

# TECHNICAL SPECIFICATIONS

## NEW PARKING AREA CONSTRUCTION – L21 6-0-60



### **PROJECT: LOCKHEED MARTIN FACILITIES** **190 Street La Montana, Aguadilla Pueblo Ward** **Municipality of Aguadilla, PUERTO RICO**

Prepared for:

**Puerto Rico Industrial Development Company - PRIDCO**

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**SECTION 01 10 00**

**SUMMARY OF WORK**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Project Information.
- B. Work covered by Contract Documents.
- C. Work by Tenant.
- D. Access to site.
- E. Work restrictions.
- F. Specification and drawing conventions.
- G. Miscellaneous provisions.
- H. Scope of Work - General.

**1.2 RELATED SECTIONS**

- A. Division 00 - Procurement and Contracting Requirements.
- B. Remaining Division 01 Sections - General Requirements.
- C. Divisions 02 through 41 Sections - Technical Specifications.

**1.3 PROJECT INFORMATION**

- A. Project Identification: New Parking Areas Lot L 216-0-60  
Lockheed Martin  
Aguadilla, Puerto Rico
- B. Project Location: Avenue 190 Jardines de Aguadilla Street  
Borinquen Aguadilla, Puerto Rico
- C. Owner: PRIDCO (Puerto Rico Industrial Development Company)
- D. Architect-Engineer: JTO Engineering, LLC  
PR-152 Int. Km 1.7  
Barranquitas, Puerto Rico 00794

**1.4 WORK COVERED BY CONTRACT DOCUMENTS**

- A. The Work of Project is defined by the Contract Documents and consists of the following:
  - 1. Site Construction: Selective demolition, earthwork, detention pond, paving & marking, lighting, etc.
  - 2. The Contractor shall furnish all necessary materials, labor,

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supervision and any other necessary incidental required to complete the Scope of Work as described herein or as indicated on the drawings and related specifications.

B. Type of Contract:

1. Project will be constructed under a single prime, lump sum contract.

**1.5 WORK BY OWNER**

1. None.

**1.6 WORK BY TENANT**

- A. General: Cooperate fully with separate contractors hired and paid by the Tenant so work on those contracts may be carried out smoothly without interfering with or delaying work under this contract or other contracts.
- B. Concurrent Work: Tenant will award separate contractors for the following construction operations at Project site. These operations will be conducted simultaneously with work under this Contract.
  1. N/A.

**1.7 ACCESS TO SITE**

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated on the drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  1. Limits: Confine construction operations to areas within Contract limits.

**1.8 WORK RESTRICTIONS**

- A. Nonsmoking: Smoking is not permitted within the project site.
- B. Controlled Substances: Use of tobacco products and other controlled substances on project facilities is not permitted.

- C. Employee Identification: Provide identification tags with photograph for Contractor personnel working on the project at Lockheed Martin Facilities. Require personnel to use identification tags with photograph at all times.

## **1.9 SPECIFICATION AND DRAWING CONVENTIONS**

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

## **1.10 MISCELLANEOUS PROVISIONS**

- A. Safety Requirements:

1. It is the Contractor's responsibility to provide safety equipment required to protect the Owner's personnel and Owner's property to the satisfaction of OSHA Standards for the Construction Industry (29 CFR Part 1926). This includes but is not limited to the follows:
  - a. Provide Owner approved fire blankets and welding boxes as required for welding.



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- b. Provide fire hoses with pressure to nozzle at all times when performing hot work. The hose will be manned at all times during working hours.
- c. Provide adequate fire extinguishers when performing hot work.
- d. In addition to the above, the Contractor shall bring, special emphasis to bear on the subject to safety by use of posters and other visual reminders and such other methods as he may devise. The Contractor's proposed safety program is to be reviewed with the Owner's On Site Representative prior to the start of field construction and integrated into the overall safety program.

2. The Contractor shall conduct an indoctrination session of the "Contractor Safety Regulations" with his own forces and sub- contractors employees within the first week of employment. Each Contractor and Sub-Contractor employee receiving this indoctrination will be required to sign a Contractor's form stating that he has received this training. Contractor shall conduct weekly safety meetings with his employees.

## **PART 2 - SCOPE OF WORK - GENERAL**

### **2.1 GENERAL**

- A. The following is an outline of the general work requirements for the New parking Areas; Lot L21 6-0-60 Aguadilla, Puerto Rico. This outline is prepared as a guide only and is not to be considered as a complete description of the work requirements.
- B. The Contractor shall construct the items listed below and the more specifically detailed in the drawings in strict accordance with the specifications listed elsewhere in the Contract Documents.
- C. Where the Contractor's work shall encounter existing construction, the Contractor shall verify the condition and dimensional accuracy before proceeding. Where the new construction, as specified, is in conflict with existing conditions, the Contractor shall immediately bring it to the attention of the Owner's On Site Representative and/or Architect-Engineer for resolution.
- D. All equipment and materials shall be installed in strict accordance with the approved shop drawings and the printed instructions of the manufacturer, unless more stringent requirements are required by the Owner's On Site Representative or are shown on the drawings.
- E. Contractor shall notify and receive written approval from the Owner's On Site Representative and/or Architect-Engineer for proposed deviations from Contract Documents. If proposed deviations are made without the Owner's On Site Representative and/or Architect-Engineer written approval, this shall be considered as just cause for dismantling and removal of said work at Owner's On Site Representative and/or Architect-Engineer discretion. Reconstruction and/or reinstallation of the work shall be at Contractor's expense.
- F. Owner's On Site Representative, Architect-Engineer and/or his authorized representative shall have the right at all times to inspect and test the work and shall for this purpose have access to the work whenever it is in preparation or in progress. The Contractor shall provide necessary labor and proper facilities for such access, inspection and testing, and shall provide complete information concerning all materials entering into the work.
- G. Contractor shall handle and haul all materials, equipment and tools from the designated storage area(s) to the work area.
- H. Contractor shall provide all hoisting, scaffolding and/or shoring required for the complete installation of all materials, equipment or systems included in this Scope of Work.

- I. Contractor shall provide all required cutting, drilling, bolting, welding, patching, weatherproof, etc. necessary to complete the work under this Scope of Work.
- J. Contractor shall furnish the services of all trades necessary to complete all items enclosed in this Scope of Work.
- K. Contractor shall furnish material and labor necessary to correct at his expense, any items improperly installed.
- L. Contractor shall receive, unload, store and provide necessary weather protection for all materials, equipment and tools which he furnishes and installs. These items shall be stored in areas within the site designated by the Owner's On Site Representative.
- M. Contractor shall furnish, install and maintain all temporary field offices required for this work for the duration of this Contract. Location of temporary field office to be designated by the Owner's On Site Representative.
- N. Contractor shall furnish all field engineering services required to complete this work.
- O. Contractor shall make all submittals and obtain all approvals as specified and required to complete this work.
- P. Contractor shall provide all required guarantees and certification for items of work and systems installed under this contract.
- Q. Rubbish and dirt resulting from the Contractor's work shall be removed by the Contractor daily or more frequently as necessary to prevent the accumulation thereof and shall be disposed of as directed by the Owner's On Site Representative and/or Architect-Engineer. Failure of the Contractor to clean up and remove rubbish as called for, will be cause for the Owner's On Site Representative and/or Architect-Engineer to order this work to be done by others at the expense of the Contractor.
- R. The areas assigned for Contractor's use and areas in which he is doing construction work shall be cleaned thoroughly at least once daily. All construction debris shall be removed in a legal manner from the project site on a daily basis. Contractor is responsible for maintaining a high standard of housekeeping in his construction sites and storage areas at all times. Contractor shall store materials in a safe and organized manner and dispose off site material containers and construction debris on a daily basis.
- S. All construction trailers, office sheds and warehouses used by the Contractor during the execution of this work shall be placed at the place (authorized by the Owner's On Site Representative) within the site of the project.

- T. When the work is being executed away from the premises, the Owner's On Site Representative and Architect-Engineer shall be notified, in reasonable time, where such work is being done and when it will be ready for inspection, so that the Owner's On Site Representative, the Architect-Engineer and/or his authorized representatives may, if they should so desire, inspect the same from time to time before delivery.
  - U. Contractor shall take necessary actions to eliminate possible fire hazards and to prevent damage to any construction work, building materials, equipment, temporary field offices, storage sheds and all other property.
  - V. Contractor shall protect all existing materials and areas against damage during the performance of his Work. Any damage to roads, parking lots, traffic coatings (parking lots), steel, concrete slabs, floor finishes, walls, roof, piping, equipment, etc., inflicted by this Contractor will be repaired at his expense.
  - W. Contractor shall contact Owner's On Site Representative regarding safety requirements and shall comply with said requirements for the entire duration of the Contract.
  - X. The progress schedule will be monitored on a daily and/or weekly basis by the Owner's On Site Representative and/or the Architect-Engineer, if it becomes apparent during the monitoring of the progress that slippage has occurred, then the Owner's On Site Representative and/or the Architect-Engineer shall direct the Contractor to take all necessary steps to regain the slippage and maintain the additional manpower until such time that the progress agrees with the current schedule. This will be accomplished at no cost to Owner.
  - Y. The Contractor will be responsible for maintaining the project with the maximum number of skilled workers at all times to achieve the completion dates indicated in the construction schedule. If the Contractor determines that overtime and/or shift work is required to attain such dates, such costs shall be included in the Bid Proposal.
  - Z. Contractor shall hire and pay for the services of a testing laboratory to perform all inspection and tests required by the respective Specification Sections. Testing, because of faulty work, will be paid by the Contractor.
1. Any testing listed in the drawings and technical specifications.

## 2.2 FIRE PROTECTION AND SAFETY

- A. During the construction, Contractor shall provide the quantity of filled or fully charged fire extinguishers and hose to meet safety and fire prevention practices established under NFPA 241.
- B. Welding, flame cutting or other operations involving the use of flame, arcs or sparking devices, will not be allowed without adequate protection. All combustible or flammable material shall be removed from the immediate working area or, if removal is impossible, all flammable or combustible materials shall be protected with suitable noncombustible shields to prevent spark, flames, or hot metal from reaching the flammable or combustible materials.
- C. Not more than one day's supply of flammable liquids such as oil, gasoline, paint or paint solvent shall be brought into the buildings at any one time. All flammable liquids having a flash point of one hundred ten degrees Fahrenheit (110°F) or below which must be brought into the building shall be confined in Underwriters' Laboratories labeled safety cans. If one day's supply requires quantities greater than a safety can will hold, one (1) fifty-five (55) gallon drum may be used. Drums are to be equipped with safety bungs and U.L. listed pumps. The bulk supply of all flammables shall be stored at least seventy-five feet (75'-0") from the building or other combustible materials. Spigots on drums containing flammable liquids are prohibited on the project site.
- D. Flammable building materials located inside the building shall be kept to an absolute minimum.
- E. Oil-soaked rags, papers, and other combustible debris shall be removed from the building at the close of each day's work. This material shall be stored in a suitable approved area away from all buildings and hauled away prior to reaching large accumulations.
- F. Burning of debris and rubbish on the site is not permitted.
- G. Materials and/or equipment stored within the building in cardboard cartons, wood crates or other combustible containers shall be stored in an orderly manner and accessibly located. Firefighting equipment of approved types shall be placed in the immediate vicinity of any materials or equipment stored in this type of crane or carton.
- H. No gasoline, benzine or like combustible materials shall be poured into sewers, manholes, or traps.
- I. The gases used for welding and cutting shall be purchased in cylinders. These cylinders shall be constructed and maintained in accordance with regulations of the U.S. Department of Transportation. The cylinders shall bear DOT markings and the

contents of each cylinder shall be legibly marked in large letters.

- J. Cylinders of oxygen and acetylene inside buildings shall be stored in areas that are well ventilated and free from moisture and water. Flammable substances, such as oil and volatile liquids shall not be stored in the same area. The area assigned to cylinder storage shall be well protected by location from possible damage by other types of activity. Oxygen cylinders stored inside shall be separated by a fire-resistant partition from cylinders containing flammable gases.
- K. Cylinders of oxygen and acetylene are to be protected from the hot sun by such means as canopies and/or sheds.
- L. To avoid confusion, full cylinders and empty cylinders should be stored in separate groups. All empty cylinders shall be marked "Empty" or "MT."
- M. Flammable gas, such as acetylene, and other gases shall not be premixed with air or oxygen, prior to consumption, except at burner or in a cutting or welding torch designed for that purpose.
- N. Oxygen and acetylene shall be withdrawn from cylinders provided with regulators and/or pressure-reducing valves specifically designed for such purposes.
- O. All cylinders shall be set in a vertical position during storage at the job site and while in portable carts, when in use, and shall be fastened to insure against tipping.

### **2.3 OWNER RIGHT TO PERFORM WORK**

- A. Owner reserves the right to perform work related to the Project with its own forces, and to award separate contracts in connection with other portions of the Project or another work on the Project Site which are not part of the Work.
- B. Owner shall provide for the coordination of the work of its own and of each separate contractor with the Work of Contractor (Work of this Bid Package) who shall cooperate therewith as provided herewith.
- C. Contractor (this Bid Package) shall afford Owner and separate contractors reasonable opportunity for the introduction and storage of their materials and equipment and for the execution of their work.
- D. Contractor shall connect and coordinate the work with the work of Owner and separate contractors as required by the Contract Documents. If any part of the Work (this Bid Package) depends for proper execution or results upon the work of Owner or any other separate contractor, Contractor shall, prior to proceeding with Work, promptly report to the Owner's On Site Representative any

discrepancies or defects that are reasonably discoverable which render such work unsuitable for proper execution and results.

- E. Failure of Contractor so to report shall constitute an acceptance of Owner's or separate contractor's work as fit and proper to receive the Work.
- F. Any costs caused by defective or ill timed work shall be borne by the party responsible therefore.
- G. Should Contractor (this Bid Package) cause damage to the work or property of Owner, or to other work or property on the Project site, Contractor (this Bid Package) shall promptly remedy such damages.

## **2.5 PIPE AND EQUIPMENT IDENTIFICATION**

### **A. Piping**

- 1. Not Used.

### **B. Equipment Identification:**

- 1. Not Used.

### **C. Valves Identification**

- 1. Not Used.

## **2.6 PROTECTION OF DUCTWORK**

- A. Not Used.

## **2.7 INDOOR AIR QUALITY DURING CONSTRUCTION**

- A. The Contractor shall provide to the Owner material data sheets (MSDS) or other appropriate documents upon request, but prior to the installation or use for the following products including but not limited to: adhesive, caulking, sealants, insulating materials, fireproofing of fire stopping materials, paints, carpets, floor and wall patching or leveling materials, lubricants, clear finishes for wood surfaces, etc.
- B. All MSDS shall comply with Occupational Safety and Health Administration (OSHA) requirements. The Contractor and its subcontractors shall comply with all recommended measures in the MSDS to protect the health and safety of personnel.

**END OF SECTION**

**SECTION 01 20 00**

**PRICE AND PAYMENT PROCEDURES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Schedule of values.
- B. Applications for payment.
- C. Change procedures.

**1.2 SCHEDULE OF VALUES**

- A. Submit printed schedule of Application and Certificate for Payment. Contractor's standard form or electronic media printout will be considered.
- B. Submit four copies of the Schedule of Values within 10 calendar days after Date of Owner-Contractor Agreement or Date of Notice to Proceed, whichever comes first.
- C. Format:
  - 1. The Contractor and each Subcontractor shall prepare a trade payment breakdown for the work for which each is responsible.
  - 2. Utilize the Table of Contents of this Project Manual.
  - 3. Identify each line item with number of the major specification section.
  - 4. The form shall be divided in detail sufficient to exhibit each section of the Work and shall be updated as required by the Owner Representative.
  - 5. Any trade breakdown which fails to include sufficient detail, is unbalanced or exhibits "front loading" of the value of the Work shall be rejected.
  - 6. If trade breakdown has been initially approved and subsequently used, but later found improper for any reason, sufficient funds will be withheld from future Applications for Payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Work.
  - 7. Include within each line item, a direct proportional amount of Contractor's profit.
- D. Revise schedule to list approved Change Orders, with each Application for Payment.

**1.3 APPLICATIONS FOR PAYMENT**

- A. Submit four (4) copies of each application; Application and Certificate for Payment.



- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Submit preliminary application for payment to Owner's Representative, for review and concurrence, 5 calendar days prior to formal submission date. Include only percentage of completion figures, not complete money tabulations. Resubmit corrected percentages with formal application for payment to Owner's Representative for his approval and signature prior to submittal to Owner.
- D. Payment Period: Submit at intervals stipulated in the Agreement.
- E. First Application for Payment will not be processed until all the following documentation is approved by the Owner Representative:
  - 1. Schedule of Values
  - 2. Schedule of Submittals
  - 3. Cash-Flow (S-Curve)
  - 4. Procurement Schedule Format
  - 5. Construction Schedule (Cash-flow related)
- F. No progress payment will be made until Record Documents are up to date (Refer to Section 01 73 00) and submittals of all products and materials submitted for payment have been approved by the Architect - Engineer.
- G. The progress payment 30 days before Substantial Completion will not be made until all operating and maintenance manuals and guaranties are submitted as required in Section 01 73 00.
- H. Progress payment may be withheld for failure to submit shop drawings and product data as requested in Section 01 33 00.
- I. Include the following documentation with each Application for Payment:
  - 1. Record documents as specified in Section 01 73 00, for review by the Owner Representative which will be returned to the Contractor. Certify as a part of each application for payment that the project record documents are current at the time of application is submitted. The Contractor shall require such drawings to be correct as a condition of approving any payment to the trade Contractor and Subcontractor.
  - 2. Written list identifying each location where materials are stored off the Project site and the value of materials at each location. The Contractor shall procure insurance satisfactory to the Owner for materials stored off the Project site in an amount not less than the total value thereof.
  - 3. As-Built construction progress schedules, revised and current as specified in Section 01 33 00. If actual progress is behind schedule, discussion of a "catch up plan" that Contractor has employed or will employ to recover the original Project Schedule.

4. An update of the Procurement Schedule.
5. An update of the S-Curve indicating projected and actual cash flow to date.
6. A 30-Day Look-Ahead Schedule of Project.
7. A summary of any claims anticipated by Contractor with respect to the Work, including the anticipated cost and schedule impacts of any such claims.
8. Concrete compressive strength test results of concrete placed during the payment period covered by the Application for Payment.
9. Compaction test results of fill material placed during the payment period covered by the Application for Payment.

#### **1.4 CHANGE PROCEDURES**

- A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. The Owner Representative will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions form.
- C. The Owner Representative may issue a Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with stipulation of overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 21 calendar days.
- D. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for Change Order as approved by Owner Representative.
  1. Contractor shall submit proposals for changes in the Work to the Owner Representative within 21 calendar days after a modification is issued.
  2. Proposals, to be submitted within 21 calendar days after receipt of request for proposal, shall be in legible form (three copies), with an itemized breakdown that will include material, quantities, unit prices, labor costs (separated into trades), construction equipment, etc. Labor costs are to be identified with specific material placed or operation performed. The Contractor must obtain and furnish with a proposal an itemized breakdown as described above, signed by each subcontractor participating in the change regardless of tier.
  3. Proposals will not be reviewed if the same does not comply with paragraph D.2.
- E. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on fixed unit price basis. For

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unit costs or quantities of units of work which are not pre-determined, execute Work under Construction Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.

- F. Construction Change Directive: Owner Representative may issue directive, on Form Construction Change Directive signed by Owner Representative, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change.
- G. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Owner Representative will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
- H. Maintain detailed records of work done on Time and Material Force Account basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
- I. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.
- J. Change Order Forms: Change Order.
- K. Execution of Change Orders: Owner Representative will issue Change Orders for signatures of parties as provided in Conditions of the Contract.
- L. Correlation Of Contractor Submittals:
  - 1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
  - 2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
  - 3. Promptly enter changes in Project Record Documents.

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used

**END OF SECTION**

**SECTION 01 31 00**

**ADMINISTRATIVE REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Coordination and project conditions.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Pre-installation meetings.

**1.2 COORDINATION AND PROJECT CONDITIONS**

- A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

**1.3 PRECONSTRUCTION MEETING**

- A. Owner will schedule meeting after Notice of Award.
- B. Attendance Required: Owner, Tenant, Architect/Engineer, and Contractor.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
  - 5. Designation of personnel representing parties in Contract, and Architect/Engineer.
  - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  - 7. Scheduling.
  - 8. Construction's personnel parking.
  - 9. Construction Compound.

- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect/Engineer, Owner, Tenant, and those affected by decisions made.

#### **1.4 SITE MOBILIZATION MEETING**

- A. Owner will schedule meeting at Project site prior to Contractor occupancy.
- B. Attendance Required: Owner, Tenant, Architect/Engineer, Contractor, Contractor's Superintendent, Safety Officer, and major Subcontractors.
- C. Agenda:
  - 1. Use of premises by Owner and Contractor.
  - 2. Owner's requirements.
  - 3. Construction facilities and controls.
  - 4. Security and housekeeping procedures.
  - 5. Schedules.
  - 6. Submittal Procedures.
  - 7. Application for payment procedures.
  - 8. Procedures for testing.
  - 9. Procedures for maintaining record documents.
  - 10. Requirements for start-up of equipment.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect/Engineer, Owner, Tenant, and those affected by decisions made.

