding

Insulation of individual conductors of multiple-conductor cables shall be color-coded in accordance with paragraph 5.3 of NEMA WC 8, except that colored braids will not be permitted. Only one color-code method shall be used for each cable construction type. Control cable color-coding shall be in accordance with Table 5-2 of NEMA WC 8. Power cable color-coding shall be black for ungrounded Line 1, red for ungrounded Line 2, white for grounded neutral, and green for an insulated grounding conductor, if included.

2.1.7 Cabling

Individual conductors of multiple-conductor cables shall be assembled with flame-and moisture-resistant fillers, binders, and a lay conforming to Part 5 of NEMA WC 8, except that flat twin cables will not be permitted. Fillers shall be used in the interstices of multiple-conductor round cables with a common covering where necessary to give the completed cable a substantially circular cross section. Fillers shall be non-hygroscopic material, compatible with the cable insulation, jacket, and other components of the cable. The rubber-filled or other approved type of binding tape shall consist of a material that is compatible with the other components of the cable and shall be lapped at least 10 percent of its width.

2.1.8 Dimensional Tolerance

The outside diameters of single-conductor cables and of multiple-conductor cables shall not vary more than 5 percent and 10 percent, respectively, from the manufacturer's published catalog data.

2.2 INSTALLATION INSTRUCTIONS

The following information shall be provided by the cable manufacturer for each size, conductor quantity, and type of cable furnished:

- a. Minimum bending radius, in inches - For multiple-conductor cables, this information shall be provided for both the individual conductors and the multiple-conductor cable.
- b. Pulling tension and sidewall pressure limits, in pounds.
- c. Instructions for stripping semiconducting insulation shields, if furnished, with minimum effort without damaging the insulation.

d. Upon request, compatibility of cable materials and construction with specific materials and hardware manufactured by others shall be stated. Also, if requested, recommendations shall be provided for various cable operations, including installing, splicing, terminating, etc.

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 16302

UNDERGROUND TRANSMISSION AND DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2 (1997) National Electrical Safety Code

ANSI C119.1 (2002) Sealed Insulated Underground Connector Systems Rated 600 Volts

ASTM INTERNATIONAL (ASTM)

ASTM B 1 (2001) Hard-Drawn Copper Wire

ASTM B 8 (1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM F 512 (1995; R 2001e1) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA RN 1 (1998) Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA TC 2 (2003) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit

NEMA TC 3 (1999) PVC Fittings for Use with Rigid PVC Conduit and Tubing

NEMA TC 8 (1990) Extra-Strength PVC Plastic Utilities Duct for Underground Installation

NEMA TC 9 (1999) Fittings for PVC Plastic Utilities Duct for Underground Installation

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (1991) Electrical Power Distribution Equipment and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code
NFPA 70B (2002) Electrical Equipment Maintenance

UNDERWRITERS LABORATORIES (UL)

UL 6 (2000; Rev thru May 2003) Rigid Metal Conduit
UL 467 (1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A (1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 510 (1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A (1996; Rev thru Nov 2001) Metallic Outlet Boxes
UL 514B (1997; Rev thru Feb 2002) Fittings for Cable and Conduit
UL 854 (1999; Rev thru Nov 2002) Service-Entrance Cables

1.2 DEFINITIONS

- a. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

600 volt wires and cables

SD-06 Test Reports

Acceptance checks and tests

Identify each cable for 600-volt cable tests. When testing grounding electrodes and systems, identify each electrode and system for each test, as well as the resistance and soil conditions at the time the measurement were made.

SD-09 Manufacturer's Field Reports

Factory engineered heat shrinkable joint kit

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Conduit

2.1.1.1 Rigid Metal Conduit

UL 6, galvanized steel, threaded type.

2.1.1.2 Rigid Metal Conduit, PVC Coated

UL 6, galvanized steel, threaded type, coated with a polyvinyl chloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mils thick, conforming to NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, tensile strength shall be minimum 3500 psi, and aging shall be minimum 1000 hours in an Atlas Weatherometer.

2.1.1.3 Plastic Conduit for Direct Burial

NEMA TC 2, EPC-80-PVC.

2.1.1.4 Plastic Utilities Duct for Concrete Encasement

NEMA TC 8, ASTM F 512, Type EB-35.

2.1.2 Fittings

2.1.2.1 Metal Fittings

UL 514B, threaded type.

2.1.2.2 PVC Conduit Fittings

NEMA TC 3, UL 514B, UL 651.

2.1.2.3 PVC Duct Fittings

NEMA TC 9.

2.1.2.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit shall be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed

closures and shall conform to UL 514A.

2.1.3 Conductors Rated 600 Volts and Less

Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length. Wires and cables manufactured more than 24 months prior to date of delivery to the site shall not be used.

2.1.3.1 600 Volt Wires and Cables

Underground conductors shall conform to UL 854, Type USE. Conductor size and number of conductors in each cable shall be as indicated. Conductors shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, or heat shrink type sleeves. Control circuit terminations shall be properly identified. Conductors No. 10 AWG and smaller shall be solid copper. Conductors No. 8 AWG and larger shall be stranded copper. All conductors shall be copper.