#### **1.5 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals.
- B. Make arrangements for meetings prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Tenant, Architect/Engineer, as appropriate to agenda topics for each meeting.
- D. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of Work progress.

3. Field observations, problems, and decisions.
  4. Identification of problems impeding planned progress.
  5. Review of submittals schedule and status of submittals.
  6. Review of off-site fabrication and delivery schedules.
  7. Maintenance of progress schedule.
  8. Corrective measures to regain projected schedules.
  9. Planned progress during succeeding work period.
  10. Coordination of projected progress.
  11. Maintenance of quality and work standards.
  12. Effect of proposed changes on progress schedule and coordination.
  13. Other business relating to Work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect/Engineer, Owner, Tenant, and those affected by decisions made.

#### **1.6 PRE-INSTALLATION MEETINGS**

- A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Notify Architect/Engineer four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  1. Review conditions of installation, preparation and installation procedures.
  2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect/Engineer, Owner, and those affected by decisions made.

#### **PART 2 - PRODUCTS**

Not Used.

#### **PART 3 -EXECUTION**

Not Used.

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**END OF SECTION**

**SECTION 01 33 00**

**SUBMITTAL PROCEDURES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Requests for Information (RFI)
- D. Proposed products list.
- E. Product data.
- F. Shop drawings.
- G. Samples.
- H. Design data.
- I. Test reports.
- J. Certificates.
- K. Manufacturer's instructions.
- L. Manufacturer's field reports.
- M. Erection drawings.
- N. Subcontractor's Equipment Orders.
- O. Subcontractor's Coordination Drawings.
- P. Extra Material.

**1.2 SUBMITTAL PROCEDURES**

- A. Transmit each submittal with Owner Representative accepted form.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- C. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.



- E. Schedule submittals to expedite Project, and deliver to Owner Representative at project site. Coordinate submission of related items.
- F. For each submittal (product data, samples, shop drawings) for review, allow 7 working days. Submittals received by Architect-Engineer after 2:00 p.m. will be considered as received the following working day.
- G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.
- H. Allow space on submittals for Contractor and Architect-Engineer review stamps.
- I. When revised for resubmission, identify changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- K. Submittals not requested will not be recognized or processed.
- L. The Architect-Engineer's review of Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect-Engineer for evaluation of additional resubmittals.

### **1.3 CONSTRUCTION PROGRESS SCHEDULES**

- A. Submit to Architect - Engineer four (4) copies of initial schedules within 15 calendar days after Date of Owner-Contractor Agreement or Date of Notice to Proceed, whichever comes first. After review, resubmit required revised data within ten days.
- B. Submit as-built Progress Schedules with each Application for Payment.
- C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.
- D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.
- E. The construction schedule shall be in a detailed precedence-style critical path management ("CPM"), primavera-type format or Microsoft Project Manager format satisfactory to the Owner Representative. Schedule shall also provide the following:
  - 1. Graphic representation of each activity and events that will occur during performance of the Work.
  - 2. Identify each phase of construction and occupancy.
  - 3. Set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents (hereinafter referred to as "Milestone Dates").

- F. Upon review and acceptance by the Owner and the Architect - Engineer of the Milestone Dates, the construction schedule shall be deemed part of the Contract Documents.
- G. If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Architect - Engineer and resubmitted for acceptance.
- H. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner and Architect-Engineer of any delays or potential delays.
- I. The accepted construction schedule shall be updated to reflect actual conditions as set forth in subparagraph 3.10.1 of the General Conditions or if requested by the Owner Representative.
- J. In the event any progress report indicating and delays, the Contractor shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report constitute an adjustment in the Contract Time, any Milestone Date, or the Contract Sum unless such adjustment is agreed to by the Owner and authorized pursuant to Change Order.

#### **1.4 REQUESTS FOR INFORMATION (RFIs)**

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI to the Architect - Engineer.
  - 1. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. Project number.
  - 3. Date.
  - 4. Name of Contractor.
  - 5. Name of Architect and Owner Representative.
  - 6. RFI number, numbered sequentially.
  - 7. RFI subject.
  - 8. Specification Section number and title and related paragraphs, as appropriate.
  - 9. Drawing number and detail references, as appropriate.
  - 10. Field dimensions and conditions, as appropriate.

11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Owner Representative.
- D. Architect-Engineer's Action: Architect-Engineer will review each RFI, determine action required, and respond. Allow five (5) working days for Architect-Engineer's response for each RFI. RFIs received by Architect-Engineer after 2:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 20 00.
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify the Owner Representative in writing within five days of receipt of the RFI response.
- E. On receipt of Architect action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Owner Representative within five days if Contractor disagrees with response.

- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect and Owner Representative.
  4. RFI number including RFIs that were dropped and not submitted.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- G. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect-Engineer for evaluating and responding to the Contractor's requests for information (RFI's) that are not prepared in accordance with the Contract Documents or when the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

#### **1.5 PROPOSED PRODUCTS LIST**

- A. Within 15 calendar days after date of Owner-Contractor Agreement or date established on Notice to Proceed whichever comes first, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

#### **1.6 PRODUCT DATA**

- A. Product Data: Submit to Owner's Representative for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents. Provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 73 00.
- B. Submit number of copies Contractor requires, plus two copies Architect/Engineer will retain.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. After review distribute in accordance with Submittal Procedures article above and provide copies for record documents described in Section 01 73 00.

#### **1.7 SHOP DRAWINGS**

- A. Shop Drawings: Submit to Owner's Representative for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents. Produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 73 00.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Submit in form of one reproducible transparency and one opaque reproduction.

#### **1.8 SAMPLES**

- A. Samples: Submit to Owner's Representative for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents. Produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 73 00.
- B. Samples For Selection as Specified in Product Sections:
  - 1. Submit to Owner's Representative for aesthetic, color, or finish selection by Architect.
  - 2. Submit samples of finishes from full range of manufacturers' standard colors or in custom colors selected, textures, and patterns for Architect/Engineer selection.
  - 3. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 73 00.
- C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full Project information.
- E. Submit number of samples specified in individual specification sections; Architect/Engineer will retain one sample.
- F. Reviewed samples which may be used in the Work are indicated in individual specification sections.
- G. Samples will not be used for testing purposes unless specifically stated in specification section.

### **1.9 DESIGN DATA**

- A. Submit for Owner's Representative and Architect's knowledge.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

### **1.10 TEST REPORTS**

- A. Submit for Owner's Representative and Architect's knowledge.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

### **1.11 CERTIFICATES**

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

### **1.12 MANUFACTURER'S INSTRUCTIONS**

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Owner's Representative for delivery to Architect in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

### **1.13 MANUFACTURER'S FIELD REPORTS**

- A. Submit report in duplicate within 10 days of observation to Owner's Representative for information.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

### **1.14 ERECTION DRAWINGS**

- A. Submit drawings to Owner's Representative.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

- C. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner's Representative.

#### **1.15 SUBCONTRACTOR'S EQUIPMENT ORDERS**

- A. Obtain from the plumbing, mechanical, fire protection and electrical subcontractors and submit within eight (8) weeks after award of Contract verification that orders have been placed for the specified major plumbing, mechanical and electrical equipment, including but not limited to items such as the following: electrical panels, electrical fixtures, pumps, fan units, etc. and other items requiring long lead time.
- B. In addition to verification of equipment orders as requested in A above, obtain from those subcontractors and submit within four (4) weeks of award of contract the brand names of all specified equipment and materials they will be furnishing and installing on this job.

#### **1.16 SUBCONTRACTOR'S COORDINATION DRAWINGS**

- A. Coordinate the installation of all the Work. To this end, obtain scaled installation drawings for the HVAC, plumbing, fire protection and electrical subcontractors. The HVAC subcontractor shall prepare one set of coordinate drawings showing the proposed installation, indicating scaled sizes (not line drawings) and exact locations of ducts, pipes, conduits, and the required openings through walls, floors, and roofs for their penetration. Include relation to all structural elements.
- B. Architect will have the 1/8 in. scale original drawings blow up to  
1/4 in. scale at Contractor's expense if Contractor so requests.
- C. For purposes of clarity and completeness make the final drawings a composite showing all the above mentioned trades work. In addition to plan view, prepare sections indicating heights to clarify clearances from structure and from each other. Use partial sections where necessary.
- D. Upon review and acceptance by Contractor, submit three (3) sets to Owner Representative for review. Review by Architect is to assist Contractor only. Responsibility for coordinating the work lies with the Contractor. Installation shall be started only in areas the have been reviewed.

#### **1.17 EXTRA MATERIAL**

- A. In the various sections, where a certain percentage of additional or extra material is required to be delivered to the Owner, obtain from the Owner's representative to whom the material is delivered a signed receipt stating the nature of the material, the quantity, and the place and date. Delivery such receipts to the Architect- Engineer upon completion of the work.

### **PART 2 - PRODUCTS**

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Not Used.

**PART 3 -EXECUTION**

Not Used.

**END OF SECTION**



**SECTION 01 40 00**

**QUALITY REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Quality control and control of installation.
- B. Tolerances.
- C. References.
- D. Mock-up requirements.
- E. Testing and inspection services.
- F. Manufacturers' field services.
- G. Examination.
- H. Preparation.

**1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

**1.3 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

- C. Adjust products to appropriate dimensions; position before securing products in place.

#### **1.4 REFERENCES**

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date for receiving bids except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

#### **1.5 MOCK-UP REQUIREMENTS**

- A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be comparison standard for remaining Work.
- D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect/Engineer.

#### **1.6 TESTING AND INSPECTION SERVICES**

- A. Contractor shall employ and pay for specified services of an independent firm to perform testing and inspection services.
  - 1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer specialist and responsible officer.
  - 2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.
- B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Architect/Engineer.

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1. Laboratory: Authorized to operate in the Commonwealth of Puerto Rico.
  2. Laboratory Staff: Maintain full time registered Engineer on staff to review services.
  3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Architect/Engineer or Owner.
- D. Reports will be submitted by independent firm to Architect/Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
1. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
  2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Architect/Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
- H. Agency Responsibilities:
1. Test samples of mixes submitted by Contractor.
  2. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.
  3. Perform specified sampling and testing of products in accordance with specified standards.
  4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  5. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or products.
  6. Perform additional tests required by Architect/Engineer.
  7. Attend preconstruction meetings and progress meetings.

- I. Agency Reports: After each test, promptly submit two copies of report to Architect/Engineer and to Contractor. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
1. Date issued.
  2. Project title and number.
  3. Name of inspector.
  4. Date and time of sampling or inspection.
  5. Identification of product and specifications section.
  6. Location in Project.
  7. Type of inspection or test.
  8. Date of test.
  9. Results of tests.
  10. Conformance with Contract Documents.
- J. Limits On Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  2. Agency or laboratory may not approve or accept any portion of the Work.
  3. Agency or laboratory may not assume duties of Contractor.
  4. Agency or laboratory has no authority to stop the Work.

#### **1.7 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Refer to Section 01 33 00 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

#### **PART 2 - PRODUCTS**

Not Used.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify utility services are available, of correct characteristics, and in correct locations.

#### **3.2 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

**END OF  
SECTION**

**SECTION 01 50 00**

**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Temporary Utilities:
  - 1. Temporary electricity.
  - 2. Telephone service.
  - 3. Temporary water service.
  - 4. Temporary sanitary facilities.
- B. Construction Facilities:
  - 1. Parking.
  - 2. Progress cleaning and waste removal.
- C. Temporary Controls:
  - 1. Security.
  - 2. Dust control.
  - 3. Noise control.
  - 4. Pollution control.
- D. Removal of utilities, facilities, and controls.

**1.2 TEMPORARY ELECTRICITY**

- A. Contractor shall provide and pay for power service required from utility source as needed for construction operations.
- B. Provide temporary electric feeder from utility source.
- C. Provide power outlets, with branch wiring and distribution boxes located at each floor or as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment.
- D. Provide main service disconnect and over-current protection at convenient location.

**1.3 TELEPHONE SERVICE**

- A. Contractor shall provide, maintain, and pay for telephone service to Contractor's field office at time of project mobilization.

**1.4 TEMPORARY WATER SERVICE**

- A. Contractor shall provide and pay for suitable water service as needed to maintain specified conditions for construction operations.

- B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

#### **1.5 TEMPORARY SANITARY FACILITIES**

- A. Contractor shall provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization. The use of building restrooms is not permitted.

#### **1.6 PARKING**

- A. Contractor shall provide parking facilities for his construction personnel.

#### **1.7 PROGRESS CLEANING AND WASTE REMOVAL**

- A. Maintain areas under Contractor's control free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to closing the space.
- C. Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. The Contractor shall provide and maintain adequate trash receptacles about the site and inside the buildings, and shall promptly empty the containers when filled.
- D. Contractor is responsible for maintaining a high standard of housekeeping (broom clean) inside the construction areas, storage areas at all times. Contractor shall store materials in a safe and organized manner. Contractor shall employ and pay a maintenance crew during the execution of this Contract to provide housekeeping practices at all times. In addition to this housekeeping requirement during the working hours, the construction area shall be left free of debris (broom clean) at the end of each working day.
- E. If, in the opinion of the Owner's Site Representative the Contractor fails to respond satisfactorily within 24 hours to a written notice of poor housekeeping, the Owner's Site Representative will, through a third party, execute a cleanup program. All costs incurred by the above shall be to the Contractor's account.
- F. Adequate cleanup will be a condition for recommendation of progress payment applications.
- G. Control cleaning operations so that dust and other particulates will not adhere to wet or newly-coated surfaces.
- H. Remove waste materials, debris, and rubbish from site on a daily basis and dispose of off-site.
- I. All wastes shall be removed from the site and disposed of in a manner complying with local ordinances and antipollution laws.

## **1.8 SECURITY**

### **A. Entry Control:**

1. Restrict entrance of persons and vehicles into Project site and existing facilities.
2. Allow entrance only to authorized persons with proper identification.
3. Maintain log of workers and visitors, make available to Owner on request.
4. Owner will control entrance of persons and vehicles related to Owner's operations.

### **B. Personnel Identification:**

1. Provide identification badge to each person authorized to enter premises.
2. Badge To Include: Personal photograph, name and employer.
3. Maintain list of accredited persons, submit copy to Owner on request.
4. Require return of badges at expiration of their employment on the Work.

### **C. Restrictions:**

1. Do not allow cameras on site or photographs taken except by written approval of Owner.

## **1.9 DUST CONTROL**

- A. Execute Work by methods to minimize raising dust from construction operations.
- B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

## **1.10 NOISE CONTROL**

- A. Provide methods, means, and facilities to minimize noise produced by construction operations.

## **1.11 POLLUTION CONTROL**

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

## **1.12 FIRE PROTECTION**

- A. Place one (1) new dry chemical fire extinguisher, minimum U.L. rating 2A-10BC, every 2,000 square feet or fraction thereof, for



the area under construction and within easy reach of mechanics who are operating plumbers furnaces, burning or welding apparatus, etc.

- B. In general, the use of open flame devices is prohibited. In the event that operations are undertaken to which the use of an open flame device is essential, the Owner may require precautions in addition to those given above as he deems necessary. Conduct all operations involving the use of open flame devices only when a worker with approved firefighting equipment and training in its use is on duty at the location of the operation.

#### **1.13 GENERAL PROTECTION WORK**

- A. Protect all existing buildings, paving, site improvements and utilities from damage by construction operations by dust protection, including dust barriers and sprinkling, barricades, or other material or labor required whenever and wherever these may occur on-site or adjacent to the site.
- B. Protect concrete floor slabs from construction damage. In addition, provide wood planking for all equipment which could damage the slabs.
- C. Perform no work on concrete floors including stairs and landings that will detrimentally affect the finish or appearance of uncovered floors or the application of finish flooring where called for. Do not permit operations such as cutting or threading pipe, burring, or welding, paint mixing or clean up of painting in these areas. Do not permit scissor scaffolds, vehicles, etc. with black rubber tires without wrapping tires to prevent marking.
- D. Take special care to protect all surfaces from welding damage.
- E. Maintain extreme caution and care not to damage waterproof membranes. Do not drag equipment and material across the surface. Cover area with 1/4 in. or thicker plywood or other approved materials for protection. Constantly police the area, picking up all scraps of material, discard fasteners, etc., which when stepped on, could damage the membrane and cause leaks.
- F. If any damage occurs to any of the above because of the construction operation, repair, replace and clean at no cost to Owner. At the discretion of Architect-Engineer, major damage shall not be repaired if results would not be satisfactory, but will require replacement.

#### **1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.

**END OF SECTION**

**SECTION 01 60 00**

**PRODUCT REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.

**1.2 PRODUCTS**

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- C. Furnish interchangeable components from same manufacturer for components being replaced.

**1.3 PRODUCT DELIVERY REQUIREMENTS**

- A. Transport and handle products in accordance with manufacturer's printed instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

**1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS**

- A. Store and protect products in accordance with manufacturers' printed instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

- H. Arrange storage of products to permit access for inspection.  
Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

#### **1.5 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only:  
Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers:  
products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

#### **1.6 SUSTAINABLE DESIGN REQUIREMENTS FOR PRODUCTS**

- A. Refer to Section 01 81 13 - Sustainable Design Requirements - LEED Commercial Interiors.

#### **PART 2 - PRODUCTS**

Not Used

#### **PART 3 - EXECUTION**

Not Used

**END OF  
SECTION**

**SECTION 01 73 00**

**EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Substantial Completion.
- B. Closeout procedures.
- C. Final cleaning.
- D. Starting of systems.
- E. Demonstration and instructions.
- F. Testing, adjusting and balancing.
- G. Protecting installed construction.
- H. Project record documents.
- I. Operation and maintenance data.
- J. Manual for materials and finishes.
- K. Manual for equipment and systems.
- L. Spare parts and maintenance products.
- M. Product warranties and product bonds.
- N. Maintenance service.

**1.2 SUBSTANTIAL COMPLETION**

- A. The Owner shall consider the Work to be Substantial Complete when the following requirements are met:
  - 1. General
    - a. Final endorsement of the Fire Department.
      - 1) Means of Egress, Fire Alarm and Fire Protection Systems.
    - b. Final endorsement of the Health Department.
    - c. All temporary construction items (not required for completion of the punch list) such as temporary walls, temporary fencing, scaffolding, rigging, supports, strainers, blanks, etc. are removed.
    - d. Record Drawings (Section 01 73 00) are transmitted and approved by the Owner.

- e. All Final Operation and Maintenance Data Manuals transmitted and approved by the Owner and Architect-Engineer.
  - f. All start-up of all systems completed and approved by the manufacturer's technical representative, Owner and Architect-Engineer.
  - g. Product Warranties and Bonds are transmitted to the Owner.
  - h. Manual for materials and finishes are transmitted to the Owner.
  - i. Manual for equipment and systems are transmitted to the Owner.
2. Architectural
- a. Interior construction shall be completed with only minor Owner/Architect-Engineer authorized punch list items remaining and Tenant is able to begin installation/operational start-up/training on Equipment and/or systems.
  - b. Construction areas cleaned, mopped and wall wiped clean.
  - c. Doors and frames complete and operational.
  - d. All painting except for minor touch-up complete.
3. Mechanical/Plumbing/Fire Protection
- a. All utility systems mechanically complete, tested and functional per design parameters. This shall include air ductwork, piping, insulation, controls and accessories.
  - b. All HVAC systems balanced to plus or minus ten percent (+/-10%) of design criteria.
  - c. Temporary construction and startup filters removed and final operating filters installed.
  - d. All piping has been hydrostatically or pneumatically tested and witnessed by Owner.
  - e. Piping systems have been insulated and identified as required. All valves tagged.
  - f. Piping systems have been flushed to remove foreign matter. All traps and strainers have been cleaned.
  - g. Electrical connections have been completed, tested and verified.
  - h. Electrical motors have been checked with respect to amperage and rotation.
  - i. Equipment checked for alignment, balancing and noise. Equipment started up by factory representative and installation certified.

- j. Systems for controlling room air volumes or pressurization tested, calibrated and fully operational by manufacturer's technical personnel.
  - k. Fire protection system complete and operational including extinguishers, hoses, etc.
  - l. All seismic restraints installed.
4. Electrical
- a. All power, lighting, control equipment, circuitry, systems, etc., complete, cleaned, tested and functional. Meggar readings submitted and approved.
  - b. List of fuses and overload heaters approved. Proper size fuses and overload heaters installed.
  - c. All protective devices set and functionally tested.
  - d. All lighting fixtures lamped per Contract Documents.
  - e. All receptacles functional.
  - f. All equipment and devices have been identified per the Contract Documents.
  - g. At least one (1) set of as built drawings available for switching and troubleshooting.
  - h. All interlocks tested and keys available to Owner.
  - i. All seismic restraints installed.

### 1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's final review.
- B. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. The following documents shall be transmitted with the Final Application for Payment:
  - 1. Statement that all punch list items have been corrected and accepted by the Owner's On Site Representative and Architect-Engineer.
  - 2. Release from the Workmen Compensation Fund ("Fondo").
  - 3. Contractor's Affidavit of Payment of Debts and Claims.
  - 4. Contractor's Affidavit of Release of Liens.
  - 5. Consent of Surety to Final Payment.

#### 1.4 FINAL CLEANING

- A. Contractor shall execute final cleaning prior to final project assessment.
- B. Clean interior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- D. Replace all filters of operating equipment.
- E. Clean debris from roofs systems affected by construction.
- F. Remove waste and surplus materials, rubbish, and construction facilities from site.

#### 1.5 STARTING OF SYSTEMS (CONTRACTOR FURNISHED/INSTALLED)

- A. Prior to Start Up
  - 1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, including, but not limited to the following:
    - a. Proper motor and fan/pump rotation.
    - b. Flushing and cleaning of the system.
    - c. Wiring.
    - d. Auxiliary connections.
    - e. Lubrication.
    - f. Venting.
    - g. Controls.
    - h. Installation of filters and strainers.
    - i. Setting of relief and safety valves.
  - 2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing
  - 3. The Contractor shall submit at least 60 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of electrical mechanical equipment. This schedule shall include work on a system-by-system, floor-by-floor basis.
    - a. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of



equipment, but all related elements of other crafts to make all equipment operate as a system.

- b. The startup check list will cover all related crafts, e.g., controls, electrical, mechanical, and a clean environment of equipment startup.
  - c. The Contractor shall schedule a tour with the Owner's On Site Representative and the Engineer to review start-up conditions prior to equipment start-up. This tour shall take place during the associated consultant's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Architect-Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment start-up. The Contractor will be required to reschedule a back check with the Architect-Engineer prior to attempting an equipment start-up and provide verification of the manufacturer's representatives be present at equipment start-up.
4. Equipment of systems should not be started until systems and associated sub-systems are completed. Verify that other continuing work could possibly damage completed systems if they are in operation. Furnish signed off pre-startup checklist.

#### B. Start-Up and Commissioning

1. Start-Up and Commissioning of all equipment shall be completed and accepted by the Owner's On Site Representative prior to the Date of Substantial Completion.
2. System Start-up and Operation
  - a. The Contractor shall provide all labor, materials and services necessary for the initial start-up and operation of all systems and equipment furnished and installed under this Section.
  - b. The Contractor shall provide the services of qualified factory representatives for all major equipment pre-start set-up, start-up and initial operation. Such periods shall be sufficient to insure the proper operation of systems and equipment. Major equipment to include, but not limited to air handling units, cooling towers, modular cooling units, elevators, temperature controls, pump sets, fan systems, electrical systems, emergency power, fire alarm systems and fire sprinkler, etc.
  - c. The Contractor and the manufacturer's technical representative shall check all equipment during initial start-up to insure correct rotation, proper lubrication adequate fluids or air flows, non-overloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for air and/or water flows throughout without blockages. Air handling systems shall be checked for proper damper connections and positions, aligned and adjusted belt drives, proper lubrication,

temporary air filters installed, non-excessive electrical characteristics and minimal vibration. Other miscellaneous equipment shall be started and operated as described above as applicable. Manufacturer's representative to submit a preliminary written copy of equipment start-up check sheet prior to leaving job site.

- d. After initial start-up and operation of systems, the Contractor shall submit a final report.
- e. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainer, clean-out, filter replacement, bearing lubrication, packing replacement, and other consumables shall be provided without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Architect-Engineer.

#### **1.6 DEMONSTRATION AND INSTRUCTIONS**

- A. Demonstrate operation and maintenance of products to Owner's personnel at least three (3) weeks prior to Date of Substantial Completion.
- B. Demonstrate Project equipment and instruct in classroom environment located at project site and instructed by qualified manufacturer's representative who is knowledgeable about the Project.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time at equipment location.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- F. The Contractor shall submit at least 60 days in advance a schedule listing proposed training schedule for each system to the Architect-Engineer for review by the Architect-Engineer, Owner and Commissioning Authority, under the following conditions.
  - 1. Maintenance manuals are complete and accepted by the user a minimum of ten (10) working days prior to any training.
  - 2. Training will be scheduled for complete systems, not individual pieces of equipment.

3. Training schedule will be submitted to the Architect-Engineer and approved by the Owner.

G. The Contractor shall certify in writing ten (10) days prior to the training date that the systems is complete and operational with a list of any exceptions from a complete system.

H. All training sessions shall be completed prior to the Date of Substantial Completion.

#### **1.7 TESTING, ADJUSTING AND BALANCING**

A. Contractor shall will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing of air conditioning systems.

B. Reports will be submitted by independent firm to Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents prior to the Date of Substantial Completion. Reports shall be signed by a certified testing and balancing Engineer.

#### **1.8 PROTECTING INSTALLED CONSTRUCTION**

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

#### **1.9 PROJECT RECORD DOCUMENTS**

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications to the Contract.

5. Reviewed Shop Drawings, Product Data, and Samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Maintain a complete set of drawings and specifications tagged "Record Documents" on the job for the sole purpose of marking in all deviations from the original documents and noting accurately the actual locations of underground lines, stubouts, etc. This information shall be kept current and shall be inserted by Contractor and subcontractors under the observation of the Owner's On Site Representative. Each person making a change shall identify the change marked with the date and initials in a code and manner approved by the Contractor and Architect-Engineer. Progress billings will not be paid until the Owner's On Site Representative has reported to the Architect-Engineer that Record Documents are complete, and up to date as of the billing.
- C. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  1. Manufacturer's name and product model and number.
  2. Product substitutions or alternates utilized.
  3. Changes made by Addenda and modifications.
- D. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  1. Measured depths of foundations in relation to finish first floor datum.
  2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  4. Field changes of dimension and detail.
  5. Details not on original Contract drawings.
- E. Submit documents to Architect/Engineer at Date of Substantial Completion.

#### **1.10 OPERATION AND MAINTENANCE DATA**

- A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Operating instructions.
    - e. Maintenance instructions for equipment and systems.
    - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
  - 3. Part 3: Project documents and certificates, including the following:
    - a. Shop drawings and product data.
    - b. Air and water balance reports.
    - c. Certificates.
    - d. Originals of warranties and bonds.

#### **1.11 MANUAL FOR MATERIALS AND FINISHES**

- A. Submit two (2) copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

- E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.
- F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- H. Additional Requirements: As specified in individual product specification sections.
- I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

#### **1.12 MANUAL FOR EQUIPMENT AND SYSTEMS**

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit two sets of revised final volumes in final form within 10 days after final inspection.
- E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- G. Include color coded wiring diagrams as installed.
- H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
- I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

- J. Include servicing and lubrication schedule, and list of lubricants required.
- K. Include manufacturer's printed operation and maintenance instructions.
- L. Include sequence of operation by controls manufacturer.
- M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- N. Include control diagrams by controls manufacturer as installed.
- O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
- P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- R. Include test and balancing reports as specified in Section 01 40 00.
- S. Additional Requirements: As specified in individual product specification sections.
- T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

#### **1.13 SPARE PARTS AND MAINTENANCE PRODUCTS**

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

#### **1.14 PRODUCT WARRANTIES AND PRODUCT BONDS**

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.
- F. Submit prior to final Application for Payment.

G. Time Of Submittals:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

**1.15 MAINTENANCE SERVICE**

- A. Furnish service and maintenance of components indicated in specification sections for one year from date of Substantial Completion.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
- D. Do not assign or transfer maintenance service to agent  
or  
Subcontractor without prior written consent of Owner.

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.

**END OF  
SECTION**



**SECTION 01 80 00**

**PERMITS, FEES, AND NOTICES**

**PART 1 - GENERAL**

**1.1 REQUIREMENTS INCLUDED**

- A. Construction Permit (OGPe) for each Construction Package:
  - 1. Architect-Engineer will prepare all documentation to secure a "Notification of Approval for a Construction Permit".
  - 2. Architect-Engineer will secure the "Notification of Approval for a Construction Permit" from OGPe.
  - 3. Contractor shall secure Construction Permit from OGPe.
- B. Occupancy Permit (OGPe) for Entire Project:
  - 1. Architect-Engineer will prepare all documentation to secure the "Occupancy Permit".
  - 2. Contractor shall secure all endorsements from OGPe prior to the Date of Substantial Completion:
    - a. Fire Department (Fire Alarm & Means of Egress).
    - b. Department of Health (Toilet Rooms, Kitchen & Water Coolers).
    - c. Puerto Rico Electric Power Authority Endorsement.
    - d. Puerto Rico Aqueduct and Sewer Authority Inspection (Water Distribution System Connection & Sanitary Sewer System Connection).
    - e. Department of Transportation and Public Works Endorsement.
    - f. Environmental Quality Board (Emergency Generator General Permit).
  - 3. Contractor shall secure all endorsements from government agencies prior to the Date of Substantial Completion:
    - a. Release from Workmen Compensation Fund Puerto Rico.
  - 4. Contractor shall provide all certificates required for Occupancy Permit prior to the Date of Substantial Completion:
    - a. Master Plumber Certificate: Certificate of Plumbing Work.
    - b. "Perito Electricista": Certificate of Electrical Installation - "Colegio de Peritos Electricistas de Puerto Rico" Form.
    - c. Fire Detection and Alarm System Certificate.

- d. HVAC Control System Certificate.
- 5. Architect-Engineer shall secure Occupancy Permit.
- C. Consolidated General Permit (OGPe)
  - 1. Architect-Engineer will prepare the documentation and contractor will submit file documentation to OGPe and pay all fees.
  - 2. Contractor shall implement and maintain at all times control measures at the job site based upon OGPe approved Permit.
  - 3. Contractor will file monthly reports to OGPe.
  - 4. Contractor shall comply with all Permit conditions.
- D. All connections changes, assessments, or inspection fees as may be imposed by any municipal agency or utility company shall be included in the Contract Sum and shall be the Contractor's responsibility.
- E. All permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the work which are customarily secured after execution of the Contract and which are legally required at the time the bids are received.
- F. The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the work.

**PART 2 - PRODUCTS**

Not used

**PART 3 EXECUTION**

Not used

**END OF  
SECTION**

**SECTION 02 41 00**  
**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

**1.2 RELATED WORK:**

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTH MOVING

**1.3 PROTECTION:**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.
- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
1. No wall or part of wall shall be permitted to fall outwardly from structures.
  2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
  3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain in the property any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Owner's approval.

#### **1.4 UTILITY SERVICES:**

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 DEMOLITION:**

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
  - 1. As required for installation of new utility service lines.
  - 2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the site to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Owner. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.
- D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable local or federal, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as

unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

- E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Owner. When Utility lines are encountered that are not indicated on the drawings, the Owner shall be notified prior to further work in that area.

### **3.2 CLEAN-UP:**

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Owner. Clean-up shall include disposal of all items and materials not required to remain property of PRIDCO as well as all debris and rubbish resulting from demolition operations.

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## **SECTION 02 41 19**

### **SELECTIVE STRUCTURE DEMOLITION**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Examination of areas.
- B. Utility services and mechanical/electrical systems.
- C. Preparation.
- D. General selective demolition procedures.
- E. Demolition and removal of selected portions of building or structure.
- F. Demolition and removal of selected site elements.
- G. Disposal of demolished materials.
- H. Cleaning.
- I. Schedule of selective demolition.

##### **1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.

##### **1.3 REFERENCES**

- A. ANSI/ASSE A10.6 - Safety Requirements for Demolition Operations.
- B. NFPA 241 - Safeguarding Construction, Alteration, and Demolition Operation.

##### **1.4 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

##### **1.5 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner

that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### **1.6 PREINSTALLATION MEETINGS**

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

#### **1.7 INFORMATIONAL SUBMITTALS**

A. Section 01 33 00 - Submittal Procedures.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.

D. Predemolition Photographs or Video: Submit before Work begins.

#### **1.8 CLOSEOUT SUBMITTALS**

A. Section 01 33 00 - Submittal Procedures.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.



## **1.9 FIELD CONDITIONS**

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect-Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect-Engineer.
- E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
  - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or preconstruction videotapes.

### **3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS**

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Equipment to Be Removed: Disconnect and cap services and remove equipment.

### **3.3 PREPARATION**

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent

movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

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

### **3.4 SELECTIVE DEMOLITION, GENERAL**

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect-Engineer, items may be removed to a suitable, protected storage location during selective

demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### **3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS**

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

### **3.6 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Section 01 74 19.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally disposes of them.

### **3.7 CLEANING**

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

### **3.8 SCHEDULE OF SELECTIVE DEMOLITION**

A. Refer to Demolition drawings.

**END OF  
SECTION**

**SECTION 03 11 13**

**CAST IN PLACE CONCRETE FORMING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Verification of lines, levels and centers.
- B. Installation of formwork.
- C. Application of form release agent.
- D. Form cleaning.
- E. Erection formwork tolerances.
- F. Field quality control.
- G. Removal of forms.
- H. Re-use of forms.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 03 21 00 - Reinforcing Steel.
- C. Section 03 30 00 - Cast-in-Place Concrete.
- D. Section 04 82 00 - Reinforced Unit Masonry Assemblies: Product requirements for masonry accessories for placement by this Section.

**1.3 REFERENCES**

- A. ACI 117 - Tolerances for Concrete Construction and Materials.
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. ACI 318 - Building Code Requirements for Structural Concrete.
- D. ACI 347 - Guide to Formwork for Concrete.
- E. AF & PA - National Design Specifications for Wood Construction.
- F. APA/EWA PS1 - Voluntary Product Standard for Construction and Industrial Plywood.
- G. U.S. Green Building Council - LEED CI: Green Building Rating System for Commercial Interiors. Version 3.0.

#### **1.4 DESIGN REQUIREMENTS**

- A. Design, engineer and construct formwork and bracing in accordance with ACI 318 and ACI 347 to conform to design and applicable code requirements to achieve; resultant concrete shape, line and dimension as indicated on Drawings.

#### **1.5 QUALITY ASSURANCE**

- A. Section 01 40 00 - Quality Requirements
- B. Perform Work in accordance with ACI 347.
- C. Examine the conditions under which concrete formwork is to be erected. Do not proceed with the work until unsatisfactory conditions have been corrected.
- D. For wood products furnished for work of this Section, comply with AF & PA.
- E. Design formwork under direct supervision of a Professional Engineer licensed in the Commonwealth of Puerto Rico and experienced in design of this Work.
- F. Allowable Tolerances: Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347.
- G. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and locations of concrete members and stability of forming systems.
- H. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

#### **1.6 SUBMITTALS**

- A. Section 01 33 00 - Submittal Provisions
- B. Product Data: Provide data and installation instructions for proprietary materials including form coatings, ties and accessories.

#### **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Section 01 60 00 - Product Requirements
- B. Store forms off ground in ventilated and protected manner to prevent deterioration from moisture.

#### **1.8 COORDINATION**

- A. Section 01 30 00 - Administrative Requirements

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

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - WOOD FORMS**

- A. Softwood Plywood: APA/EWA PS 1, C Grade, Group 2.
- B. Lumber Forms:
  - 1. Application: Use for edge forms and unexposed finish concrete.
  - 2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, "Standard" Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.
- C. Plywood Forms:
  - 1. Application: Use for exposed finish concrete.
  - 2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
  - 3. Plywood where "Smooth Finish" is required, as indicated on Drawings: APA/EWA "HD Overlay Plyform Structural I Exterior" grade, minimum of 3/4 inch thick.

### **2.2 MATERIALS - FORMWORK ACCESSORIES**

- A. Form Ties: Factory fabricated removable or snap-off type, galvanized metal, adjustable length, cone type, with waterproofing washer, 1½-inch back break dimension, free of defects that could leave holes larger than one inch in concrete surface. Form ties fabricated on the project site and wire ties are not acceptable. Use stainless steel form ties for planned exposed tie hole locations, where shown on the drawings. When used, break-back point may be 1-inch from outer concrete surface.
- B. Spreaders: Standard, non-corrosive metal from clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.
- C. Form Anchors and Hangers
  - 1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.



2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of members.
3. Penetrations of structural steel members is not permitted.
- D. Form Release Agent: Commercially formulated form - release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces. VOC Content: less than 300 g/L. Acceptable Manufacturers:
  1. Cresset Chemical Company; Product: Crete-Lense 20-VOC-Xtra Release Agent
  2. Nox-Crete Company; Product: Nox-Crete Form Coating.
- E. Corners: Chamfered, rigid plastic type; 3/4 inch by 45 degrees size; maximum possible lengths.
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

## **2.3 MATERIALS - METAL INSERTS**

- A. Use metal inserts for anchorage of materials or equipment to concrete construction as required for the work.
- B. Use adjustable wedge inserts of malleable cast iron, complete with bolts, nuts and washers; 3/4 inch diameter bolt size unless otherwise shown.
- C. Use threaded inserts of malleable cast iron, furnished complete with full-depth bolts; 3/4 inch diameter bolt size, unless otherwise shown.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Provisions
- B. Verify lines, levels and centers before proceeding with formwork. Verify dimensions agree with Drawings.
- C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect-Engineer.

### **3.2 INSTALLATION - CONCRETE FORMS**

- A. Formwork - General:

1. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
2. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
3. Complete wedging and bracing before placing concrete.

B. Forms for Smooth Finish Concrete:

1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

C. Framing, Studding and Bracing:

1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

D. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301 and ACI 318.

- E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- F. Obtain Architect/Engineer's approval before framing openings in structural members not indicated on Drawings.
- G. Install fillet and chamfer strips on external corners of beams, joists, columns, and any other concrete exposed to view.
- H. Do not reuse wood formwork more than two (2) times for concrete surfaces to be exposed to view. Do not patch formwork.

### **3.3 APPLICATION - FORM RELEASE AGENT**

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

### **3.4 FORM CLEANING**

- A. Clean and remove foreign matter within forms as erection proceeds.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

### **3.5 ERECTION FORMWORK TOLERANCES**

- A. Construct formwork to maintain tolerances required by ACI 301.
- B. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

### **3.6 FIELD QUALITY CONTROL**

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.
- C. Notify Architect-Engineer after placement of reinforcing steel in forms, but prior to placing concrete.
- D. Schedule concrete placement to permit formwork inspection before placing concrete.

### **3.7 REMOVAL OF FORMS**

- A. General: Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation, and provided that curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs and other structural elements may not be removed in less than 14 days, and not until concrete has attained design 28 day compressive strength.
  - 1. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of the concrete location or members, as specified in 3E series Sections.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

### **3.8 RE-USE OF FORMS**

- A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces, except as acceptable to the Engineer.

PRIDCO  
Puerto Rico Industrial Development Company

L21 6-0-60  
New Parking Area Construction Works

Aguadilla, Puerto Rico

**END OF  
SECTION**

**SECTION 03 21 00**

**REINFORCING STEEL**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Examination of substrates.
- B. Preparation of reinforcing steel.
- C. Placement of reinforcing steel bars including supports, ties, supports and accessories.
- D. Field quality control.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 03 11 13 - Cast In Place Concrete Forming.
- C. Section 03 30 00 - Cast-in-Place Concrete.
- D. Section 04 82 00 - Reinforced Unit Masonry Assemblies.

**1.3 REFERENCES**

- A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.
- B. ACI 301 - Structural Concrete for Buildings.
- C. ACI 315 - Details and Detailing of Concrete Reinforcement.
- D. ACI 318 - Building Code Requirements For Reinforced Concrete.
- E. ACI SP-66 - American Concrete Institute - Detailing Manual.
- F. ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- G. ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- H. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- I. ASTM A706 - Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- J. ASTM E329 - Specifications for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- K. CRSI (MSP-1) - Manual of Standard Practice.

- L. CRSI - Placing Reinforcing Bars.
- M. CRSI - Reinforcement: Anchorages, Tap Splices and Connections.
- N. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

#### **1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and location of supporting and spacing devices. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures".
- D. Mill Certificates (For Record Purposes Only): Manufacturer's records of chemical and physical properties of all heats of billet steel bars and as well, 5 copies of an affidavit for all material stating that the respective material furnished meets the requirements for the steel reinforcement specified.
- E. Tensile and Bend Tests (Basis of Approval): In addition to mill certificates, submit tensile and bend tests of each bar size to be used on the project. Testing shall be performed in strict accordance with ASTM A370. Tests performed by the steel fabricator or vendor will not be accepted.
  - 1. Perform sampling from lots stored at the job site.
  - 2. Take two (2) samples from each 20 tons or fraction thereof of each size of reinforcing steel (No. 3 through No. 18).
  - 3. Make one (1) tensile and one (1) bend test in accordance with ASTM A370 from each pair of samples obtained.
  - 4. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
  - 5. Testing laboratories that perform testing services on reinforcing steel shall meet the requirements of ASTM E329.
- F. Weldable Steel: Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
- G. Field Bending: Submit requests and procedure to field bend or straighten reinforcement partially embedded in concrete.
- H. Reinforcement Relocation: Submit request to relocate any reinforcement that exceeds placement tolerances.