- a. Colors for coding conductors shall be:

120/240-VOLT SYSTEM

Neutral	-	White
Ungrounded Line 1	-	Black
Ungrounded Line 2	-	Red
Grounding conductor	-	Green

2.1.4 600 Volt Wire Connector and Terminals

Shall provide a uniform compression over the entire contact surface. Solderless terminal lugs shall be used on stranded conductors.

- a. For use with copper conductors: UL 486A.

2.1.5 600 Volt Splices

Provide splices with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with ANSI C119.1.

- a. Provide cast-type splice insulation by means of molded casting process employing a thermosetting epoxy resin insulating material applied by a gravity poured method or by a pressure injected method. Provide component materials of the resin insulation in a packaged form ready for convenient mixing without removing from the package.
- b. Gravity poured method shall employ materials and equipment

contained in an approved commercial splicing kit which includes a mold suitable for the cables to be spliced. When the mold is in place around the joined conductors, prepare the resin mix and pour into the mold.

- c. Provide heavy wall heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied by a clean burning propane gas torch.
- d. Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation shall not require heat or flame, or any additional materials such as covering or adhesive. It shall be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.1.6 Tape

2.1.6.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.1.7 Pull Rope

Shall be plastic having a minimum tensile strength of 200 pounds. Leave a minimum of 24 inches of slack at each end of the pull wires.

2.1.8 Grounding and Bonding Equipment

UL 467. Ground rods shall be copper clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and 10 feet long unless otherwise indicated.

2.1.9 Cable Tags

Provide as specified in Section 16050N BASIC ELECTRICAL MATERIALS AND METHODS.

PART 3 EXECUTION

3.1 INSTALLATION

NFPA 70 and ANSI C2.

3.1.1 Contractor Damage

The Contractor shall promptly repair any indicated utility lines or systems damaged by Contractor operations. Damage to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the General Provisions of the contract. If the Contractor is advised in writing of the location of a nonindicated line or system, such notice shall provide that portion of the line or system

with "indicated" status in determining liability for damages. In any event, the Contractor shall immediately notify the Contracting Officer of any such damage.

3.1.2 Concrete

Concrete work for electrical requirements shall be 3000 psi minimum ultimate 28-day compressive strength with one inch minimum aggregate conforming to the requirements of Section 03308 CONCRETE.

3.1.3 Underground Conduit/Duct Without Concrete Encasement

Type of conduit shall be EPC-80-PVC.

3.1.3.1 Conduit Installation

Top of the conduit shall be not less than 12 inches below finished grade, and shall have a minimum slope of 6 inches in each 100 feet toward pull boxes, handholes, and /or other necessary drainage points. Run conduit in straight lines except where a change of direction is necessary. As each conduit run is completed, for conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. Provide not less than 3 inches clearance from the conduit to each side of the trench. A minimum clearance of 2 1/2 inches shall be provided between adjacent conduits. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 4 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve.

3.1.3.2 Multiple Conduits

Separate multiple conduits by a minimum distance of 2 1/2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches. Stagger the joints of the conduits by rows and layers to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, and top spacers to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.1.4 Conduit Protection at Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations shall be PVC coated and shall extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.1.5 Cable Pulling

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the location of the highest elevation. Use flexible cable

feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into handholes, pull boxes, and other enclosures. Cable with tape shield shall have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.1.5.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables. Cable lubricants shall not be deleterious to the cable sheath, jacket, or outer coverings.

3.1.5.2 Cable Pulling Tensions

Tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.

3.1.5.3 Secondary Cable Runs, 600 Volts and Less

Provide insulated copper equipment grounding conductor, sized as required by the rating of the overcurrent device supplying the phase conductors, or as indicated.

3.1.5.4 Cables in Handholes and Pull Boxes

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators at a maximum of 18 inches.

3.1.5.5 Cable Tags

Provide cable markers (or tags) as specified in Section 16050N BASIC ELECTRICAL MATERIALS AND METHODS.

3.1.6 600 Volt Cable Splicing and Terminating

Provide splices and terminations to protect 600 volts insulated power and lighting cables from accidental contact, deterioration of coverings and moisture. Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Make splices in underground distribution systems only in accessible locations such as handholes and pull boxes.

3.1.6.1 Splices for 600 Volt Class Cables

Splices in underground distribution systems shall made only in accessible locations such as handholes and pull boxes, with a compression connector on the conductor and by insulating and waterproofing by one of the following methods suitable for continuous submersion in water and comply with ANSI C119.1.

- a. Provide cast-type splice insulation by means of molded casting process employing a thermosetting epoxy resin insulating material applied by a gravity poured method or by a pressure injected method. Provide component materials of the resin insulation in a packaged form ready for convenient mixing without removing from the package. Do not allow the cables to be moved until after the splicing material has completely set.
- b. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which includes a mold suitable for the cables to be spliced. When the mold is in place around the joined conductors, prepare the resin mix and pour into the mold. Do not allow cables to be moved until after the splicing materials have completely set.
- c. Provide heavy wall heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which should be applied by a clean burning propane gas torch. Cables may be moved when joint is cool to the touch.
- d. Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation shall not require heat or flame, or any additional materials such as coverings or adhesive. It shall be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

3.1.7 Grounding Systems

Shall be as indicated, and as required by NFPA 70 and ANSI C2.

3.1.7.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.

3.1.7.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.7.3 Grounding Conductors

Grounding conductors shall be stranded-bare copper conforming to ASTM B 8, Class B, for sizes No. 6 AWG and larger, and shall be solid-bare copper conforming to ASTM B 1 for sizes No. 8 and smaller. Cable sheaths, cable shields, conduit, and equipment shall be grounded with No. 6 AWG.

3.1.7.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.2 FIELD QUALITY CONTROL

As an exception to requirements that may be stated elsewhere in the contract, notify the Contracting Officer 5 working days prior to each test.

Furnish labor, equipment, and incidentals required for testing, except that the Government will provide electric power required for the tests. Correct defects in the work provided by the Contractor and repeat tests until the work is in compliance with contract requirements.

3.2.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, NFPA 70B, NETA ATS, and referenced ANSI standards. Include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.2.1.1 600 Volt Cable Tests

Perform tests after wiring is completed, connected, and ready for operation, but prior to placing system in service and before any branch circuit breaker is closed.

a. Visual and Mechanical Inspection

(1) Inspect cables for physical damage and proper connection in accordance with contract plans and specifications.

(2) Test cable mechanical connections to manufacturer's recommended values using a calibrated torque wrench. In the absence of manufacturer's data use NETA recommended values.

(3) Check cable color coding for compliance with contract specifications.

b. Electrical Tests

(1) Perform insulation-resistance test on each conductor with respect to ground and adjacent conductor; applied potential shall

be 1000 volts DC for 1 minute; minimum insulation-resistance values shall not be less than 2 megohms.

(2) Perform continuity test to insure proper cable connection.

3.2.1.2 Ground Rods

Perform ground resistance tests for ground rods before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Ground resistance shall also be measured for each piece of equipment and medium voltage cable splice to the ground electrode.

Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test.

-- End of Section --

SECTION 16528

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS-4 (2001; 2002 Interim) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C119.1 (2002) Sealed Insulated Underground Connector Systems Rated 600 Volts

ANSI C135.1 (1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction **

ANSI C135.14 (1979) Staples with Rolled or Slash Points for Overhead Line Construction

ANSI C136.10 (1996) Roadway Lighting-Locking Type Photocontrol Devices and Mating Receptacle - Physical and Electrical Interchangeability and Testing **

ANSI C136.11 (1995) Roadway Lighting Equipment Series Sockets and Series Sockets Receptacles

ANSI C136.15 (1997) Roadway Lighting Equipment High Intensity Discharge and Low Pressure Sodium Lamps in Luminaires, Field Identification

ANSI C136.2 (1996) Roadway Lighting Equipment: Luminaires, Voltage Classification

ANSI C136.3 (1995) Roadway Lighting Equipment-Luminaire Attachments **

ANSI C136.6 (1997) Roadway Lighting Equipment - Metal Heads and Reflector Assemblies -

Mechanical and Optical Interchangeability

- ANSI C136.9 (1990) Roadway Lighting Equipment - Socket Support Assemblies for Metal Heads - Mechanical Interchangeability
- ANSI C78.1351 (1989) Electric Lamps - 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps **
- ANSI C78.1355 (1989) Electric Lamps - 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps **
- ANSI C80.1 (1994) Rigid Steel Conduit - Zinc Coated
- ANSI C82.4 (2002) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

ASTM INTERNATIONAL (ASTM)

- ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A 153/A 153M (2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM A 575 (1996; R 2002) Steel Bars, Carbon, Merchant Quality, M-Grades
- ASTM A 576 (1990b; R 2000) Steel Bars, Carbon, Hot-Wrought, Special Quality
- ASTM B 117 (2002) Operating Salt Spray (Fog) Apparatus
- ASTM B 2 (2000) Medium-Hard-Drawn Copper Wire
- ASTM B 8 (1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- ASTM D 1654 (1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
- ASTM G 7 (1997) Standard Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

- IESNA RP-8 (2000) Roadway Lighting

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C136.13 (1992) Roadway Lighting Equipment, Metal
Brackets for Wood Poles ++

IEEE C2 (2002) National Electrical Safety Code

IEEE Std 81 (1983) Guide for Measuring Earth
Resistivity, Ground Impedance, and Earth
Surface Potentials of a Ground System
(Part 1)Normal Measurements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NEMA ICS 1 (2000) Industrial Control and Systems:
General Requirements

NEMA ICS 2 (2000) Industrial Controls and Systems:
Controllers, Contactors, and Overload
Relays Rated 600 Volts