## 1.5 QUALITY ASSURANCE

- A. Section 01 40 00 - Quality Requirements
- B. Perform Work in accordance with CRSI - Placing Reinforcing Bars, CRSI - Recommended Practice for Placing Bar Supports, and CRSI - Manual of Practice, ACI 301 and ACI SP-66. Maintain one copy of each document at the site.
- C. Provide Architect/Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
- D. Examine the substrate and the conditions under which concrete reinforcement is to be placed. Do not proceed with the work until unsatisfactory conditions have been corrected.
- E. Fabricating and Placing Tolerances: Reinforcing bars shall be fabricated in accordance with the standard fabricating tolerances in Figures 4 and 5 of ACI 315. Reinforcement shall be placed to the following tolerances:

	Tolerances, <u>(inches)</u>
Clear Distance	
To other formed surfaces	$\pm \frac{1}{4}$
Minimum Spacing Between Bars	$-\frac{1}{4}$
Clear Distance from Unformed Surface to Top Reinforcement	
Members 8 inches deep or less	$\pm \frac{1}{4}$
Members More than 8 inches deep but less than 24 inches deep	$-\frac{1}{4}, +\frac{1}{2}$
Members 24 inches deep or greater	$-\frac{1}{4}, +1$
Uniform Spacing of Bars, but the required number of bars shall not be reduced	$\pm 2$
Uniform Spacing of stirrups and ties, but the required number of stirrups and ties shall not be reduced	$\pm 1$
Longitudinal locations of bends and ends of reinforcement	
General	$\pm 2$
Discontinuous ends of members	$\pm \frac{1}{2}$
Length of bar laps	$\pm 1\frac{1}{2}$
Embedded length	



Tolerances,  
(inches)

For bar sizes No. 3 through 11

-1

## **1.6 COORDINATION**

- A. Section 01 31 00 - Administrative Provisions
- B. Coordinate with placement of formwork, formed openings and other Work.

## **1.7 DELIVERY, HANDLING AND STORAGE**

- A. Section 01 60 00 - Product Requirements and Closeout
- B. Deliver reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- C. Store concrete reinforcement materials at the site to prevent bending, coating with earth, oil or other material, or otherwise damaging the reinforcement.
- D. Rust, seams, surface irregularities, or mill scales shall not be cause for rejection, provided the weight, minimum dimensions, and height of deformation of a hand-wire-brushed test specimen are not less than the applicable ASTM specification requirements.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, unfinished.
- B. Weldable Reinforcing Steel: ASTM A706, Grade 60, deformed, unfinished.

### **2.2 MATERIALS - SUPPORTS FOR REINFORCEMENT**

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel or Stainless steel type; size and shape as required. Comply with Class 1, maximum protection in CRSI Manual of Standard Practice.
- C. Do not use wood, brick, and any other unacceptable material.

### **2.3 FABRICATION**

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice, ACI SP-66, ACI 318, and tolerances of ACI 117. In case

- of fabrication errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Form standard hooks for 180 degree bends, 90 degree bends, stirrup and tie hooks, and seismic hooks as indicated on Drawings and approved shop drawings.
  - C. Form reinforcement bends with minimum diameters in accordance with ACI 318.
  - D. Fabricate column reinforcement with offset bends at reinforcement splices.
  - E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous plain or deformed bar or wire.
  - F. Form ties and stirrups from the following:
    - 1. For bars No. 10 and Smaller: No. 3 deformed bars.
  - G. Welding of cross bars (tack welding) for assembly of reinforcement, supports, or embedded items is prohibited.
  - H. All reinforcement shall be bent cold, and shall not be bent or straightened in a manner that will injure the material.
  - I. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the work:
    - 1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
    - 2. Bend or kinks not indicated on drawings or approved shop drawings.
    - 3. Bars with reduced cross-section due to excessive rusting or other cause.
  - J. Identification of Reinforcing Steel:
    - 1. Bundles of reinforcing bars shall be tagged showing quantity, grade, size, heat number and suitable identification to allow checking, sorting and placing.
  - K. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Architect-Engineer. Indicate these splices on shop drawings.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Section 01 31 00 - Administrative Provisions

- B. Verify substrate is ready to receive reinforcing steel bars.
- C. Advise General Contractor of any deficiencies prior to beginning of installation of reinforcing steel bars.

### **3.2 PREPARATION - REINFORCING STEEL**

- A. All reinforcement, at the time concrete is placed, shall be free of mud, oil, or other materials that may adversely affect or reduce the bond.
- B. Reinforcement with rust, mill scale, or a combination of both shall be considered satisfactory provided the minimum dimensions, weight, and height of deformations of a hand-wire brushed test specimen are not less than the applicable ASTM specification requirement.

### **3.3 PLACEMENT - REINFORCING STEEL**

- A. General: Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute (CRSI) recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement and supports, and as herein specified. Spacing of supports shall conform to ACI 315.
- B. Tolerances: Place, support, and fasten reinforcement as shown on the approved Shop Drawings. Do not exceed the placing tolerances specified in ACI 117 before concrete is placed. Placing tolerances shall not reduce cover requirements except as specified in ACI 117.
- C. Reinforcement Relocation: When necessary to move reinforcement beyond the specified placing tolerances to avoid interference with other reinforcement, conduits, or embedded items, submit the resulting arrangement of reinforcement for acceptance.
- D. Reinforcement Supports: Place reinforcement supported from the ground or mud mat on precast concrete reinforcement supports (4 inches square). Place non-coated reinforcement supported from formwork on reinforcement supports made of concrete, metal or plastic. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcement bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports for runways for concrete conveying equipment and similar construction loads.
- E. Splices: Make splices as indicated in the Project Drawings or as approved on the placing drawings. Provide standard reinforcement splices by lapping ends, placing bars in contact and tightly wire tying. Comply with requirements of ACI 318 for minimum lap of spliced bars.
- F. Concrete Cover:

1. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces. Minimum concrete cover for reinforcement, except for extremely corrosive atmosphere, other severe exposures, or fire protection, shall be as follows:

Minimum Cover  
(inches)

Slab

Top and bottom bars for dry conditions

#11 bars and smaller 3/4

Formed concrete surfaces exposed to earth, water or weather, and over or in contact with sewage and for bottoms bearing on work mat, or slabs supporting earth cover

#5 bars or smaller 1½

#6 through #18 bars 2

Walls

For dry conditions

#11 bars and smaller 3/4

Formed concrete surfaces exposed to earth, water, sewage, weather, or in contact with ground

2

Footings and Base Slabs

At formed surfaces and bottoms bearing on concrete work mat

2

At unformed surfaces and bottoms in contact with earth

3

Top of footings

#5 bars and smaller 1½

2. For bundles of bars, minimum concrete cover shall be equal to the equivalent diameter of the bundle but need not be greater than 2 inches; except the minimum cover shall not be less than specified above. The equivalent diameter of the bundle shall be based on a single bar of a diameter derived from the equivalent total area.
3. Tolerances on minimum cover shall meet the requirements of ACI 117.

- G. Field Cutting of Reinforcement: Reinforcement shall not be cut in the field except when specifically permitted in writing by the Architect-Engineer. Flame torch cutting of bars is strictly prohibited.
- H. Reinforcement through Expansion Joint: Do not continue reinforcement or other embedded metal items bonded to concrete through expansion joints. Dowels bonded on only one side of a joint and waterstop may extend through the joint.
- I. Bending or straightening of bars partially embedded in concrete is prohibited.

### **3.4 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed by the testing laboratory in accordance with ACI 318.
- B. Provide free access to Work and cooperate with appointed firms.
- C. Reinforcement Inspection:
  - 1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
  - 2. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover and splicing.

**END OF  
SECTION**

**SECTION 03 30 00**

**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Pre-placement inspection.
- B. Preparation of forms and previously placed concrete surfaces.
- C. Installation of joints.
- D. Placement of concrete.
- E. Finishing of formed surfaces.
- F. Miscellaneous concrete items.
- G. Curing and protection.
- H. Concrete surface repairs.
- I. Field quality control.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 03 11 13 - Cast in Place Concrete Forming.
- C. Section 03 21 00 - Reinforcing Steel.
- D. Section 04 82 00 - Reinforced Unit Masonry Assemblies.
- E. Section 05 50 00 - Metal Fabrications.
- F. Section 07 92 00 - Joint Sealants.
- G. Section 09 24 00 - Portland Cement Plastering.
- H. Section 09 31 13 - Thin Ceramic Floor Tile.
- I. Section 09 31 16 - Thin Ceramic Wall Tile.
- J. Section 09 91 00 - Painting.

**1.3 REFERENCES**

- A. AASHTO M182 - Burlap Cloth Made from Jute or Kenaf or Cotton Mats.
- B. ACI 117 - Tolerances for Concrete Construction and Materials.
- C. ACI 201.2R - Guide to Durable Concrete.

- D. ACI 211.1 - Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
- E. ACI 301 - Specifications for Structural Concrete.
- F. ACI 304 - Measuring, Mixing, Transporting and Placing Concrete.
- G. ACI 305 - Hot Weather Concreting.
- H. ACI 308.1 - Curing Concrete.
- I. ACI 309R - Guide for Consolidation of Concrete.
- J. ACI 318 - Building Code Requirements for Reinforced Concrete.
- K. ACI CP1 - Technician Workbook for ACI Certification Concrete Field Testing Technician Grade I.
- L. ACI SP15 - Field Reference Manual.
- M. ACI - Manual of Concrete Practice.
- N. ASTM C31 - Practice for Making and Curing Concrete Test Specimens in Field.
- O. ASTM C33 - Concrete Aggregates.
- P. ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- Q. ASTM C42 - Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- R. ASTM C94 - Ready-Mixed Concrete.
- S. ASTM C143 - Test Method for Slump of Hydraulic Cement Concrete.
- T. ASTM C150 - Portland Cement.
- U. ASTM C171 - Sheet Materials for Curing Concrete.
- V. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
- W. ASTM C192 - Standard Practice for Method of Making and Curing Concrete Test Specimens in the Laboratory.
- X. ASTM C219 - Terminology Relating to Hydraulic Cement.
- Y. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- Z. ASTM C494 - Chemical Admixtures for Concrete.
- AA. ASTM C881 - Epoxy-Resin-Base Bonding Systems for Concrete.

- AA. ASTM C1017 - Chemical Admixtures for Use in Producing Flowing Concrete.
- AB. ASTM C1059 - Latex Agents for Bonding Fresh to Hardened Concrete.
- AC. ASTM C1064 - Test Methods for Temperature of Freshly Mixed Portland Cement Concrete.
- AD. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- AE. ASTM C1315 - Liquid Membrane Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- AF. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous).
- AG. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- AH. ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- AI. ASTM E329 - Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- AJ. ASTM E548 - Guide for General Criteria Used for Evaluating Laboratory Competence.
- AK. CRSI - Manual of Standard Practice.
- AL. NCMCA - Certification of Ready Mixed Concrete Production Facilities.
- AM. Portland Cement Association (PCA) - Design and Control of Concrete Mixtures.

#### **1.4 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash, blended hydraulic cement and other pozzolans, ground granulated blast - furnace slag, and silica fume; subject to compliance with requirements.

#### **1.5 QUALITY ASSURANCE**

- A. Section 01 40 00 - Quality Requirements: Testing and Inspection services.
- B. Field Reference Manual: Have available at the Contractor's project field office a copy of ACI SP-15 "Specifications for Structural Concrete for Buildings with Selected ACI and ASTM References".



- C. Conform to ACI 305 when concreting during hot weather.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturing's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301 - Specification for Structural Concrete, Sections 1 through 5.
  - 2. ACI 117 - Specifications for Tolerance for Concrete Construction and Materials.
- F. Tests for Concrete Materials:
  - 1. For normal weight concrete, test aggregates by the methods of sampling and testing of ASTM C33.
  - 2. For portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.
  - 3. Submit written reports to the Architect-Engineer, for each material sampled and tested, prior to the start of work. Provide the project identifications name and number, date of report, name of contractor, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.
- G. Qualifications of Concrete Manufacturer/Supplier:
  - 1. A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
  - 2. Manufacturer certified according to NRCMCA's "Certification of Ready Mixed Concrete Production Facilities".
    - a. Cemex Concretos.
    - b. Master Concrete.
- H. Qualifications of Concrete Testing Laboratories:
  - 1. An independent, qualified according to ASTM C1077 and ASTM E329 for testing indicated, as documented according to ASTM E548.

2. Qualified laboratory field testing technicians (Contractor's personnel not allowed to do this work) shall perform tests on fresh concrete at the job site, prepare specimens required for curing under field conditions, prepare specimens required for testing in the laboratory, and record the temperature of the fresh concrete when preparing specimens for strength tests.
3. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade I, according to ACI CP-01 or an equivalent certification program.
4. Personnel performing laboratory tests shall be ACI-Certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisory shall be an ACI-Certified Concrete Laboratory Testing Technician - Grade II.

#### 1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product's Data: Submit complete product data and installation instructions of each type of product indicated.
- C. Material Certificate: For each of the following signed by manufacturers:
  1. Cementitious materials.
  2. Admixtures.
  3. Curing compounds.
  4. Bonding agents.
  5. Adhesives.
  6. Joint-filler strips.
  7. Repair materials.
- D. Concrete Mix Design: Submit concrete mix design for each strength and type of concrete. Each mix design submittal shall include the following:
  1. Location of structure where concrete mix will be used, foundations, walls, columns, beams, elevated slabs, stairs, etc.
  2. Dosage of each component (cement, water, fine aggregate, coarse aggregate, admixtures) of the concrete mix design.

3. Data on trial mixture and certified laboratory test results of trial mixture.
  4. Thirty (30) consecutive test results of the mix design used from a previous recorded project in accordance with ACI 301, Method 2.
  5. Cement certification including type, class, producer's names and plant location. Cement will be accepted on the basis of a manufacturer's mill certificate that the cement furnished meets the physical and chemical characteristics of ASTM C150. The Architect-Engineer reserves the right, however, to sample and conduct such tests on cement as he deems necessary for compliance with the requirements of these specifications.
  6. Gradation analysis of coarse aggregate in accordance with ASTM C33 including pit or quarry locations, producer's name, gradations, specific gravities and weight retained per seive.
  7. Gradation analysis of fine aggregate in accordance with ASTM C33 including pit or quarry locations, producer's name, gradations, specific gravity and weight retained per sieve.
  8. Data on admixtures including ASTM C494 classification, brand, manufacturer. Admixtures shall be the product of one manufacturer.
  9. Indicate amounts of mixing water to be withheld for later addition at Project site.
  10. Fine aggregate content.
  11. Mortar fraction.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect-Engineer.
- F. Test and Inspection Reports: Testing agencies shall report results of concrete and concrete material tests and inspections performed during the course of the Work to the Owner, Architect-Engineer, Contractor, and the Concrete Supplier.
1. Strength test reports (7 and 28 days) shall include locations in the Work where the batch represented by the test was deposited and the batch ticket number.
  2. Reports of strength tests shall include detailed information of storage and curing of specimens prior to testing.

3. Final reports shall be provided within seven (7) calendar days of test completion.
- G. Qualification Data: For testing agency.
- H. Placement Schedule: Prepare a placement schedule and submit to Architect-Engineer for review prior to start of concrete placement operations.
- I. Delivery Tickets: Furnish copies of delivery tickets for each load of concrete delivered to the site. Provide items of information as specified. Concrete supplier shall furnish to the Owner's On Site Representative with each batch of concrete before unloading at the site, a delivery ticket on which is printed, stamped, or written, information concerning said concrete as follows:
1. Name of ready-mix company and batch plant, or batch plant number,
  2. Serial number of ticket,
  3. Date,
  4. Truck number,
  5. Name of purchaser,
  6. Specific designation of job (name and location),
  7. Specific class or designation of the concrete in conformance with that employed in job specifications,
  8. Amount of concrete in cubic yards,
  9. Time loaded or of first mixing of cement and aggregates, and
  10. Water added by receiver of concrete and his initials.
- J. Batch Computer Printouts: Furnish copies of each computer batch printout. The manufacturer of the concrete shall furnish to Contractor with each batch of concrete before unloading at the site, a batch printout with the following information:
1. Reading of revolution counter at the first addition of water.
  2. Type, brand, and amount of cement.
  3. Type, brand, and amount of admixtures.
  4. Source and amount of each metered or weighted water.
  5. Information necessary to calculate the total mixing of water. Total mixing water includes free water on aggregates, batch water (metered or weighted) including wash water retained in

the mixing drum, and water added by the truck operator from the mixer tank.

6. Maximum size of aggregate.
7. Mass (amount) of fine and course aggregate.
8. Ingredients certified as being previously approved.
9. Signature or initials of producer's representative.

K. Change of Materials: When brand, type, size, or source of cementitious materials, aggregates, water, or admixtures are proposed to be changed, new field data or data from new trial mixtures or evidence which indicates that the change will not adversely affect the relevant properties of the concrete shall be submitted for acceptance prior to use in concrete.

### **1.7 CLOSEOUT SUBMITTALS**

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

### **1.8 COORDINATION**

- A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

### **1.9 DELIVERY AND STORAGE**

- A. Section 01 60 00 - Product Requirements.
- B. Do not deliver concrete until forms, reinforcement, embedded items, sleeves, and chamfer strips are in place, ready for placement, and approved by the Owner's on Site Representative and/or Architect/Engineer.
- C. ACI 301 for job site storage of concrete aggregates.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - CONCRETE MATERIALS**

- A. Portland Cement: ASTM C150, Type I, gray. It shall be of the same brand and type, and from the same plant of manufacture as the portland cement used in the concrete represented by the submitted field test data or used in the trial mixtures. Acceptable manufacturers:

1. Cemento San Juan - Italcementi Group.

2. Cemex.

B. Normal-Weight Aggregates: ASTM C33 unless otherwise specified. When a single size or a combination of two or more sizes of coarse aggregates are used, the final gradation shall conform to the grading requirements of ASTM C33 unless otherwise specified or permitted. Aggregates used in concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by submitted historical data, or used in trial mixtures.

1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. The use of manufactured sand is not permitted.

<u>Sieve Designation</u>	<u>Percent Passing</u>
3/8 inch	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	5 to 30
No. 100	0 to 10

The fine aggregate shall have not more than 45 percent passing any sieve and retained on the next consecutive sieve of those shown above, and its fineness modulus shall be not less than 2.3 nor more than 3.1.

Amount of deleterious substances in fine aggregate shall not exceed the limits prescribed in Table 1 of ASTM C33.

2. Coarse Aggregate: Size Number 5; clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter. Nominal maximum size of coarse aggregate shall not exceed three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

<u>Sieve Designation</u>	<u>Percent Passing</u>
1½ inch	100
1 inch	90 to 100
¾ inch	20 to 55
½ inch	0 to 10
3/8 inch	0 to 5

- a. Class 1N for slabs subject to abrasion, floors, sidewalks and pavements.

- b. Class 2N for all other classes of concrete.

C. Water: ASTM C94 and potable.

## **2.2 MATERIALS - ADMIXTURES**

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494, Type A.
2. Retarding Admixture: ASTM C494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.

B. Calcium Chloride: Use of calcium chloride in any form is strictly prohibited.

## **2.3 MATERIALS - CURING**

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Acceptable manufacturers and products are:

1. BASF Construction Chemicals - Building Systems; Product: Confilm.
2. Conspec by Dayton Superior; Product: Aquafilm.
3. Dayton Superior Corporation; Product: Sure Film (J-74).
4. Edoco by Dayton Superior; Product: BurkeFilm.
5. Euclid Chemical Company (The), an RPM Company; Product: Eucobar.
6. L&M Construction Chemicals, Inc.; Product: E-CON.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. Acceptable manufacturers and products are:

1. Edoco by Dayton Superior; Product: Res X Cure WB.
2. Conspec by Dayton Superior Company; Product: W.B. Resin Cure.
3. Euclid Chemical Company (The); Product: Kurez W VOX; Tammscure WB 30C.
4. L&M Construction Chemicals, Inc.; Product: L&M Cure R.
5. Vexcon Chemicals, Inc.; Product: Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering. Acceptable manufactures and products are:

1. Edoco by Dayton Superior; Product: Spartan Cote WB II.
2. Conspec by Dayton Superior Company; Product: Cure and Seal WB.
3. Euclid Chemical Company (The); Product: Aqua Cure VOX; Clearseal WB 150.
4. L&M Construction Chemicals, Inc.; Product: Dress & Seal WB.
5. Vexcon Chemicals, Inc.; Product: Starseal 309.