NEMA ICS 6 (1993; R 2001) Industrial Control and
Systems: Enclosures

NEMA OS 1 (1996) Sheet Steel Outlet Boxes, Device
Boxes, Covers, and Box Supports

NEMA OS 2 (1998) Nonmetallic Outlet Boxes, Device
Boxes, Covers and Box Supports

NEMA RN 1 (1998) Polyvinyl Chloride (PVC) Externally
Coated Galvanized Rigid Steel Conduit and
Intermediate Metal Conduit

NEMA TC 6 (1990) PVC and ABS Plastic Utilities Duct
for Underground Installation **

NEMA TC 9 (1999) Fittings for PVC Plastic Utilities
Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)

ANSI/SCTE 77 (2002) Specification for Underground
Enclosure Integrity

UNDERWRITERS LABORATORIES (UL)

UL 1029	(1994; Rev thru Feb 2001) High-Intensity-Discharge Lamp Ballasts
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures **
UL 44	(1999; Rev thru May 2002) Thermoset-Insulated Wires and Cables
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev thru May 2001) Wire Connectors for Use with Aluminum Conductors
UL 514A	(1996; Rev thru Nov 2001) Metallic Outlet Boxes
UL 514B	(1997; Rev thru Feb 2002) Fittings for Cable and Conduit
UL 514C	(1996; Rev thru Nov 2002) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 2002) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(2000; Rev thru Oct 2002) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 854	(1999; Rev thru Nov 2002) Service-Entrance Cables
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Lighting System; G

a. Detail drawings for the complete system and for poles, lighting fixtures, bracket arms, cable boxes, handholes, and controllers.

b. Color sample for luminaires, poles, appurtenances

Equipment and Materials

Data published by the manufacturer of each item on the list of equipment and material, to permit verification that the item proposed is of the correct size, properly rated or applied, or is otherwise suitable for the application and fully conforms to the requirements specified.

SD-06 Test Reports

Ground Resistance Measurements

The measured resistance to ground of each separate grounding installation, indicating the location of the rods, the resistance of the soil in ohms per millimeter and the soil conditions at the time the measurements were made. The information shall be in writing.

SD-10 Operation and Maintenance Data

Lighting System

A draft copy of the operation and maintenance manuals, prior to beginning the tests for use during site testing. Final copies of the manuals as specified bound in hardback, loose-leaf binders, within 30 days after completing the field test. The draft copy used during site testing shall be updated with any changes required, prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the field test shall include modifications made during installation checkout and acceptance.

1.3 SYSTEM DESCRIPTION

1.3.1 Lighting System

The lighting system shall be configured as specified and shown. The system

shall include all fixtures, hardware, poles, cables, connectors, adapters and appurtenances needed to provide a fully functional lighting system.

1.3.2 Electrical Requirements

The equipment shall operate from a 240/120-volt, single-phase source as shown, plus or minus 10 percent, and 60 Hz, plus or minus 2 percent.

1.3.3 Interface Between Lighting System and Power Distribution

Conductors shall include all conductors extending from the load side of the watt-hour meter and shall be as indicated.

1.3.4 Nameplates

Each major component of equipment shall have a nonferrous metal or engraved plastic nameplate which shall show, as a minimum, the manufacturer's name and address, the catalog or style number, the electrical rating in volts, and the capacity in amperes or watts.

1.3.5 Standard Products

Materials and equipment shall be standard products of manufacturer regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.3.6 Unusual Service Conditions

Equipment and materials furnished under this section shall be suitable for the following unusual service conditions: high humidity.

1.4 CORROSION PROTECTION

1.4.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

1.4.2 Ferrous Metal Materials

1.4.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

1.4.2.2 Equipment

Equipment and component items, including but not limited to metal poles and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat

to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall have a rating of not less than 7 in accordance with TABLE 1, (procedure A) of ASTM D 1654. Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

1.4.3 Finishing

Surfaces of all luminaires, mountings, and poles shall be powder coated with thermosetting polyester resins providing a UV-resistant finish per ASTM G 7. Surfaces shall be chemically treated prior to painting. Finish color of luminaires, poles, and appurtenances shall be as approved by Government.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 BRACKET ARMS

2.2.1 On Aluminum Poles

Poles shall be provided with bracket arms 8 feet in length, measured from the center line of the pole to the outer end of the bracket arm. Bracket arms shall conform to the design of the pole provided. The bracket arms shall be capable of supporting the equipment to be mounted on it with the maximum wind and ice loading encountered at the site. Strength of bracket arms shall be in accordance with IEEE C136.13. Steel brackets shall be galvanized. Wood bracket arms shall not be used. Bracket arms shall be a decorative architectural style similar in appearance to the "CRM8" as manufactured by Lumec, Genlyte Thomas Group LLC. All appurtenant adaptors, caps, covers, hardware, etc. necessary to make a complete installation of the luminaire and bracket to the pole shall be furnished.

2.3 CABLE

The Contractor shall provide all wire and cable not indicated as government furnished equipment. Wire and cable components shall be able to withstand the jobsite environment for a minimum of 20 years.

2.3.1 Insulated Cable

Cable shall be type USE conforming to UL 854, with copper conductors and type RHW insulation conforming to UL 44, and shall include green grounding conductor. Cable shall be rated 600 volts. Parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as

indicated. Conductors of size 8 AWG and larger shall be stranded.

2.3.2 Bare Copper Conductors

Medium-hard-drawn copper conductors shall conform to ASTM B 2 and ASTM B 8.

2.4 CABLE SPLICES AND CONNECTORS

Cable splices and connectors shall conform to UL 486A. Underground splices and connectors shall also conform to the requirements of ANSI C119.1.

2.5 CABLE BOXES

Boxes and covers shall be made of cast iron with zinc coated or aluminized finish, and shall be of the sizes indicated on drawings. The minimum inside dimensions shall be not less than 12 inches square by 6 inches deep and not less than required to house the cable splice. A suitable gasket shall be installed between the box and cover for watertightness. A sufficient number of screws shall be installed to hold the cover in place along the entire surface of contact. Grounding lugs shall be provided.

2.6 HANDHOLES, AND PULLBOXES

Handholes and pullboxes shall be as specified. Strength of handholes and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Handholes for low voltage cables installed in walkways and turfed areas shall be the open-bottom style and shall be from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and handhole covers in walkways and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers. Alternately, handholes and pullboxes shall be precast polymer concrete units similar to Quazite style PG or PC, as manufactured by Strongwell Corporation. Polymer concrete enclosures and covers shall be UL listed and ANSI/SCTE 77 compliant. A sufficient number of tamperproof bolts shall be installed to hold the cover firmly in place along the entire surface of contact; a tool for the tamperproof bolts shall be furnished. Each cover shall have logo "Street Lighting" molded into it.

2.7 CONDUIT, DUCTS AND FITTINGS

2.7.1 Conduit, Rigid Steel

Rigid steel conduit shall conform to ANSI C80.1 and UL 6.

2.7.2 Conduit Coatings

Underground metallic conduit and fittings shall be coated with a plastic resin system conforming to NEMA RN 1, Type 40. Epoxy systems may also be used.

2.7.3 Conduit Fittings and Outlets

2.7.3.1 Boxes, Metallic Outlets

NEMA OS 1 and UL 514A.

2.7.3.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.7.3.3 Boxes, Switch (Enclosed), Surface Mounted

UL 98.

2.7.3.4 Fittings for Conduit and Outlet Boxes

UL 514B.

2.7.3.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.7.4 Non-Metallic Duct

Non-metallic duct lines and fittings utilized for underground installation shall be suitable for the application. Duct shall be thick-wall, single, round-bore type. Material of one type shall be used. Acrylonitrile-butadiene-styrene (ABS) duct shall conform to NEMA TC 6 and NEMA TC 9. High-density conduit shall conform to UL 651A. Schedule 80 polyvinyl chloride (PVC) shall conform to UL 651. Plastic utility duct and fittings manufactured without a UL label or listing shall be provided with a certification as follows: "The materials are suitable for use with 167 degree F wiring. No reduction of properties in excess of that specified for materials with a UL label or listing will be experienced if samples of the finished product are operated continuously under the normal conditions that produce the highest temperature in the duct."

2.8 GROUND RODS

Ground rods shall be of copper clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into earth.

2.9 POLES

Metal poles shall be the pole manufacturer's standard design for supporting the fixtures specified. Poles shall be designed for a wind velocity of 70 mph at the base of the pole, for a wind gust factor of 1.3, and for the height and drag factors recommended by AASHTO LTS-4. The effective projected area of luminaires and other pole-mounted devices shall be taken into account in pole design. Poles shall be designed to support the furnished bracket arm, the furnished luminaire, and other pole-mounted devices. Poles shall be made from extruded aluminum. Poles shall have grounding provisions. Grounding connection shall be provided near the

bottom of each pole. A ground rod shall be installed at each pole location. Scratched, stained, chipped, or dented poles shall not be installed.

2.9.1 Aluminum Poles

Aluminum poles and brackets for roadway lighting shall have a uniform finish to match fixtures and shall not be painted. Poles and pole bases shall be a decorative architectural design and shall be similar in appearance to the "RA54" as manufactured by Lumec, Genlyte Thomas Group LLC. Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

- a. Shafts shall be made from a 5-inch round tube and shall be of one-piece seamless 12-flute construction. The wall thickness shall be at least 0.188 inch. Exterior surfaces shall be free of protuberances, dents, cracks, and discoloration. Material for shafts shall be 6063 aluminum alloy; after fabrication, the alloy shall have a T6 temper. Tops of shafts shall be designed and manufactured for use with the bracket arm specified in paragraph 2.2. Poles shall be the length necessary for the assembled unit including the furnished luminaire, the furnished bracket arm, and the installed pole to provide a luminaire mounting height of 14 feet above the pole's mounting base. Bases shall be anchor bolt mounted, made of cast aluminum alloy 356-T6, and shall be machined to receive the lower end of shafts. Joints between shafts and bases shall be welded. Bases shall be provided with four holes, spaced 90 degrees apart, for anchorage.
- b. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel.