## **2.4 MATERIALS - EXPANSION AND ISOLATION JOINT FILLER STRIPS**

A. Expansion and Isolation Joint Filler Strips: ASTM D1752, Type I (sponge rubber). Products complying with these requirements are:

1. A.C. Horn Co.; Product: Horn Darktone Sponge Rubber.
2. W.R. Meadows Co.; Product: Sponge Rubber Expansion Joint Filler.
3. Williams Products Co.; Product: Concrete Grey SBR Sponge.

## **2.5 MATERIALS - JOINT SEALANTS**

A. Joint Sealants: Refer to Section 07 92 00.

## **2.6 MATERIALS - BONDING AGENTS**

A. Chemical Bonding Agent: Film-forming, suitable for brush or spray application complying with MIL-B-19235. Products offered by manufacturers to comply with the requirements for latex type concrete bonding agents include the following:



1. Chem-Master Corp.; Product: Polyweld.
  2. W.R. Grace; Daraweld-PBA. Product: Daraweld-PBA.
  3. Larsen Products Corp.; Product: Weldcrete.
  4. Euclid Chemical; Product: Eucoweld.
- B. Epoxy-Resin Bonding Agent: Two-component, mineral-filled, epoxy-polysulphide polymer complying with ASTM C881, Type I or Type II, Grade A. Products offered by manufacturers to comply with the requirements for epoxy-resin type grout include the following:
1. Sika Chemical Corp.; Product: Colma Fix
  2. W.R. Grace.; Product: Epoxitime
  3. Euclid Chemical Co.; Product: Euco Epoxy
  4. Chem-Masters Corp.; Product: Polytops
  5. Sonneborn-Contech; Product: Sonobond

## **2.7 MATERIALS - REPAIR MATERIALS**

- A. Repair Underlayment (Floor and Slab Areas Beneath Floor Coverings): Cement-based, polymer modified, self-leveling product that can be applied in thickness from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
  2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8 to 3/4 inch or coarse sand as recommended by underlayment manufacturer.
  4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C109.
- B. Repair Underlayment (Floor or Slab Areas Remaining Exposed and Not Receiving Floor Coverings): Cement-based, polymer-modified, self-leveling product that can be applied in thickness from 3/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
  2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109.
5. Acceptable products are:
  - a. Ardex Engineered Cements; Product: Ardex K500.
  - b. BASF Construction Chemicals; Product: Mastertop Topping

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## 2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Limit water-soluble, chloride-ion content in hardened concrete to the following:
  1. Reinforced Concrete Exposed to Chloride: 0.15 percent by weight of cement.
  2. Reinforced Concrete that will not be Dry or Protected from Moisture: 0.30 percent by weight of cement.
  3. Reinforced Concrete that will be Dry or Protected from Moisture: 1.00 percent by weight of cement.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
  1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  3. Use water-reducing admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.50.
- D. Ready Mixed Concrete: Measure, batch mix and deliver concrete in conformance with ASTM C94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1½ hours to 75 minutes.
  2. When air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.
- E. Cement Material Content: Adequate for concrete to satisfy the specified requirements for strength, water-cement ratio and finishing ability.

## **2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS**

A. Cross Gutter, Footings, Retaining walls, Interior slab on grade, walls, roof slabs and beams: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50 maximum.
3. Slump Limit: 4 inches maximum or 8 inches maximum for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.

B. Concrete curbs, sidewalks and ramps: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50 maximum.
3. Slump Limit: 4 inches maximum or 8 inches maximum for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.

## **PART 3 - EXECUTION**

### **3.1 PRE-PLACEMENT INSPECTION**

- A. Section 01 31 00 - Administrative Requirements.
- B. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and securely install all required inserts, anchors sleeves, conduits and other items specified under other sections or as shown on the Contract Drawings to be embedded or cast-in.
- C. Where concrete is placed on the ground or sub-course, the foundation upon which concrete is placed shall be clean, damp, and free from standing or running water. Prior to placing concrete, the earth foundation shall have been satisfactorily compacted.
- D. Soil at bottom of foundation systems are subject to testing for soil bearing value by the testing laboratory, as directed by the

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Aguadilla, Puerto Rico

Architect-Engineer. Place concrete immediately after approval of foundation excavations.

### **3.2 PREPARATION**

- A. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.
- B. Coordinate the installation of joint materials with placement of forms and reinforcing steel.
- C. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

### **3.3 INSTALLATION - EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

### **3.4 INSTALLATION - JOINTS**

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 3. Locate joints for beams and slabs in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 6. Use epoxy-bonding adhesive at locations where fresh concrete

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is placed against hardened or partially hardened concrete surfaces.

### 3.5 PLACEMENT - CONCRETE

#### A. General:

1. Place concrete in compliance with the practices and recommendations of ACI 304, and as herein specified.
2. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and jointing is complete and that required inspections have been performed.
3. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Architect-Engineer.

#### B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as indicated. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.

#### C. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

#### D. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

#### E. Concrete Conveying:

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.
2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, and other deleterious materials.

#### F. Placing Concrete into Forms:

1. Deposit concrete in forms in horizontal layers not deeper than 12 inches unless additional thickness is permitted by the

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Architect-Engineer, and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

2. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
3. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted, unless otherwise accepted by the Architect-Engineer.
4. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

G. Bonding:

1. Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent, and clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and to not leave laitance, loose particles of aggregate, or damaged concrete at the surface.
2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:
  - a. At joints between footings and walls, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.
  - b. At joints in exposed work: At vertical joints in walls; dampen, but do not saturate, the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.
  - c. Use neat cement grout consisting of equal parts portland cement and fine aggregate by weight and not more than 6 gal. of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

- d. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instruction of the bonding material manufacturer.
3. Prepare for bonding of fresh concrete to fully-cured hardened concrete or existing concrete by using an epoxy-resin bonding agent as follows:
  - a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.
  - b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.
  - c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

H. Hot Weather Placement:

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Wet forms thoroughly before placing concrete.
4. Use set-control admixtures when required and accepted in mix designs.

**3.6 FINISHING - FORMED SURFACES**

A. Rough-Formed Finish:

1. As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on form-surface irregularities.
  - a. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish:

1. As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins

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and other projections that exceed specified limits on formed-surface irregularities.

a. Apply to concrete surfaces exposed to public view or,

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or other abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

### **3.7 MISCELLANEOUS CONCRETE ITEMS**

A. Reinforced Masonry:

1. Provide concrete for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

B. Filling-In:

1. Fill-in holes and openings left in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

C. Curbs:

1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

### **3.8 CONCRETE PROTECTION AND CURING**

A. General: Protect freshly placed concrete from premature drying and excessive hot temperatures. Comply with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder:



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1. Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations.
2. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces:

1. Begin curing immediately after finishing concrete.
2. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven consecutive days with the following materials:
  - a. Water.
  - b. Continuous water-fog spray.
  - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Cure for not less than seven consecutive days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
  - b. Cure concrete surfaces to receive floor coverings with moisture-retaining cover only.

3. Curing Compound: Apply uniformly in continuous operation by

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power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

F. Temperature of Concrete During Curing:

1. When the atmospheric temperature is 80 degrees F, and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protection complying with the requirements of ACI 305.
2. Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceed 5 degrees F in any one hour.

G. Protection from Mechanical Injury:

1. During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

### 3.9 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect-Engineer. Remove and replace concrete that cannot be repaired and patched to Architect-Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Patching Defective Areas:
  1. Repair and patch defective areas with cement mortar immediately after removal of forms, but only when directed by the Architect-Engineer.
  2. Cut out honeycomb, rock pockets, voids over ½-inch diameter, and holes left by tie rods and bolts, down to solid concrete

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but, in no case, to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the Architect-Engineer.

- a. For exposed to public view surfaces, blend white portland cement and standard portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.
3. Fill holes extending through concrete by means of a plunger-type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure completely filling.

D. Repair of Formed Surfaces:

1. Repair exposed-to-view formed concrete surfaces, where possible, that contain defects which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the Architect-Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.
2. Repair concealed formed concrete surfaces, where possible, that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01 inch wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls.

E. Repair of Unformed Surfaces:

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
3. Repair finish unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
5. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Architect-Engineer.
6. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating, or use concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same materials to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
7. Repair isolated random cracks and single holes not over 1-inch in diameter by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with a neat grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part portland cement to 2½ parts fine aggregate passing

a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

8. Repair methods not specified above may be used, subject to the acceptance of the Architect-Engineer.

F. Perform structural repairs of concrete, subject to Architect-Engineer's approval, using epoxy adhesive and patching mortar.

G. Repair material and installation not specified above may be used, subject to Architect-Engineer's approval.

### **3.10 FIELD QUALITY CONTROL**

A. Section 01 40 00 - Quality Requirements.

B. Testing: The Contractor shall employ and pay an approved qualified testing laboratory to perform field quality control testing and to submit reports.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one (1) composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one (1) test at point of placement for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Concrete Temperature: ASTM C 1064; one (1) test hourly when air temperature is 80 deg F and above, and one (1) test for each composite sample.

4. Compression Test Specimens: ASTM C 31.

a. Cast and laboratory cure two (2) sets of two standard cylinder specimens for each composite sample.

b. Cast and field cure two (2) sets of two standard cylinder specimens for each composite sample.

5. Compressive-Strength Tests: ASTM C 39; test one (1) set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
  - a. Test one (1) set of two field-cured specimens at 7 days and one (1) set of two specimens at 28 days.
  - b. A compressive-strength test shall be the average compressive strength from a set of two (2) specimens obtained from same composite sample and tested at age indicated.
6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Test results shall be reported in writing to Architect-Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect-Engineer but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing agency shall make additional tests of concrete when test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect-Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect-Engineer.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Defective Work:

1. Concrete work which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense. The Contractor shall also be responsible for the cost of corrections to any work affected by or resulting from corrections to the concrete work.
2. In the event the additional testing becomes necessary, the Contractor shall cooperate with and provide assistance to the Engineer in proceeding with the test.
3. Reasonable compensation will be allowed for any additional work required which is not the result of unacceptable materials.

**END OF  
SECTION**

**SECTION 07 92 00**

**JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Inspection of joint surfaces and dimensions.
- B. Preparation of joint surfaces.
- C. Installation of joint backing materials.
- D. Installation of joint sealants.
- E. Field quality control.
- F. Protection and cleaning.
- G. Schedule installation of joint sealants - exterior and interior.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 03 30 00 - Cast-In-Place Concrete: Sealants used in conjunction with Cast-In-Place Concrete.
- C. Section 04 82 00 - Reinforced Unit Masonry Assemblies: Sealants used in conjunction with Reinforced Unit Masonry Assemblies.
- D. Section 05 50 00 - Metal Fabrications: Sealants used in conjunction with Metal Fabrications.
- E. Section 08 12 13 - Hollow Metal Frames: Sealants used in conjunction with Standard Hollow Metal Frames.
- F. Section 08 71 00 - Door Hardware: Sealants used in conjunction with Hardware.
- G. Section 08 80 00 - Glazing: Sealants used in conjunction with Glazing.
- H. Section 09 24 00 - Portland Cement Plastering: Sealants used in conjunction with Portland Cement Plaster.
- I. Section 09 21 16 - Gypsum Board Assemblies: Sealants used in conjunction with Gypsum Board Systems.
- J. Section 09 31 13 - Thin Set Ceramic Floor Tile: Sealants used in conjunction with Ceramic Floor Tile.
- K. Section 09 31 16 - Thin Set Ceramic Wall Tile: Sealants used in conjunction with Ceramic Wall Tile.
- L. Section 09 51 13 - Acoustical Panel Ceilings: Sealants used in conjunction with Suspended Acoustical Panel Ceilings.
- M. Section 10 28 13 - Commercial Toilet Accessories: Sealants used in conjunction with Toilet Accessories.



### 1.3 REFERENCES

- A. ASTM C510 - Test Method for Staining and Color Change of Single or Multicomponent Joint Sealants.
- B. ASTM C794 - Test Method for Adhesion in Peel of Elastomeric Joint Sealants.
- C. ASTM C920 - Elastomeric Joint Sealants.
- D. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- E. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open Cell Foam).
- F. ASTM D2203 - Test Method for Staining from Sealants.
- G. FS TT-S-227 - Sealing Compound, Rubber Base, Two Component.
- H. FS TT-S-230 - Sealing Compounds, Synthetic-Rubber Base, Single Component, Chemically Curing.
- I. FS TT-S-1543 - Sealing Compound, Silicone Rubber Base.

### 1.4 QUALITY ASSURANCE

- A. Section 01 40 00 - Quality Requirements.
- B. Single Source: Each joint sealant system material, or if not the products of a single manufacturer, all components of the system shall be approved by the manufacturer whose sealants is to be installed on the system.
- C. Accessory Materials: Associated accessory such as backer rods and/or compressible fillers shall be acceptable to the manufacturer of the sealant which would contact such accessory materials.
- D. Manufacturer's Representative: Do not use sealant produced by a manufacturers who will not agree to send a qualified technical representative to the project site, when required, for the purpose of rendering advice concerning the proper installation of materials. Begin the installation of each major type of sealant only in the presence of the manufacturer's technical representative.
- E. Staining Tests: Provide sealant systems which shall not cause staining of substrate surfaces. Manufacturer shall perform staining tests of sealant systems in accordance with ASTM C510 and ASTM D2203 for each substrate condition.
- F. Bond Test: Manufacturer shall test each sealant for bond with each joint substrate condition as per ASTM C794, minimum 15 lbs pull strength with no loss of adhesion.
- G. Sample Joint: Before sealant work is started, provide a sample of each type of finished joint where directed. Sample shall show the workmanship, bond, and color of sealant. The workmanship, bond,

and color of sealant throughout the project shall match the approved sample joints.

- H. **Installer Qualifications:** Engage an experienced Installer to perform joint sealant work who has specialized in the installation of joint sealant systems similar to that required for this project and who is acceptable to by manufacturer of joint sealant materials.
- I. **Installer Certification:** Obtain written certification from manufacturer of joint sealant certifying that Installer is approved by manufacturer for installation of specified joint sealant. Provide copy of certification to Architect-Engineer prior to award of joint sealant work.
- J. **Installer's Field Supervision:** Require Installer to maintain a full-time supervisor/foreman who is on jobsite during times that joint sealant work is in progress and who is experienced in installation of joint and accessory materials sealant similar to type and scope required for this Project.
- K. **Installer:** Sealant installer shall have a minimum of five year documented experience.

#### **1.5 SUBMITTALS**

- A. **Section 01 33 00 - Submittal Procedures.**
- B. **Product Data:** For each joint sealant product indicated/specified.
- C. **Certificates of Compliance:** Submit five copies of certificates from the manufacturers attesting that materials meet the specified requirements.
- D. **Manufacturer's Descriptive Data:** Submit five copies of complete descriptive data for each type of material. Clearly mark data to indicate type of sealant the Contractor intends to provide. Data shall state conformance to specified requirements.
- E. **Certification of Storage:** Submit Contractor's certification that all materials were stored in accordance with the sealant manufacturer's written recommendations for the duration of the work.

#### **1.6 GUARANTEE**

- A. **Section 01 73 00 - Execution and Closeout Requirements.**
- B. **Provide one year warranty in all sealant work.**
- C. **Warranty:** Replace sealants which fail because of loss of cohesion or adhesion, or do not cure.
- D. **In addition to the guarantee required in Section 01 73 00 for all work,** furnish an additional guarantee for a period of five (5) years after the Date of Substantial Completion against leaks and defects which indicate imminent leaking such as bubbles, tears, or separation from sides of joints. Repair al such leaks and defects immediately upon notice from Owner.

## **1.7 JOB CONDITIONS**

- A. Section 01 60 00 - Product Requirements.
- B. Weather: Do not proceed with installation of sealants under adverse weather conditions. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of early bond strength.
- C. Protection: Protect building surfaces adjacent to joints to be sealed from coming in contact with materials of the sealant application.

## **1.8 DELIVERY, STORAGE AND HANDLING**

- A. Section 01 60 00 - Product Requirements.
- B. Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon.
- C. Containers of elastomeric sealant shall be labeled as to type, class, grade, and use.
- D. Carefully handle and store materials to prevent inclusion of foreign materials and under conditions recommended by the manufacturer.
- E. Do not accept or retain materials which have exceeded the shelf life recommended by the manufacturer.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - JOINT SEALANTS**

- A. Type 1: Urethane - Single component, non sag; conforming to requirements of FS TT-S-00230C, Type II, Class A. Products complying with these requirements are:
  - 1. Dynatrol I - Pecora Corporation.
  - 2. Dymonic - Tremco.
  - 3. 1A - Sika Corporation
- B. Type 2: Urethane - Single Component, self leveling; conforming to requirements of FS TT-S-00230C, Type I, Class A. Products complying with these requirements are:
  - 1. Urexpan NR-201 - Pecora Corporation.
  - 2. 45 - Vulkem (Tremco).
  - 3. 1C, SL - Sika Corporation.
- C. Type 3: Urethane - Two component, nonsag; conforming to requirements of FS TT-S-00227E, Type II, Class A. Products complying with these requirements are:

1. Dynatrol II - Pecora Corporation.
  2. Dymeric - Tremco.
  3. NP II - Sonneborn Building Products.
- D. Type 4: Urethane - Two component, self leveling; conforming to requirements of FS TT-S-00227E, Type I, Class A. Products complying with these requirements are:
1. Urexpan NR-200 - Pecora Corporation.
  2. THC 900 - Tremco.
  3. 255 - Vulkem (Tremco).
- E. Type 5: Silicone - single component, glazing applications; conforming to requirements of FS TT-S-001543, Class A. Products complying with these requirements are:
1. 860 - Pecora Corporation.
  2. 999 - Dow Corning.
  3. 1200 - General Electric.
- F. Type 6: Acoustical Sealant - single component; conforming to requirements of ASTM C834. Products complying with these requirements are:
1. AC-20 Acoustical Sealant - Pecora Corporation.
  2. Acoustical Sealant - Tremco.
  3. Acoustical Sealant - USG.
- G. Type 7: Silicone Rubber: Single component, fungicidal, mildew resistant, high humidity and temperature extremes applications; conforming to the requirements of FS TT-S-001543, Class A. Products complying with these requirements are:
1. 786 Mildew Resistant Silicone Sealant - Dow Corning.

## **2.2 MATERIALS - ACCESSORIES**

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Filler: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent.
- D. Bond Breaker Type: Polyethylene or other material as manufactured or specified by the sealant manufacturer to prevent three sided adhesion in locations where backer-rod cannot be used.
- E. Joint Backing Rod: Compressible resilient, closed cell polyethylene acceptable to the sealant manufacturer. Joint backing

rod shall exhibit good compressive recovery characteristics, low water absorption, and be non-staining. Material impregnated with oil or bitumen shall not be used. Joint backing shall be compatible with the sealant. The size and shape of the joint backing rod shall be as recommended by the sealant manufacturer for the intended application. Products complying with these requirements are:

1. Ethafoam SB - Dow Chemical Company.
2. Sonofoam Bacher Rod - Sonneborn Building Products.
3. Expand-O-Foam - Williams Products, Inc.
4. Denver Foam - Backer Rod Manufacturing, Inc.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

- A. Section 01 30 00 - Administrative Provisions.
- B. Verify joint dimensions, physical, and environmental conditions are acceptable to receive work of this Section.
- C. Beginning of installation means acceptance.

#### **3.2 PREPARATION - JOINT SURFACES**

- A. Clean, prepare, and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.
- B. Verify that joint shaping materials and release tapes are compatible with sealant.
- C. Examine joint dimensions and size materials to achieve required width/depth ratios.
- D. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
- E. Use bond breaker where required.

#### **3.3 INSTALLATION - JOINT SEALANT**

- A. Install sealant in accordance with manufacturer's printed instructions.
- B. Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature ranges.
- C. Tool joints as indicated.
- D. Joints: Free of air pockets, foreign embedded matter, ridges, and sags.

### 3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Manufacturer's Field Service: Provide for exterior sealant work. At the start of installation, periodically as the work progresses, and after completion, furnish the services of the sealant manufacturer's technical representative at the job site as necessary to advise on every phase of the work. As a minimum furnish full-time attendance during the first 2 work days, at least once every week thereafter, and furnish technical assistance to the installer as may be required.
- C. Water Hose Tests (AAMA 501.2)
  - 1. After installation and curing of sealants, check for water leaks by testing at least a total of 30 lineal feet of the exposed joint system where leakage could be observed. Conduct tests at locations as directed and in the presence of the Owner's On Site Representative.
  - 2. Use a 3/4" ID garden hose equipped with a control valve, pressure gage and 1/2" ID brass nozzle. Adjust the water flow to 30 psi at the nozzle inlet and spray the water perpendicular to the joint at a distance 12" from the surface. Slowly move the nozzle back and forth for 5 minutes along a 5 foot segment of joint. Starting from the lowest point and working upward, repeat the process on successive segments until designated location has been tested. Repair leaks and retest as directed.
  - 3. Schedule of Water Hose Tests
    - a. All exterior windows.
    - b. All exterior doors with weatherstripping in place.

### 3.5 PROTECTION AND CLEANING

- A. Protection: Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.
- B. Cleaning: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

### 3.6 SCHEDULE

- A. Exterior: As detailed on the drawings or specified herein.

Location

Type of  
Sealant

<u>Location</u>	<u>Type of Sealant</u>
1. Perimeter of exterior openings where frames meet exterior facade of building.	1,3
2. Control and expansion joint in exterior surfaces of unit masonry walls.	1,3
3. Roof sheet metal work.	5
4. Pipe and conduit penetrations on Non-Fire Rated Walls (Between Sleeve and Pipe or Conduit).	1,2
5. Ductwork Penetrations on Non-Fire Rated Walls (Between Sleeve and Ductwork).	1,2
6. Expansion Joints on Sidewalks.	Section 32 13 13
7. Pipe and Conduit Penetrations on Fire-Rated Walls.	Section 07 84 13
8. Ductwork Penetrations on Fire-Rated Walls.	Section 07 84 13

B. Interior: As detailed on the drawings or specified herein.

<u>Location</u>	<u>Type of Sealant</u>
1. Interior perimeter of exterior openings.	1,3,5
2. Contraction and expansion joints on the interior of exterior poured-in-place concrete walls.	1,3,5
3. Contraction and expansion joints on the interior of exterior surfaces of unit masonry walls.	1,3,5
4. Perimeter of interior frames.	1,3,5
5. Interior masonry vertical control joints (block to block, block to concrete, and intersecting masonry walls).	1,3,5
6. Unexposed construction, contraction and isolation joints on slab on grade.	4
7. Exposed isolation joints on slab on grade.	4
8. Exposed control joints in gypsum board partitions.	1,3
9. Joint between edge angle of suspended acoustical ceiling and adjoining vertical surfaces.	6

<u>Location</u>	<u>Type of Sealant</u>
10. Under metal thresholds (exterior doors).	5
11. Joint around sound rated gypsum board partitions.	6
12. Pipe and conduit penetrations on Non-Fire Rated Walls.	1,3,5
13. Ductwork penetrations on Non-Fire Rated Walls.	1,3,5
14. Perimeter of sinks, urinals, bathroom fixtures, rimless sinks, water closets and lavatories.	8
15. Ceramic Wall Tile Expansion Joints.	Section 09 31 16
16. Ceramic Floor Tile Expansion Joints.	Section 09 31 13
17. Exposed construction and contraction joints on slab on grade.	Section 03 31 27
18. Pipe and Conduit penetrations and Fire Rated Walls.	Section 07 84 13



Aguadilla, Puerto Rico

<u>Location</u>	Type of <u>Sealant</u>
19. Cable Trays penetrations on Fire Rated Walls.	Section 07 84 13
20. Ductwork penetrations on Fire Rated Walls.	Section 07 84 13

**END OF  
SECTION**

**SECTION 09 24 00**

**PORTLAND CEMENT PLASTERING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Inspection of surfaces.
- B. Surface preparation.
- C. Installation of accessories.
- D. Application of portland cement plaster system over masonry surfaces.
- E. Patching and pointing.
- F. Tolerances.
- G. Adjusting.
- H. Cleaning and protection.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 04 82 00 - Reinforced Unit Masonry Assemblies.
- C. Section 09 91 00 - Painting

**1.3 REFERENCES**

- A. ACI 524 - Guide to Portland Cement Plastering.
- B. ASTM C150 - Portland Cement.
- C. ASTM C206 - Finishing Hydrated Lime.
- D. ASTM C207 - Hydrated Lime for Masonry Purposes.
- E. ASTM C897 - Aggregate for Job-Mixed Portland Cement Based Plasters.
- F. ASTM C926 - Application of Portland Cement-Based Plaster.
- G. ASTM C932 - Surface Applied Bonding Agents for Exterior Plastering.
- H. ASTM C1063 - Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
- I. ASTM C1116 - Fiber Reinforced Concrete and Shotcrete.

J. NCMA TEK 9-3A - Plaster and stucco for Concrete Masonry.

K. PCA (Portland Cement Association) - Plaster (Stucco) Manual.

#### **1.4 QUALITY ASSURANCE**

A. Section 01 40 00 - Quality Requirements.

B. Applicator: Company or personnel specializing in performing work of this section with minimum five years documented experience.

C. Perform portland cement plaster work in accordance with ASTM C926.

#### **1.5 SUBMITTALS**

A. Section: 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for each type of product indicated.

C. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

D. Laboratory Test Reports: Submit gradation test reports of fine aggregate for base and finish coats.

#### **1.6 PRE-INSTALLATION MEETINGS**

A. Section 01 31 00 - Administrative Requirements.

B. Convene minimum two weeks prior to commencing work of this section.

#### **1.7 ENVIRONMENTAL REQUIREMENTS**

A. Section: 01 60 00 - Product Requirements.

B. Comply with ASTM C926 requirements.

C. Interior Plasterwork: Maintain room temperatures at greater than 70 degrees F for at least 48 hours before plaster application, and continuously during and after application.

1. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.

2. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

D. Exterior Plastering

1. Apply and cure plaster to prevent drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 60 00 - Product Requirements.
- B. Store materials inside cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
- C. Store bulk materials in area of intended use and exercise caution to prevent subsequent contamination and segregation of bulk materials prior to use.

**PART 2 - PRODUCTS**

**2.1 MATERIALS - PLASTER BASE COAT**

- A. Cement: ASTM C150, Type I Portland cement, gray.
- B. Lime: ASTM C206, Type S.
- C. Aggregate: ASTM C897, Natural sand, within the following sieve sizes and percentage retained limits:

<u>Sieve Size</u>	<u>Percent Retained</u>
No. 4	0
No. 8	0 to 5
No. 16	5 to 30
No. 30	30 to 65
No. 50	65 to 95
No. 100	90 to 100

1. Not more than 50 percent shall be retained between any two consecutive sieves shown in the above table, not more than 25 percent between No. 50 and No. 100 sieves. The amount of material finer than a No. 200 sieve shall not exceed 3 percent.
  2. Fineness modulus shall fall between 2.05 and 3.05.
- D. Water: Clean, fresh, potable and free of mineral or organic matter which can affect the set, the plaster, or any metal in the system.
  - E. Bonding Agent: ASTM C932; type recommended for bonding plaster to concrete and concrete masonry surfaces.

## **2.2 MATERIALS - PLASTER FINISH COAT**

- A. Cement: As specified for plaster base coat, grey color.
- B. Lime: As specified for plaster base coat.
- C. Aggregate: ASTM C897; natural sand, natural color, and shall be graded within the limits shown above for base coats, except that all of the sand shall pass the No. 30 sieve.
- D. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

## **2.3 MATERIALS - PLASTIC TRIMS**

- A. Acceptable Manufacturers:
  - 1. Alabama Metal Industries Corporation (AMICO).
  - 2. Plastic Components, Inc.
  - 3. Vinyl Corporation.
- B. Cornerbeads: High-impact PVC; with perforate flanges
  - 1. Small nose cornerbead; use unless otherwise indicated.
  - 2. Small nose cornerbead recommended by manufacturer for use where durable corner is required; use on columns and for finishing unit masonry corners.
  - 3. Bull nose cornerbead, radius  $\frac{3}{4}$  inch minimum; use at locations indicated on Drawings.
- C. Casing Beads: High-impact PVC; with perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
  - 1. Square-edge style; use unless otherwise indicated.
  - 2. Bull nose style, radius  $\frac{3}{4}$  inch minimum; use at locations indicated on Drawings.

## **2.4 PLASTER MIXES**

- A. General: comply with ASTM C926 for applications indicated.
  - 1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu ft of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

B. Base-Coat Mixes for Use Over Concrete Unit Masonry: Single base coats for two-coat plasterwork as follows:

1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and  $\frac{3}{4}$  to  $1\frac{1}{2}$  parts lime. Use  $2\frac{1}{2}$  to 4 parts aggregate per part of cementitious materials (sum of separate volumes of each component materials).

C. Job-Mixed Finish-Coat Mixes:

1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and  $\frac{3}{4}$  to  $1\frac{1}{2}$  parts lime. Use  $1\frac{1}{2}$  to 3 parts aggregate per part of cementitious materials (sum of separate volumes of each component materials).

D. Mix only as much plaster as can be used prior to initial set.

E. Mix materials dry, to uniform color and consistency, before adding water.

F. Protect mixtures from contamination and excessive evaporation.

G. Do not retemper mixes after initial set has occurred.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.

B. Clean surfaces to which plaster is to be applied of all projections, dust, loose particles, grease, bond breakers, and other foreign matter.

C. Masonry: Verify joints are cut flush and surface is ready to receive work of this Section. Verify no bituminous or water repellent coatings exist on masonry surface.

D. Concrete: Verify surfaces are flat, honeycomb is filled flush, and surface is ready to receive work of this Section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster bond.

E. Examine welded hollow metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

F. Grounds and Blocking: Verify items within walls for other Sections of work have been installed. Check metal grounds, corner beads, screeds, and other accessories carefully for alignment before work is started.

- G. Mechanical and Electrical: Verify services within walls have been tested and approved.
- H. Beginning of installation means acceptance of existing conditions.

### **3.2 PREPARATION**

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering. Install and maintain floor protective coverings at all times during the application of plaster.
- B. Dampen masonry surfaces to reduce excessive suction.
- C. Clean concrete surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.
- D. Roughen smooth concrete surfaces and apply bonding agent. Apply in accordance with manufacturer's instructions.

### **3.3 INSTALLATION - ACCESSORIES**

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
  - 1. Install lath-type external-corner reinforcement at exterior locations.
  - 2. Install cornerbead at interior locations.

### **3.4 APPLICATION - PORTLAND CEMENT PLASTER**

- A. General: Apply plaster in accordance with ASTM C926.
  - 1. Do not deviate more than plus or minus  $\frac{1}{4}$  inch 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
  - 2. Grout hollow metal frames, bases, and similar work occurring in plastered areas, with base coat plaster material, before lathing where necessary.
  - 3. Finish plaster flush with metal frames and other built-in metal times or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

- B. Bonding Compound: Apply on unit masonry and concrete plaster bases.
- C. Base Coat: Apply to a nominal thickness of 3/8 inch over concrete and masonry surfaces.
- D. Finish Coat: Apply to a nominal thickness of 1/8 inch over the base coat.
- E. Moist cure base coat.
- F. After curing, dampen base coat prior to applying finish coat.
- G. Apply finish coat and wood float to a smooth and consistent finish.
- H. Avoid excessive working of surface. Delay trowelling as long as possible to avoid drawing excess fines to surface.
- I. Moist cure finish coat for minimum period of 48 hours.

### **3.5 PATCHING AND POINTING**

- A. Upon completion, cut out and patch loose, cracked, damaged, or defective plaster. Patching shall match existing work in texture, color, and shall be finished flush with plaster previously applied.
- B. Do all pointing and patching of plastered surfaces abutting or adjoining any other finish work in a neat and workmanlike manner.

### **3.6 TOLERANCES**

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

### **3.7 ADJUSTING**

- A. Section 01 73 00 - Execution Requirements.
- B. Remove damaged or defective plaster with finish coat materials spray applied to entire finish coat surface.

### **3.8 CLEANING AND PROTECTION**

- A. Remove temporary protection and enclosure of other work.
- B. Promptly remove plaster from door frames, windows, and



other surfaces not indicated to be plastered.

C. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

**END OF SECTION**

**SECTION 09 91 00**

**PAINTING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Inspection of surfaces.
- B. Surface preparation.
- C. Painting schedule.
- D. Field application of painting.
- E. Field Quality Control

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 05 50 00 - Metal Fabrications.
- C. Section 06 20 23 - Interior Finish Carpentry.
- D. Section 08 12 13 - Hollow Metal Frames.
- E. Section 08 13 13 - Hollow Metal Doors.
- F. Section 09 24 00 - Portland Cement Plastering.

**1.3 REFERENCES**

- A. ANSI/ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ANSI/ASTM D660 - Method of Evaluating Degree of Checking of Exterior Paints.
- C. ASTM D3276 - Recommended Guide for Paint Inspectors.
- D. PDCA (Painting and Decorating Contractors of America) - Architectural Specifications Manual.
- E. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

**1.4 QUALITY ASSURANCE**

- A. Section 01 40 00 - Quality Requirements
- B. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

- C. **Applicator Qualifications:** Engage an experienced applicator to perform painting work who has specialized in the application of painting systems similar to that required for this project and who is acceptable to by manufacturer of specified paint.
- D. **Applicator Certification:** Obtain written certification from manufacturer of paints certifying that Applicator is approved by manufacturer for application of specified paint systems. Provide copy of certification to Architect-Engineer prior to award of paint work.
- E. **Applicator's Field Supervision:** Require Applicator to maintain a full-time supervisor/foreman who is on jobsite during times that paint work is in progress and who is experienced in application of paint systems similar to type and scope required for this Project.

### **1.5 SUBMITTALS**

- A. Section 01 33 00 - Submittal Provisions
- B. **Product Data:** Submit data on finishing products.
- C. **Samples:**
  - 1. Submit two paper chip samples, 2 x 2 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
  - 2. Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard 2 x 2 inch in size.
- D. **Manufacturer's Installation Instructions:** Submit special surface preparation procedures, substrate conditions requiring special attention, and any other specific requirements.

### **1.6 CLOSEOUT SUBMITTALS**

- A. Section 01 70 00 - Execution and Closeout Requirements
- B. **Operation and Maintenance Data:** Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

### **1.7 MOCKUP**

- A. Section 01 40 00 - Quality Requirements
- B. Construct mockup panel, 5 feet long by 5 feet wide, illustrating coating color, texture, and finish.
- C. Locate where directed by Architect/Engineer.
- D. Incorporate accepted mockup as part of Work.

### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 60 00 - Product Requirements.

- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's printed instructions.

#### **1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Section 01 60 00 - Product Requirements.
- B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- C. Do not apply exterior coatings during rain when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.
- D. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

#### **1.10 WARRANTY**

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Furnish five year manufacturer warranty for paints and coatings.

#### **1.11 EXTRA MATERIALS**

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Supply 4 gallons of each color, type, and surface texture; store where directed.
- C. Label each container with color, type, texture, room locations, in addition to manufacturer's label.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS - PPAINTING**

- A. Benjamin Moore
- B. BLP Mobile Paints
- C. ICI/Devco Coatings
- D. Glidden Coatings.
- E. Sherwin Williams.

## **2.2 MATERIALS**

- A. Paint, Varnish, Stain, Enamel, Lacquer and Fillers: The designations in the painting schedule are for Glidden Coatings, except where otherwise noted. Colors shall be selected by the Architect/Engineer from Glidden's professional colors and natural colors.
- B. Paint Accessory Materials: (Linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve the finishes specified) of high quality and approved manufacturer.
- C. Paints: Ready-mixed except field catalyzed coatings. Pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispersed to a complete homogeneous mixture.
- D. Paints to have good flowing and brushing properties and be capable of dry or curing free of streaks or sags.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION OF SURFACES**

- A. Thoroughly examine surfaces scheduled to be painted prior to commencement of work. Report in writing to Architect/Engineer, any condition that may potentially affect proper application. Do not commence until such defects have been corrected.
- B. Correct defects and deficiencies in surfaces which may adversely affect work of this Section.
- C. Test shop applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Plaster and Gypsum Wallboard: 12 percent.
  - 2. Concrete: 12 percent.

### **3.2 PROTECTION OF SURFACES**

- A. Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.
- B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.
- C. Place cotton waste, cloths, and material which may constitute a fire hazard in closed metal containers and remove daily from site.
- D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be

carefully stored, cleaned, and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

### 3.3 SURFACE PREPARATION

- A. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.
- B. Marks: Seal with shellac those which may bleed through surface finishes.
- C. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- D. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- E. Concrete Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- F. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- G. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand power tool wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- H. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- I. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

### 3.4 APPLICATIONS

- A. Apply each coat at proper consistency.
- B. Each coat of paint is to be slightly darker than preceding coat unless otherwise approved by Architect/Engineer.
- C. Sand lightly between coats to achieve required finish.
- D. Do not apply finishes on surfaces that are not sufficiently dry.
- E. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.

- F. Prime top and bottom edges of metal doors with enamel undercoat when they are to be painted.

### **3.5 EXTERIOR AND INTERIOR PAINTING**

- A. The work includes surface preparation, painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise indicated. Surface preparation, priming, and coats of paint specified are in addition to shop priming and surface treatment specified under other sections of the work.
- B. Paint all exposed surfaces whether or not colors are designed in schedules, except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color of finish is not designated, the Architect/Engineer will select these from standard colors available for the material systems specified.

### **3.6 MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Not Used.

### **3.7 PAINTING NOT INCLUDED**

- A. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metals, hollow metal work, and fabricated components. Touch-up of damaged primed surfaces is included in the painting work.
- B. Prefinished Items: Do not include painting when factory-finishing is specified, except all roof mounted prefinished mechanical equipment is to be field-painted.
- C. Concealed Surfaces: Painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels.
- D. Finish Metal Surfaces: Architectural metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require finish painting.
- E. Operating Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operations, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

### **3.8 CLEANING**

- A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.

- B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Upon completion of work leave premises neat and clean, to the satisfaction of Architect/Engineer.

### 3.9 PAINTING SCHEDULE (EXTERIOR SURFACES)

<u>Substrate</u>	<u>Paint System</u>	<u>Coverage</u> (Mils DFT)
A. Plaster		
Primer:	Spred Satin Latex Wall Paint Sealer No. 3416	1.6
1st Coat:	Spred Latex Semi-Gloss Enamel No. 3700	1.5
2nd Coat:	Spred Latex Semi-Gloss Enamel No. 3700	1.5
B. Exposed Concrete (Acrylic Coating)		
Primer:	Glid-Seal-Krete Waterproofing Sealer	
1st Coat:	Lifemaster Pro Hi Performance Acrylic Coating No. 6900	2.0
2nd Coat:	Lifemaster Pro Hi Performance Acrylic Coating No. 6900	2.0
C. Ferrous Metals		
Shop Primer:	Glid-Guard Tank & Structural Primer No. 5205	3.0
Field Touch Up:	Glid-Guard Tank & Structural Primer No. 5205	3.0
1st Coat:	Lifemaster Pro Hi Performance Acrylic Coating No. 6900	2.0
2nd Coat:	Lifemaster Pro Hi Performance Acrylic Coating No. 6900	2.0
D. Galvanized Metals		
Shop Primer:	Glid-Guard Tank & Structural Primer No. 5205	3.0
Field Touch Up:	Glid-Guard Tank & Structural Primer No. 5205	3.0
1st Coat:	Lifemaster Pro Hi Performance	



	Acrylic Coating No. 6900	2.0
2nd Coat:	Lifemaster Pro Hi Performance Acrylic Coating No. 6900	2.0
<b>3.10 PAINTING SCHEDULE (INTERIOR SURFACES)</b>		
A. Plaster		
Primer:	Spred Satin Latex Wall Paint Sealer No. 3416	1.5
1st Coat:	Spred Latex Semi-Gloss Enamel No. 3700	1.5
2nd Coat:	Spred Latex Semi-Gloss Enamel	
B. Plaster (Epoxy Finish)		
Primer:	Glid-Guard Water Base Epoxy Enamel No. 5585	2.0
1st Coat:	Glid-Guard Water Base Epoxy Enamel No. 5585	4.0
2nd Coat:	Glid-Guard Water Base Epoxy Enamel No. 5585	4.0
C. Exposed Concrete		
Primer:	Spred Satin Latex Wall Paint Sealer No. 3416	1.5
1st Coat:	Spred Latex Semi-Gloss Enamel No. 3700	1.5
2nd Coat:	Spred Latex Semi-Gloss Enamel No. 3700	1.5
D. Gypsum Board		
Primer:	Spred Satin Latex Wall Paint Sealer No. 3416	1.5
1st Coat:	Spred Latex Semi Gloss Enamel No. 3700	1.5
2nd Coat:	Spred Latex Semi Gloss Enamel No. 3700	1.5
E. Gypsum Board (Epoxy Finish)		
Primer:	Spred Satin Latex Wall Paint Sealer No. 3416	1.5
1st Coat:	Glid-Guard Water Base Epoxy Enamel No. 5585	4.0

2nd Coat:	Glid-Guard Water Base Epoxy Enamel No. 5585	4.0
F. Ferrous Metals		
Shop Primer:	Glid-Guard Tank & Structural Primer No. 5205	3.0
Field Touch Up:	Glid-Guard Alkyd Industrial Enamel No. 5205	3.0
1st Coat:	Glid-Guard Alkyd Industrial	
2nd Coat:	Glid-Guard Alkyd Industrial Enamel No. 4550	2.5
G. Ferrous Metals (Epoxy Finish)		
Shop Primer:	Glid-Guard Epoxy Chromate Metal Primer No. 5251/5252	1.7
Field Touch Up:	Glid-Guard Epoxy Chromate Metal Primer No. 5251/5252	1.7
1st Coat:	Glid-Guard Epoxy Chemical Resistant Finish No. 5240	5.0
2nd Coat:	Glid-Guard Epoxy Chemical Resistant Finish No. 5240	5.0
H. Galvanized Metals		
Shop Primer:	Glid-Guard All-Purpose Metal Primer No. 5229	2.0
Field Touch Up:	Glid-Guard All-Purpos Metal Primer No. 5229	2.0
1st Coat:	Glid-Guard Alkyd Industrial Enamel No. 4550	2.5
2nd Coat:	Glid-Guard Alkyd Industrial Enamel No. 4550	2.5
I. Galvanized Metals (Epoxy Finish)		
Shop Primer:	Glid-Guard Epoxy Chromate Metal Primer No. 5251/5252	1.7
Field Touch Up:	Glid-Guard Epoxy Chromate Metal Primer No. 5251/5252	1.7
1st Coat:	Glid-Guard Epoxy Chemical Resistant Finish No. 5240	5.0
2nd Coat:	Glid-Guard Epoxy Chemical Resistant Finish No. 5240	5.0

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**END OF  
SECTION**

**SECTION 26 05 00**

**GENERAL PROVISIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes General Provisions for Electrical Installation.

**1.2 RELATED SECTIONS**

- A. All sections included in this Project.