2.9.2 Anchor Bolts

Anchor bolts shall be the pole manufacturer's standard, but not less than necessary to meet the pole wind and ice loading, herein and other specified design requirements.

2.10 POLE LINE HARDWARE

Zinc coated hardware shall conform to ANSI C135.1 and ANSI C135.14, and steel hardware material shall conform to ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M.

2.11 ELECTRICAL ENCLOSURES

The Contractor shall provide metallic enclosures as needed to house the lighting equipment. Enclosures shall conform to NEMA ICS 6 and NEMA 250. Enclosures shall be provided with lockable or padlock handles. Keys for lockable enclosures shall be delivered to the Contracting Officer. The enclosures shall be as specified or as shown on the drawings.

2.11.1 Exposed-to-Weather Enclosures

Enclosures to house lighting equipment in an outdoor environment shall meet the requirements of a NEMA 4 enclosure as defined in NEMA 250.

2.11.2 Corrosion Resistant Enclosures

Enclosures to house lighting equipment in a corrosive environment shall meet the requirements of a NEMA 4X enclosure as defined in NEMA 250.

2.12 ILLUMINATION

2.12.1 Roadway Lighting

Luminaires and luminaire components, ballasts, lamps, and control devices required for roadway lighting shall be in accordance with these specifications.

2.13 LAMPS AND BALLASTS, HIGH INTENSITY DISCHARGE (HID) SOURCES

2.13.1 High-Pressure Sodium

Lamps shall conform to ANSI C78.1351 or ANSI C78.1355. Ballasts shall conform to ANSI C82.4, or UL 1029. High-pressure sodium lamps shall be clear.

2.14 LUMINAIRE COMPONENTS

Luminaire components shall conform to the following: attachments, ANSI C136.3; voltage classification, ANSI C136.2; field identification marking, ANSI C136.15; interchangeability, ANSI C136.6 and ANSI C136.9; and sockets, ANSI C136.11.

2.15 LIGHTING CONTROL EQUIPMENT

2.15.1 Photo-Control Devices

Photo-control devices shall conform to ANSI C136.10. Each photo-control element shall be a replaceable, weatherproof, plug-in or twist-lock assembly adjustable operation range of approximately 0.5 to 5.0 foot-candles.

2.15.2 Manual Control Switches

Manual control switches shall conform to UL 98. The switches shall be the heavy-duty type and shall be suitable for operation on a 120-volt, 60 Hz system. The number of poles and ampere rating shall be as indicated. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. The selector switch shall have a minimum of three positions: ON, OFF, and AUTOMATIC. The automatic selection shall be used when photoelectric or timer control is desired. The selector switch shall interface with the lighting system magnetic contactor and control its activity.

2.15.3 Safety Switches

Switches shall be the heavy-duty type with NEMA ICS 6 Type 4 enclosures and shall be suitable for operation on a 240-volt, 60 Hz, single-phase system. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. Blades shall be visible with door open and shall be of the quick-make, quick-break type. Terminal lugs shall be coordinated with the wire size. Switches shall conform to UL 98.

2.15.4 Magnetic Contactor

Magnetic contactors shall be mechanically held, electrically operated, and shall conform to NEMA ICS 1 and NEMA ICS 2. The contactor shall be suitable for 240 volts, single-phase, 60 Hz. Coil voltage shall be 120 volts. Maximum continuous ampere rating and number of poles shall be as indicated on drawings. Each contactor shall be provided with a spare, normally open auxiliary contact. Terminal lugs shall be coordinated with the wire size.

2.16 PHOTOMETRIC DISTRIBUTION CLASSIFICATION

Photometrics shall conform to IESNA RP-8.

2.17 LUMINAIRES, FLOODLIGHTING

2.17.1 HID

HID lighting fixtures shall conform to UL 1572.

2.18 FIXTURES

Fixtures shall be of decorative architectural design similar in appearance to the "Tear Drop Series" as manufactured by Holophane, Acuity Lighting Group, Inc., the "Metropolis Lantern" as manufactured by Beacon Products Inc., the "Nostalgia Series" as manufactured by Union Metal Corporation, or the "Renaissance Series" as manufactured by Lumec, Genlyte Thomas Group LLC. The above-named fixtures are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar design, equivalent light distribution and brightness characteristics, equal finish and quality will be acceptable as approved. Each fixture shall be constructed of a cast aluminum housing with a one-piece seamless impact-resistant acrylic refractor, and shall include a hermetically sealed optical chamber having an imperviousness rating equivalent to, or greater than, IP (Ingress Protection) 66. Each fixture shall include an integrally-mounted ballast having a power factor not less than 90 percent. The ballast shall provide lamp wattage regulation of plus-or-minus 15 percent when the input voltage varies plus-or-minus 10 percent.