**1.3 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. AEIC - Association of Edison Illuminating Companies
  - 2. ANSI - American National Standards
  - 3. ASTM - American Society for Testing and Materials
  - 4. CBM - Certified Ballast Manufacturers
  - 5. FMS - Factory Mutual System
  - 6. ICEA - Insulated Cable Engineers Association
  - 7. IEEE - Institute of Electrical and Electronic Engineers
  - 8. NBS - National Bureau of Standards
  - 9. NEC - National Electrical Code
  - 10. NEMA - National Electric Manufacturers Association
  - 11. NESC - National Electrical Safety Code
  - 12. NETA - International Electrical Testing Association
  - 13. NFPA - National Fire Protection Association
  - 14. OSHA - Occupational Safety and Health Act.
  - 15. PREPA - Puerto Rico Electrical Power Authority
  - 16. ORHA - Puerto Rico Highway Authority
  - 17. PRTC - Puerto Rico Telephone Company
  - 18. UL - Underwriters Laboratories

#### **1.4 SYSTEM DESCRIPTION**

- A. The work covered by this specification shall include furnishing all labor, material, equipment and services to construct and install the complete electrical system as shown on Drawings and Specifications.

#### **1.5 DESIGN DRAWINGS**

- A. The Architect-Engineer's drawings shall serve as the working drawings. They indicate the general layout of the complete electrical system.
- B. Field verification of scale dimensions on plans is directed since actual locations, distances and levels will be governed by actual field conditions.
- C. The Electrical Contractor shall also review architectural, structural and mechanical drawings to avert possible installation conflicts. Should drastic change from original plans be necessary to resolve such conflicts, the contractor shall notify the Architect-Engineer, and secure written approval and agreement on necessary adjustments before the installation is started.
- D. Discrepancies shown on different plans, or between plans and actual field conditions, or between plans and specifications, shall promptly be brought to the attention of the Architect-Engineer for a decision.
- E. All items not specifically mentioned in the specifications or noted in the drawings but which are obviously necessary to make a complete working installation shall be included.

#### **1.6 TEMPORARY POWER**

- A. The Electrical Contractor shall furnish, install, maintain, and remove after construction is completed a temporary power and lighting system. He shall coordinate the characteristics of the system with the General Contractor.

#### **1.7 SAFETY PRECAUTIONS**

- A. The Electrical Contractor shall furnish and place proper guards for prevention of accidents. He shall provide and maintain any other construction required to secure safety of life or property, including the maintenance of sufficient lights.

#### **1.8 SUBMITTALS**

- A. The Electrical Contractor shall submit detailed dimensioned shop drawings covering all items of equipment, data for each type of product used in the Project. No equipment should be ordered until these shop drawings and/or data sheets have been approved.

## **1.9 CLOSEOUT SUBMITTALS**

### **A. Record Drawings:**

1. The Electrical Contractor shall keep a complete set of drawings at the site of work for the express and only purpose of noting thereon on a continuous basis all changes in construction, layout or conduit, ducts, etc., which are effected during construction due to field conditions, change orders, etc.
2. This set of provisional record drawings shall be kept up to date with all changes noted thereon, and these provisional record drawings shall be submitted for the inspection and approval of the Architect-Engineer at least five days prior to any partial monthly payment.
3. Upon termination of the work, the Owner shall furnish a complete set of sepias, on which the Electrical Contractor shall, in a neat and workmanlike manner, make a complete record of all changes and revisions to the original work. These drawings shall be delivered to, and be approved by the Architect-Engineer before final liquidation of the contract.

### **B. Manuals:**

1. The Electrical Contractor shall provide the Owner with three bound copies of Instruction Manuals on the operation and maintenance of each piece of equipment installed, including: inspection, maintenance, cleaning, grounding, precaution and operation.
2. At the time the manuals are given, the Electrical Contractor shall supply the Owner with three copies of the equipment manufacturer's recommended spare parts list.
3. The Electrical Contractor shall provide three copies of the time current curves of each protective device furnished.

## **1.10 DELIVERY, RECEIVING AND STORING**

- A. All electrical materials, equipment and accessories required to complete the work shall be delivered to, received, unloaded and stored by the Electrical Contractor until they are installed.
- B. Prior to shipment, all items shall be protected or crated to prevent damage during shipment and handling. Wooden covers shall protect equipment flange faces. Electrical Contractor shall perform all required uncrating, unpacking, cleaning and inspection prior to installation.
- C. All items shall be inspected as soon as they are received to determine if any damage has occurred in transit. Damaged items

shall be repaired or replaced immediately to prevent delay in the construction schedule.

- D. All items shall be properly protected during all phases of the work. Materials, equipment and accessories, which are not weatherproof, shall be protected against weather damage during storage. The Electrical Contractor shall be responsible for the safekeeping of all items during receiving, storing and installation.
- E. Defective equipment or equipment damaged in the course of relocation, installation, or test shall be replaced or repaired in a manner meeting with the approval of the Owner.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Electrical materials shall be new and products of recognized manufacturers and as noted on the drawings and/or stated in these specifications.

### **2.2 SPECIFICATION BY BRAND NAME**

- A. It is the intent of these specifications to establish quality standards of materials and equipment installed. Hence, specific items are identified by manufacturer, trade name or catalog designation.

### **2.3 SUBSTITUTIONS**

- A. Should the Electrical Contractor propose to furnish material and equipment other than those specified as permitted by the "similar to" or "approved equal" clauses, he shall submit a written request for any or all substitutions to the Owner representative. Such a request shall be accompanied with complete description (manufacturer, brand name, catalog number, etc.) and technical data for all items.
- B. Acceptance or rejection of the proposed substitutions shall be subject to approval of the Owner representative. If requested the Electrical Contractor shall submit samples of both the specified and the proposed items for inspection.
- C. Electrical Contractor shall be responsible for notifying any other Contractor whose work should become affected due to the substitution of a piece of equipment other than that which is incurred by the other trades due to the substitution.

### **PART 3 - EXECUTION**

#### **3.1 LABOR**

- A. All workmanship shall be first class and performed by persons qualified in this trade.
- B. Insofar as is it possible, the Electrical Contractor shall keep the same foremen and workmen throughout the project duration.

#### **3.2 SUPERVISION**

- A. During the entire progress of the job, the Electrical Contractor shall have a competent experienced engineer and all necessary assistants. This engineer shall not be changed during the progress of the job without the consent of the Owner representative.

#### **3.3 SLEEVES, OPENINGS, AND INSERTS**

- A. The Electrical Contractor shall furnish and install all sleeves or openings through floor or walls required for passage of all conduits or ducts installed by him.
- B. The Electrical Contractor shall furnish and install all inserts and hangers required to support bus ducts, conduits, pull boxes, luminaires, etc.
- C. If the sleeves, hangers, inserts, etc. are improperly installed, the Electrical Contractor shall do all necessary cutting and patching at this own expense, to rectify the errors.

#### **3.4 CUTTING AND PATCHING**

- A. Cutting of walls, partitions, floor and roof that may be necessary for this installation shall be done in a neat workmanlike manner. Openings shall be cut only large enough to facilitate the installation.
- B. Cutting of structural members or cutting that in any manner weakens the structure is forbidden.
- C. Patching shall be done with the same type of material as was removed. The completed patching work shall restore the surface to its original appearance. Rubble and excess patching material shall be promptly removed from the premises.
- D. Patching of waterproofed surfaces shall be done in a manner, which shall render the area completely waterproof.

#### **3.5 EXCAVATION AND BACKFILL**

- A. All excavation trenching and backfilling required for properly installing the electrical duct systems shall be provided as part



of the electrical work unless otherwise stated in the specifications or on the drawings.

- B. Trenches shall be dug to the proper alignment and required depth only so far in advance of pipe laying as required to permit orderly progress of the work. Trenches shall be only wide enough to permit satisfactory joining of piping.
- C. All excavations shall be kept free of water by pumping or other approved means, during progress of the work and until the excavations are backfilled. Backfilling shall be done immediately after the work has been inspected and approved.
- D. Where sub-grade soils are unstable and cannot properly support piping, trenches shall be excavated at least six inches deeper than required, backfilled with an approved fill material to the proper elevation and compacted.
- E. Special conditions for anchors, supports, thrust blocks, etc., shall be as indicated on the drawings.
- F. Backfilling shall not be done until testing has been satisfactorily completed and approved and all concrete appurtenances have been properly cured.
- G. Backfill shall be select material, free from rock larger than four inches in diameter and free from deleterious material. The backfill shall be tamped in layers not exceeding six inches in depth and shall be sufficiently damp to permit thorough compaction on each side of the pipe to provide solid support and backing against the external surface, to an elevation of at least 12 inches above the top of the pipe. The balance of the fill shall contain no rock larger than eight inches in its largest dimension and free from deleterious matter. The balance shall be compacted thoroughly by puddling or flooding, or by tamping if the material does not consolidate readily by puddling.
- H. All excess excavated material not used for backfill shall be removed from the site.

### **3.6 FIELD QUALITY CONTROL**

- A. All material and workmanship shall be subject to inspection, examination and test by the Owner representative at any and all times during construction.
- B. After the installation is completed, the Electrical Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of these specifications. The test shall be performed in the presence of the Owner representative.
- C. The Electrical Contractor shall furnish promptly, without additional charge, all reasonable facilities, labor, materials

and equipment for the safe and convenient inspection and tests that may be required by the Owner representative.

- D. The electrical installation shall meet the approval of the Puerto Rico Electrical Power Authority and the Electrical Contractor shall furnish a Certificate of this approval.

### **3.7 CLEANING AND PAINTING**

- A. All equipment, luminaires, conduits, ducts and other exposed work shall be thoroughly cleaned. All plated, polished or painted work shall be bright and clean.
- B. All equipment shall have factory standard finish unless otherwise called by technical specification for special treatment. Painting Contractor will provide other painting.

### **3.8 GUARANTEE OF WORK**

- A. All the work herein specified shall be guaranteed free from labor and material defects for one year after the work is received. The Electrical Contractor shall deliver a document covering the terms of this guarantee to the Owner.

**END OF  
SECTION**

**SECTION 26 05 19**

**CONDUCTORS: WIRES AND CABLES UP TO 600 VOLTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section includes wire and cable up to 600 volts to be installed in conduits, wireways, and surface mounted raceways; and wire connectors and connections.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding
2. Section 26 08 00 - Acceptance Testing

**1.2 REFERENCES**

A. All work shall be in accordance with all applicable codes, standards, and regulations to include, but not limited to, the following:

1. NEC - National Electrical Code
2. OSHA - Occupational Safety and Health Act.
3. UL - Underwriters Laboratories
4. ANSI - American National Standards
5. ASTM - American Society for Testing and Materials
6. NEMA - National Electrical Manufacturers Association
7. NETA - InterNational Electrical Testing Association
8. ICEA - Insulated Cable Engineers Association
9. IEEE - Institute of Electrical and Electronic Engineers
10. PREPA - Puerto Rico Electrical Power Authority

**1.3 SYSTEM DESCRIPTION**

A. Product Requirements: Provide products as follows:

1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
2. Stranded conductor for feeders and branch circuits larger than 10 AWG.
3. Stranded conductors for control circuits.

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4. Conductor not smaller than 12 AWG for power and lighting circuits.

5. Conductor not smaller than 16 AWG for control circuits.

B. Wiring Methods: Provide the following wiring methods:

1. Interior Locations: Use THHN/THWN insulation in raceway.

2. Wet or Damp Interior Locations: Use RHH/RHW-2 XLP insulation in raceway

3. Exterior Locations: Use RHH/RHW-2 XLP insulation in raceway

4. Underground Locations: Use RHH/RHW-2 XLP insulation in raceway.

5. Control Circuits: Use General Purpose multi-conductor cable in raceway.

#### **1.4 SUBMITTALS**

A. Product Data: Submit for each conductor, splice and termination devices.

#### **1.5 QUALIFICATIONS**

A. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of three years experience.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

A. All materials furnished under this section shall be new, and unused.

B. Wire and Cable shall be delivered to the job in standard coils or reels with approved tags noting length, wire or cable size, insulation type and manufacturer's name.

C. All materials shall be protected from weather and damage during storage and handling at the job.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

A. Conductors shall be concentric stranded annealed uncoated copper.

B. For entire wire and cable installation, some of the following types, as noted on Drawings, shall be used:

1. THHN or THWN

2. RHH or RHW-2 or USE-2, XLP insulation

### 3. General Purpose Control Cable

- C. Wire and cable shall have permanent identification of manufacturer and classification visible on the outer jacket.
- D. Wire and cable shall be factory color-coded by integral pigmentation, with a separate color for each phase and neutral conductor. The grounding conductor shall be color-coded green.

#### 2.2 THHN or THWN

- A. Listed by UL as Type THHN or THWN per UL Standard 83.
- B. Maximum conductor temperature 90C in dry locations, 75C in wet locations in accordance with NEC.
- C. Copper single-conductor, PVC insulation and covered with nylon sheath.
- D. Insulation Voltage Rating: 600 volts.

#### 2.3 RHH or RHW-2 or USE-2, XLP INSULATION

- A. Listed by UL as Type RHH or RHW-2 or USE-2 per UL Standards 44 and 854.
- B. Maximum conductor temperature 90C in dry or wet locations (RHW-2), 90C in dry locations (RHH) in accordance with NEC.
- C. Copper single-conductor, cross-linked polyethylene insulation.
- D. Insulation Voltage Rating: 600 volts.

#### 2.4 GENERAL PURPOSE CONTROL CABLE

- A. Copper multi-conductor control cable. Polyethylene insulated individual cables with overall PVC jacket. In accordance with ICEA Pub. No. S-73-532.
- B. Maximum continuous conductor temperature 75C.
- C. Insulation Voltage Rating: 600 volts.

#### 2.5 SPLICES, TAPS AND TERMINATIONS

- A. Splices, taps and terminations shall have capacities equivalent to the conductors without overheating, be mechanically strong and enduring.
- B. All splices and joints shall be covered with an insulation equivalent to 150 percent of insulation rating of that of the conductors or with an insulating device suitable for that purpose.

- C. Splices and taps for power wiring and lighting conductors sizes No. 10 AWG and smaller shall be made by using insulated spring-type connectors of the proper size.
- D. Splices and taps for power wiring and lighting feeder conductors, sizes No. 8 AWG and larger shall be made by using compression-type connectors.
- E. Terminations of conductors shall be made using compression-type terminals.
- F. Connectors and terminals shall be made of high conductivity electrolytic copper, electro-tin plated.

## **2.6 LUBRICATION FOR CONDUCTOR INSTALLATION**

- A. Conductor pulling lubricants used to reduce the coefficient of friction between the conductor and the containing conduit shall be compatible with the materials of construction of the conductor.
- B. Lubricating oils or graphite based pulling compounds shall not be used.

## **2.7 CONDUCTOR MARKERS**

- A. Conductor markers shall be corrosion and water resistant.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Verify interior of the building has been protected from weather.
- B. Verify mechanical work likely to damage wire and cable has been completed.
- C. Verify raceway installation is complete and supported.

## **3.2 INSTALLATION**

- A. Where damage or foreign material is suspected in a conduit, completely and thoroughly swab raceway before installing the conductors.
- B. Pull conductors into raceway at same time.
- C. Cable shall be installed in accordance with manufacturer's recommendations. At no time during or after installation shall the cable be bent to a radius smaller than manufacturer's recommendation.
- D. All conductors shall be spliced or terminated only in outlets or junction boxes. No splices shall be pulled into conduit.

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- E. All cables and joints in pull and splice boxes shall be properly arranged. Each feeder or conductor group shall have a permanent tag with suitable numbers and letters for easy identification. Inscriptions shall conform to the feeder designation system as indicated on Drawings.
- F. The cut ends of the cables shall not be left with the insulation exposed to moisture. Unless splicing is to be done immediately, the ends should be properly sealed.
- G. All wires No. 10 AWG and smaller at outlet, pull and junction boxes shall extend a minimum of 6 inches for connections. Excess wire shall be provided even if wire loops through the box.
- H. All control and alarm conductors shall be installed with no splices. All required terminations shall be made on terminal strips.
- I. Wiring Connections:
  - 1. All conductor ends shall be carefully stripped of insulation to avoid nicking the metal.
  - 2. Clean conductor surfaces before installing terminals and connectors.
  - 3. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
  - 4. All conductor splices, taps, and terminations, upon completion, shall present a uniform appearance and shall be completely sealed against moisture penetration.
  - 5. Tape insulated conductors and connectors with electrical tape or heat-shrinkable products to 150 percent of insulation rating of conductor.
  - 6. Where conductors are to be connected to metallic surfaces the bare surface of the metal shall be polished before installing the connector.
- J. Color Coding:
  - 1. Wire and cable shall be color-coded as indicated on Drawings.
  - 2. For wire sizes 10 AWG and smaller, wire shall be factory coded by integral pigmentation.
  - 3. For cable sizes 8 AWG and larger, identify the cable with colored tape at terminals, splices and boxes.
  - 4. The ground conductors shall be color-coded green.

5. The neutral conductors shall be color-coded white. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

### **3.3 FIELD QUALITY CONTROL**

#### **A. Testing:**

1. Perform inspection and test listed in NETA, Section 7.3.2 (Cables: Low Voltage), Section 7.13 (Grounding System).
2. All three-phase power receptacles shall be checked with a phase-meter to assure clockwise phase rotation.
3. Test all wiring, apparatus and equipment for continuity, ground and short circuits with a megger before circuits are energized.
4. Measure the insulation resistance of all electric feeder circuits and equipment. Where the insulation is not free of grounds or short circuits, replace or repair the faulty portions of the circuit or equipment.
5. Make tests after installation and after all terminations are complete but prior to connection to any apparatus, equipment or bus work. New cables shall not have been energized at system voltage prior to acceptance testing. After completion of successful testing, energize cables at system operating voltage as promptly as possible.
6. Test all ground system as indicated on Section 26 05 26.

**END OF SECTION**



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**SECTION 26 05 33.13**

**RACEWAYS: CONDUIT SYSTEM**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes conduit and tubing
- B. Related Sections:
  - 1. Section 26 05 26 - Grounding and Bonding
  - 2. Section 26 05 33.16 - Conduit Fittings
  - 3. Section 26 05 33.29 - Outlet Boxes
  - 4. Section 26 05 33.33 - Junction Boxes, Pull Boxes and Cable Support Boxes
  - 5. Section 26 05 34 - Auxiliary Gutters

**1.2 REFERENCES**

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. UL6 - Rigid Steel Conduit.
- D. UL1242 - Intermediate Metal Conduit.
- E. ANSI/UL651 - Rigid Nonmetallic Conduit.
- F. UL1 - Flexible Metal Conduit.

**1.3 SYSTEM DESCRIPTION**

- A. Provide conduit system as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. For entire conduit system installation, some of the following types, as noted on Drawings shall be used:
  - 1. Galvanized Rigid Steel Conduit
  - 2. Electrical Metallic Tubing (EMT).
  - 3. Intermediate Metal Conduit (IMC).
  - 4. Plastic Coated Rigid Steel Conduit.