The luminaires shall produce a light distribution pattern in accordance with IESNA classification Type III. An isointensity diagram on which a rectangular coordinate grid has been superimposed to indicate computed roadway horizontal illuminance levels shall be provided for the proposed luminaires. The grid shall include a minimum of forty (40) evenly-spaced

test points, indicating roadway horizontal illuminance levels at each point. The proposed luminaires shall produce an overall computed average illuminance level of not less than 0.70 fc and an average-to-minimum (avg./min.) uniformity ratio not greater than 1.95. The computed illuminance levels shall be based on a test case which calculates a straight section of roadway, with values computed in accordance with IESNA RP-8. The test case shall assume the following conditions:

Roadway Width	20 ft.
Roadway Type	Single
IESNA Roadway Classification	R1
Luminaire Mounting Height	25 ft.
Luminaire Spacing	138 ft.
Pole Overhang (Setback from Roadway)	3 ft
Luminaire Bracket Arm Length	8 ft.
Lamp Type	High-Pressure Sodium
Lamp Wattage	150 max.

2.18.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

2.18.2 In-Line Fuse

An in-line fuse shall be provided for each fixture, and shall consist of a fuse and a UL approved waterproof fuse holder designed to accommodate the specified fuse. Fuse rating shall be 600 volts with an interrupting rating of 200,000A RMS symmetrical. Fuses shall be 13/32 inch X 1-1/2 inch, Class CC, time-delay type, and shall have current rating as recommended by fixture and/or ballast manufacturer.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall install all system components and appurtenances in accordance with the manufacturer's instructions, IEEE C2, and contract documents, and shall furnish necessary hardware, fixtures, cables, wire, connectors, interconnections, services, and adjustments required for a complete and operable system.

3.1.1 Existing Equipment

Existing lighting equipment shall remain the property of the City of Cairo. Contractor shall coordinate the removal and disposal of existing light poles and other lighting equipment with Larry Klein, General Manager, Cairo Public Utility Company, (618) 734-3200.

3.2 ENCLOSURE PENETRATIONS

Enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of enclosures

shall be sealed with rubber silicone sealant to preclude the entry of water.

3.3 PREVENTION OF CORROSION

3.3.1 Steel Conduits

Steel conduits shall not be installed within concrete slabs-on-grade. Steel conduits installed underground or under slabs-on-grade, or penetrating slabs-on-grade, shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlap, or shall have a factory-applied plastic resin, epoxy coating. Zinc coating may be omitted from steel conduit which has a factory-applied epoxy coating.

3.3.2 Cold Galvanizing

Field welds and/or brazing on factory galvanized boxes, enclosures, conduits, etc. shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

3.4 CABLE INSTALLATION

Cable and all parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors of size 8 AWG and larger shall be stranded. Each circuit shall be identified by means of fiber or nonferrous metal tags, or approved equal, in each handhole and junction box, and at each terminal.

3.4.1 Installation in Duct Lines

Grounded (neutral) and grounding conductors shall be installed in duct with the associated ungrounded conductors. Cable splices shall be made in handholes, pull boxes, or junction boxes only.

3.4.2 Direct Burial

3.4.2.1 Trenching

Trenches shall be excavated to the depths required to provide the minimum duct cover, including allowance required to slope duct for drainage. The bottom of the trench shall be smooth and free of stones and sharp objects. Where the bottom of the trench consists of material other than sand or earth, an additional 4-inch layer shall be removed and replaced by a 4-inch layer of sand or stone-free earth compacted to the approximate density of the surrounding firm soil. The duct shall be carefully placed on the sand or earth bottom.

3.4.2.2 Requirements for Cable Installation in Duct

Cable shall be installed in duct lines. Grounded (neutral) and grounding conductors shall be installed in duct with the associated ungrounded conductors. Pulling of cable into conduit from a fixed reel position will be permitted.

3.5 DUCT LINES

3.5.1 Requirements

Numbers and size of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 6 inches per 100 feet. Depending on the contour of the finished grade, the high point may be at a terminal, a pull box, a handhole, or between pull boxes or handholes. Short radius manufactured 90 degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inches in diameter, and 36 inches for duct 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells when duct lines terminate in pull boxes or handholes.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and shall match factory tapers. A coupling recommended by the duct manufacturer shall be used when an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Nonencased Direct-Burial

Top of duct lines shall be not less than 12 inches below finished grade and shall be installed with a minimum of 4 inches of sand around each duct . Bottom of trenches shall be graded toward pull boxes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 4-inch layer of sand or stone-free earth shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. The first 4-inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers.

3.5.4 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendation for the particular type of duct and coupling selected and as approved.

3.5.4.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent on insides of plastic coupling fittings and on outsides of duct ends. Each duct and

fitting shall then be slipped together with a quick 1/4 turn to set the joint tightly.

3.5.5 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other duct locations that are indeterminate because of duct curvature or terminations at completely below-grade structures.

3.6 HANDHOLES

The exact locations shall be determined after carefully considering the locations of light poles , grading, and paving. Exact locations shall be approved before construction is started. A handhole or pullbox shall be installed at each fixture pole.

3.6.1 Construction

Handholes shall be constructed as specified, including appurtenances. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic construction. Concrete shall be 3000 psi at 28 days. Precast concrete handholes having the same strength and inside dimensions as cast-in-place concrete handholes may be used. Alternately, precast polymer concrete units similar to Quazite style PG/LG or PC, as manufactured by Strongwell Corporation may be used. In paved areas, the top of entrance covers shall be flush with the finished surface of the paving. In unpaved areas, the top of entrance covers shall be approximately 1/2 inch above the finished grade. Where finished grades are in cut areas, unmortared brick shall be installed between the top of handhole and entrance frame to temporarily elevate the entrance cover to existing grade level. Where duct lines enter walls, the sections of duct may be cast in the concrete or may enter the wall through a suitable opening. The openings around entering duct lines shall be caulked tight with lead wool or other approved material.

3.7 POLE INSTALLATION

Pole lengths shall provide a luminaire mounting height of 25 feet above finished roadway surface. Electrical cabling shall be provided to the light pole as specified in Section 16120 INSULATED WIRE AND CABLE. Pole installation shall conform to the manufacturer's recommendations, NFPA 70, and IEEE C2. Poles shall be set straight and plumb.

3.7.1 Pole Brackets

Brackets shall be installed as specified by the manufacturer. Mounting hardware shall be sized appropriately to secure the mount, luminaire, and housing with wind and ice loading normally encountered at the site.

3.7.2 Concrete Foundations

Concrete foundations shall have anchor bolts accurately set in the foundation using a template supplied by the pole manufacturer. Once the concrete has cured, the pole shall be set on the foundation, leveled on the

foundation bolts, and secured with the holding nuts. The space between the foundation and the pole base shall be grouted. Concrete and grout work shall conform to Section 03308 CONCRETE. Concrete shall be 3000 psi at 28 days.

3.7.3 Aluminum Pole Installation

Poles shall be mounted on cast-in-place foundations. Conduit elbows shall be provided for cable entrances into pole interiors.

3.7.3.1 Cast-In-Place Foundations

Concrete foundations, sized as indicated, shall have anchor bolts accurately set in foundations using templates supplied by the pole manufacturer. Concrete work and grouting is specified in Section 03308 CONCRETE. After the concrete has cured, pole anchor bases shall be set on foundations and leveled by shimming between anchor bases and foundations or by setting anchor bases on leveling nuts and grouting. Poles shall be set plumb. Anchor bolts shall be the manufacturer's standard, and not less than necessary to meet the pole wind loading and other specified design requirements.

3.8 LIGHTING

3.8.1 Lamps

Lamps of the proper type, wattage, and voltage rating shall be delivered to the project in the original containers and installed in the fixtures just before completion of the project.

3.8.2 Fixture Installation

Standard fixtures shall be installed as specified and as recommended by the manufacturer.

3.8.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be installed as required for proper installation.

3.8.2.2 In-Line Fuses

An in-line fuse shall be provided for each fixture.

3.9 LIGHTING CONTROL SYSTEM

3.9.1 Photo-Control

Lighting luminaires shall be controlled as a group by a magnetic lighting contactor and a single photo-control element mounted at or near the service for the lighting circuit.

3.9.2 Manual and Safety Switches

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four 1/4 inch bolts. The use of sheet metal screws will not be allowed.

3.9.3 Magnetic Contactors

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four 1/4 inch bolts. The use of sheet metal screws will not be allowed.

3.10 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following. Grounding conductors shall be soft-drawn, stranded copper. Ground rods shall be driven into the earth so that after the installation is complete, the top of the ground rod will be approximately 1 foot below finished grade, except in handholes.

3.10.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, one additional electrode shall be provided interconnected with grounding conductors, to achieve the specified ground resistance. The additional electrode shall be a single extension-type rod, 3/4 inch in diameter, up to 30 feet long, driven perpendicular to grade. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.10.2 Items to be Grounded

Grounding conductors, metallic conduits, junction boxes, and noncurrent-carrying metallic parts of equipment shall be grounded. Connections above grade shall be made with solderless connectors, and those below grade shall be made by a fusion-welding process.

3.10.3 Lighting Pole

One ground rod shall be provided at each pole. Bases of metal lighting poles shall be connected to ground rods by means of No. 8 AWG bare copper wire. All lighting fixture brackets, housings, and other noncurrent-carrying metallic appurtenances shall be electrically continuous to assure a low impedance connection to the ground rod.

3.10.4 Handhole

Each handhole and pullbox shall be connected to adjacent ground rod by

means of No. 8 bare copper wire.

3.11 TESTS

3.11.1 Operating Test

After the installation is completed and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements specified. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the test, and the Government will furnish the necessary electric power.

3.11.2 Ground Resistance Measurements

The resistance to ground shall be measured by the fall-of-potential method described in IEEE Std 81.

-- End of Section --