5. All Plastic Polyvinyl Chloride Conduit (PVC).
  6. Flexible Metal Conduit.
  7. Liquid Tight Flexible Metal Conduit.
- C. Unless otherwise indicated on Drawings the following types of conduit shall be provided:
1. Underground: Galvanized Rigid Steel Conduit or Rigid Plastic Polyvinyl Chloride Conduit. Conduit shall be encased in at least 3 inches of concrete on all sides.
  2. Concrete Slab on Grade: Galvanized Rigid Steel Conduit or Rigid Plastic Polyvinyl Chloride Conduit. Conduit shall be encased in at least 3 inches of concrete on all sides.
  3. Concrete Slab above Grade: Galvanized Rigid Steel Conduit, Electrical Metallic Tubing or Intermediate Metal Conduit.
  4. Outdoor Locations: Galvanized Rigid Steel Conduit.
  5. Wet and Damp Locations: Plastic Coated Rigid Steel Conduit or Rigid Plastic Polyvinyl Chloride Conduit.
  6. Concealed Dry Locations: Galvanized Rigid Steel Conduit, Electrical Metallic Tubing or Intermediate Metal Conduit.
  7. Exposed Dry Locations: Galvanized Rigid Steel Conduit or Intermediate Metal Conduit.
  8. Hazardous Areas: Galvanized Rigid Steel Conduit.
- D. Unless otherwise indicated on Drawings the following type of flexible conduits shall be provided for the final connection of the equipment:
1. Luminaries or similar equipment: Flexible Metallic Conduit
  2. Motors, Transformers or other services where the equipment has to be moved within narrow limits or where vibration is presented: Liquid Tight Flexible Metal Conduit.
  3. Hazardous locations: Explosion Proof Flexible Metal Conduit. Provide explosion proof fittings as recommended by their manufacturer.
  4. Locations where water or other liquids or vapors might contact the conduits: Liquid Tight Flexible Conduit. Provide watertight fittings as recommended by their manufacturer.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit data for each type of conduit used in the Project.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Record actual routing of conduits larger than 1-1/2 inch trade size.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC conduit from sunlight.

## **PART 2 - PRODUCTS**

### **2.1 METAL CONDUIT**

- A. Rigid Steel Conduit shall be hot-dipped galvanized and shall meet the requirements of ANSI Standard C80.1.
- B. Intermediate Metal Conduit (IMC) shall be hot-dipped galvanized steel and shall meet the requirements of UL Standard UL1242.

### **2.2 PVC COATED METAL CONDUIT**

- A. Plastic Coated Rigid Steel Conduit shall be hot-dipped galvanized steel with 40 mil nominal PVC bonded coating and shall meet the requirements of UL Standard for rigid metallic conduit prior to coating.

### **2.3 ELECTRICAL METALLIC TUBING**

- A. Electrical Metallic Tubing (EMT) shall be hot-dipped or electro-galvanized steel and shall meet the requirements of ANSI Standard C80.3 for Electrical Metallic Tubing.

### **2.4 NONMETALLIC CONDUIT**

- A. Nonmetallic Conduit shall be rigid and shall meet the requirements of ANSI/UL651 Standard for Rigid Nonmetallic Conduit. The schedule of the conduit shall be as indicated on Drawings.

### **2.5 FLEXIBLE METAL CONDUIT**

- A. Flexible Metal Conduit for general purpose areas shall be hot-dipped galvanized steel, and shall meet the requirements of UL1 Standard for Flexible Metal Conduit.
- B. Flexible Metal Conduit for hazardous areas shall have steel or bronze end fittings, bronze flexible core with bronze braid covering, and shall be rated for the area classification and in accordance with UL866 Standard covering flexible conduit for use in hazardous areas.

## **2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT**

- A. Liquidtight Flexible Metal Conduit shall have a flexible galvanized steel core covered with a smooth, abrasion-resistant, liquid tight, polyvinyl chloride cover, and shall meet the requirements of UL-1 Standard for Flexible Conduit.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify outlet locations and routing and termination locations of raceway prior to rough in.
- B. Coordinate the work with that of other trades to ensure that items such as junction boxes, cabinets, etc., are true and level with finished floor.
- C. No electrical work shall be installed in areas where the work of other trades might cause physical damage to wires, conduit, equipment, boxes or fittings until the work of the other trades has been completed.

### **3.2 INSTALLATION**

- A. Conduit ends shall be cut square and reamed to remove burrs and sharp edges.
- B. Threaded joints shall connect heavy wall conduit. Field threads shall be of the same type and have same effective length as factory cut threads. All threads shall be coated at time of assembly with thread compound.
- C. Conduit joints shall be made with approved couplings or unions. Running threads shall not be used on conduit for connection of couplings.
- D. Bends and offsets in conduit up to  $\frac{3}{4}$  inch may be made at site provided they are made with an approved hickey or conduit bending machine. In the case of 1 inch or larger conduit, elbows and offsets made by the manufacturer shall be used unless the Contractor is authorized to make them at the site, using a properly designed conduit bending machine that will not deform, crush nor injure the conduit. The inside and outside of all bends and offsets shall be smooth and free from irregularities. Minimum radius of bends shall be as required by National Electrical Code.
- E. For sharp bends on exposed rigid conduit, conduit bodies may be used. Conduit bodies shall be installed with the cover opening in the vertical plane or downward in the horizontal plane.
- F. All conduit terminations at panels and cabinets shall be made so that conduit enters perpendicular to corresponding side and, if

necessary, a drilling template is to be constructed to assure proper positioning.

- G. Exercise all necessary precautions to prevent the lodgment of dirt, plaster or trash in conduits. Cap spare conduits to exclude dirt and foreign matter. A run of conduit which has become clogged shall be entirely freed of these accumulations or shall be replaced.
- H. Concealed conduit shall be run in a direct line with long sweep bends and offsets.
- I. Exposed conduit shall be run in a neat workmanlike manner at right angles and parallel to building lines. Parallel conduits shall be run straight and true with uniform and symmetrical offsets.
- J. Conduit shall not be installed behind ladder rungs or platform levels in such a manner as may cause a false or insecure step.
- K. Conduit shall be located to avoid boilers, hot pipelines or other places of high ambient temperatures. Conduit shall not be installed closer than twelve inches parallel to these hot surfaces.
- L. In wet locations conduit shall be mounted so that there is at least  $\frac{1}{4}$  inch air space between the conduit and the wall or other supporting surface.
- M. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- N. Where practicable, group conduit runs together and support using conduit rack.
- O. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
- P. Do not attach raceway to ceiling support wires or other piping systems.
- Q. For conduits being installed in concrete slabs, the following requirements shall apply:
  - 1. Outside diameters of the conduit shall not exceed one third of the slab thickness.
  - 2. Avoid crossing the conduits wherever practicable.
  - 3. Make the couplings and connections watertight. Compounds used on their threads shall be of the conductive type to insure low resistance grounding continuity through the conduits.

4. Install the conduit approximately at the center of the slab thickness so the conduits will have not less than  $\frac{3}{4}$  inch of concrete around them.
  5. Provide clear spaces between the conduits, not less than six times their outside diameters, except at conduit crossings.
- R. For conduits, which project or extend through the roof membrane, install roof pitch pockets in a manner, which is compatible with the particular type of roofing material and installation in accordance with manufacturer recommendations.
- S. When required provide the following conduit fittings:
1. Whenever conduits cross the expansion joints use approved expansion fittings.
  2. Whenever conduits cross fire-rated walls and floors use approved fire-seal fittings in order to maintain the original fire-rating.
  3. Whenever conduits pass through concrete foundation or a structure below grade or below ground water level or at entry points through an exterior wall use an approved seal fitting assuring watertight installation.
- T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- U. Provide markers for all spare conduits. Install markers at the point of origin and at the point of termination or each spare conduit. The markers at the origin of the conduit shall indicate the termination of the conduit such as column line, panel, motor control center, etc.
- V. Terminate all spare raceways a minimum of 6 inches above the finished floor or slab except inside switchboard. Inside switchboard or other equipment, turn up conduits a minimum of a standard elbow length and terminate in a coupling the top of which is flush with the concrete floor. Insert a pipe plug into the coupling to prevent the entrance of dirt into conduit.
- W. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.
- X. For nonmetallic conduit the following requirements shall apply:
1. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes.
  2. Only elbows made by the manufacturer shall be used in nonmetallic conduit.

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3. A ground conductor shall be run in nonmetallic conduits.

**END OF  
SECTION**



**SECTION 26 05 33.16**

**RACEWAYS: CONDUIT FITTINGS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes all necessary fittings for the conduit system.
- B. Related Sections:
  - 1. Section 26 05 26 - Grounding and Bonding
  - 2. Section 26 05 33.13 - Conduit system
  - 3. Section 26 05 33.29 - Outlet Boxes
  - 4. Section 26 05 33.33 - Junction Boxes, Pull Boxes and Cable Support Boxes
  - 5. Section 26 05 34 - Auxiliary Gutters

**1.2 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. NEC - National Electrical Code
  - 2. OSHA - Occupational Safety & Health Act.
  - 3. UL - Underwriters Laboratories
  - 4. ANSI - American National Standards
  - 5. NEMA - National Electric Manufacturers Association

**1.3 SYSTEM DESCRIPTION**

- A. Provide fittings for the following types of conduits as indicated on Drawings:
  - 1. Rigid Steel Conduit
  - 2. Electrical Metallic Tubing (EMT)
  - 3. Intermediate Metal Conduit (IMC)
  - 4. Plastic Coated Rigid Steel Conduit.
  - 5. All Plastic Polyvinyl Chloride Conduit (PVC).
  - 6. Flexible Metal Conduit.
  - 7. Liquid Tight Flexible Metal Conduit.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit data for each of the fittings used in the Project.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. All materials furnished under this section shall be new, unused and delivered in original manufacturer's packaging.
- B. All materials shall be labeled and identified for intended application.
- C. All materials shall be protected from damage at all times and stored in staging areas.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Fittings include all accessories to the conduit system such as, but not limited to, conduit hubs, expansion couplings, conduit couplings, conduit connectors, locknuts and bushings.

#### **2.2 BUSHINGS**

- A. Provide threaded type bushings where conduit enters a box, pull box, cabinet or auxiliary gutter. The bushing shall be of insulated type where raceways containing ungrounded conductor No. 4 AWG or larger enter a box, pull box, junction box, cabinet or auxiliary gutter.

#### **2.3 LOCKNUTS**

- A. Conduit locknuts shall be made of punched steel or malleable iron, galvanized or cadmium plated, tapped in accordance with American Standard for conduit threads. Minimum thickness shall be such that the locknut will have approximately one and one half-full threads.

#### **2.4 RIGID CONDUIT UNIONS**

- A. Rigid conduit unions shall be of steel or malleable iron, plated or galvanized.

#### **2.5 ELECTRICAL METALLIC TUBING COUPLINGS**

- A. EMT couplings shall be of compression type, rain and concrete tight. They shall be made of formed steel or malleable iron with galvanized or cadmium finish and equipped with a steel gripping ring.

## **2.6 ELECTRICAL METALLIC TUBING CONNECTORS**

- A. EMT connectors shall be of compression type, rain and concrete tight, with nylon insulated throat. They shall be made of formed steel or malleable iron with galvanized or cadmium finishes and equipped with a steel gripping ring.

## **2.7 RIGID PLASTIC POLYVINYL CHLORIDE COUPLINGS**

- A. PVC couplings shall be produced by the same manufacturer of the conduit and shall be tested in accordance with the testing requirements defined in NEMA TC-3 and UL-514.

## **2.8 RIGID PLASTIC POLYVINYL CHLORIDE CONNECTORS**

- A. PVC connectors shall be produced by the same manufacturer of the conduit and shall be tested in accordance with the testing requirements defined in NEMA TC-3 and UL-514.

## **2.9 FLEXIBLE METAL CONDUIT CONNECTORS**

- A. Flexible metal conduit connectors shall be steel or malleable iron, galvanized or cadmium plated, and equipped for squeeze or clamp slipproof positive grip means for fastening the flexible conduit. They shall be tested in accordance with the testing requirements defined in NEMA FB-1.

## **2.10 LIQUID TIGHT FLEXIBLE METAL CONDUIT CONNECTORS**

- A. Connectors for liquid tight flexible conduit shall be watertight construction with bodies made of malleable iron or steel, galvanized or cadmium finish, and shall be listed by UL for use in wet areas. They shall be tested in accordance with the testing requirement defined in NEMA FB-1.

## **2.11 COMBINATION COUPLINGS FLEXIBLE LIQUID TIGHT CONDUIT TO RIGID CONDUIT.**

- A. The combination coupling shall be suitable for connecting rigid conduit directly to flexible liquid tight conduit without any intermediate fitting, such as an ordinary conduit coupling.
- B. Combination coupling shall be watertight construction with bodies made of malleable iron, cadmium plated. The coupling shall be female threaded on one end for screwing directly on rigid threaded conduit, and equipped on the other end with grounding bushing, molded compression sealing ring and gland nut, for fastening and holding the flexible conduit in the coupling.

## **2.12 SEALING FITTINGS**

- A. Sealing fittings shall be of the malleable iron type with cadmium finish.

### **2.13 FIRE-SEAL FITTINGS**

- A. Fire-Seal Fitting shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit passes.

### **2.14 WATER-TIGHT SEAL FITTINGS**

- A. Thruwall and Floor Water-Tight Seal Fitting shall provide a positive means of sealing conduits where they pass through a concrete foundation of a structure below grade or below ground water level or at entry points through a concrete wall. They shall be labeled and identified for this application.

### **2.15 EXPANSION FITTINGS**

- A. Expansion fitting shall consist of an expansion head and body together with necessary weatherproof packing and retainer fittings. Both the head and body shall be hot dipped galvanized malleable iron.

### **2.16 CONDUIT BODIES**

- A. Conduit Bodies shall be protected both inside and outside (except at threaded joints) by suitable coatings, such as zinc or cadmium, to provide a high degree of corrosion protection.
- B. Cast alloy covers equipped with stainless steel screws shall be used for outdoor installations or in highly corrosive locations.
- C. Neoprene rubber gaskets shall be used between the conduit bodies and covers, outdoors and in damp, wet, and corrosive locations.
- D. Where Plastic Coated Rigid Steel Conduit is used conduit bodies shall be furnished with an outside surface coating of high molecular weight, polyethylene polyvinyl chloride (PVC) plastic. The minimum thickness for the coating shall be 40 mils. Cover screws shall be stainless steel.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Connectors and couplings:
  - 1. Rigid metal conduit joints shall be made with approved couplings or unions. Running threads shall not be used on conduit for connection at couplings.
  - 2. Rigid metal conduit terminals at boxes and cabinets shall be rigidly secured with double locknut and bushing, in a manner that the system will be electrically continuous.

3. All metal conduits entering an enclosure having concentric or eccentric knockouts shall be bonded to the enclosure with grounding bushings.

B. Sealing Fittings:

1. The installation of sealing fittings shall conform to the requirements of Section 501-5 of the National Electrical Code.
2. No splices shall be permitted in sealing fittings.
3. Sealing fittings shall be installed with their openings and covers accessible and properly located for applying the sealing compound.
4. Sealing fitting plugs shall not be installed for 24 hours after pouring sealing compound.
5. Vertical sealing fittings shall not be accepted in horizontal conduit runs.

C. Drain Fittings:

1. Drain fittings shall be provided to minimize the accumulation of moisture at low points where raceways and equipment enclosures are installed in humid atmospheres, wet locations or where they are subject to periods of different temperatures.
2. Drain fittings shall be provided to minimize the effect of condensation in locations where moisture or water can penetrate to the interior of raceways and equipment enclosures.
3. Drain fittings shall be provided where water accumulation is probable. In vertical raceway runs the drain fitting shall provide continuous draining. In horizontal raceway runs, the conduit shall be sloped towards the enclosure provided with a drain fitting (minimum slope  $\frac{1}{2}$  inch per 10 feet).
4. Where seal and drain fittings are installed, seals shall be placed in such a manner that they will not interfere with the natural flow of the condensate in the conduits toward the drain fittings.

D. Fire-Seal Fittings;

1. Openings through floors and walls in which conduit pass shall be sealed by fire stop fittings.
2. The fittings shall be installed in accordance with the manufacturer's recommendations in order to maintain the original fire-rating of the floor or wall.

E. Water-Tight Seal Fittings:

1. Whenever conduits pass through a concrete foundation or a structure below grade or below ground water level or at entry points through an exterior wall use an approved seal fitting assuring watertight installation.
2. The fittings shall be installed in accordance with the manufacturer's recommendations.

F. Expansion Joints:

1. Expansion joints with ground jumper shall be provided where required by structural conditions.
2. Expansion joints with ground jumper shall be provided in long runs of metallic raceways in locations, which are subject to temperature differentials.
3. The straight run shall be fixed permanently to its supporting member at the approximate center between expansion joints, with other points supported in such a manner that longitudinal expansion is not resisted. Supports must be provided within 2 feet on both sides of any expansion joint.
4. Expansion joint for rigid plastic conduit shall be provided where required to compensate for thermal expansion and contraction.

G. Conduit Bodies:

1. No splices shall be permitted in conduit bodies.
2. Conduit bodies shall be installed with their openings and covers accessible. Conduit bodies shall be installed with the cover opening in the vertical plane or downward in the horizontal plane.

H. Supports:

1. Exposed conduits shall be securely fastened in place, and hangers, supports of fastening shall be provided at each elbow and at the end of each straight run terminating at a box, cabinet or fitting.
2. The spacing of supports shall be as indicated on Drawings. When not specified, maximum support spacing shall be as follows:
  - a. Rigid Metal Conduit:
    - 1) 1 inch and smaller 7 feet
    - 2) 1-1/4 inch and over 10 feet

- b. Electric Metallic Tubing:
  - 1) 1 inch and smaller 4 feet
  - 2) 1-1/4 inch and over 10 feet
- c. Rigid Plastic Conduit
  - 1) 2 inch and smaller 4 feet
  - 2) 2-1/2 and over 6 feet
- 3. Horizontal conduits supporting pendant luminaries shall have conduit clamps as near to the fixture as possible.
- 4. Horizontal and vertical conduit runs may be supported by one-hole pipe straps with clamp-backs, or other approved devices with suitable bolts, expansion shields or beam clamps for mounting to building structure or special brackets..
- 5. Supporting devices shall not be affixed directly to a metal roof deck. Equipment and appurtenances, including conduit, shall be installed with sufficient clearance below the metal roof deck to prevent damage from screws or other fasteners, which may be used in future roof repairs or replacements.
- 6. For solid masonry or reinforced concrete structure:
  - a. Install expansion anchors and bolts or approved power-set fasteners.
  - b. Expansion anchors shall not be less than 1/4 inch diameter and shall extend not less than 2 inches into concrete or masonry.
  - c. Power-set fasteners shall not be less than 1/4 inch diameter and shall extend not less than 1 1/4 inch into the concrete..
- 7. Special hanger assemblies, as specified on drawings, shall be used to support groups of parallel conduits. Hangers shall be made of durable materials suitable for the applications involved. Where excessive conditions are encountered, hanger assemblies shall be protected after fabrication by galvanizing, special paint or other suitable preservative methods.
- 8. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and wires.
- 9. In wet locations, all supports, bolts, straps, screws, etc. shall be of corrosion resistant materials or protected against corrosion by approved corrosion resistant materials.

10. In an insulated structure, the conduit supports shall be installed prior to the insulating material and with such a length as to prevent the conduit from becoming imbedded in the insulation.
11. When flexible metal conduit is installed it shall be secured by approved means at intervals not exceeding 3 feet and within 12 inches on each side of every outlet box or fitting, except for lengths of not over 16 inches at terminals where flexibility is necessary.

**END OF  
SECTION**



## **SECTION 26 05 33.19**

### **RACEWAYS: WIREWAYS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes wireways
- B. Related Sections:
  - 1. Section 26 05 24 - Auxiliary Gutters

##### **1.2 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. NEC - National Electrical Code
  - 2. OSHA - Occupational Safety and Health Act.
  - 3. UL - Underwriters Laboratories
  - 4. ANSI - American National Standards Institute
  - 5. NEMA - National Electric Manufacturers Association

##### **1.3 SYSTEM DESCRIPTION**

- A. Provide Wireways in which conductors are laid in place after the wireway has been installed as a complete system.

##### **1.4 SUBMITTALS**

- A. Product Data: Submit data for each type of Wireway used in the Project.

##### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. All materials furnished under this section shall be new, unused and delivered in original manufacturer's packaging.
- B. All materials shall be labeled and identified for intended application.
- C. All materials shall be protected from damage at all times and stored in staging areas.

#### **PART 2 - PRODUCTS**

##### **2.1 GENERAL**

- A. Wireway System shall be provided where indicated on Drawings. The system will include straight sections, elbows, T fittings, X

fittings, and couplings as required providing a complete system. Every component shall be constructed in accordance with Underwriters' Laboratories Standards UL 870.

- B. The components of the Wireway System shall be constructed and installed to ensure adequate electrical and mechanical continuity of the complete system.
- C. Wireway shall be of sufficient size to accommodate feeder conduits and cables and provide ample room for installing the conductors.
- D. Wireway shall not contain more than 30 current-carrying conductors at any cross section. The sum of the cross-sectional areas of all contained conductors shall not exceed 20 percent of the interior cross-sectional area of the wireway.
- E. Where more than 30 conductors are installed the derating factors specified in the National Electrical Code shall be applied to the current-carrying conductors.
- F. For entire Wireway System installation, some of the following types, as noted on Drawings, shall be used.
  - 1. General Purpose Nema Type 1 for interior locations.
  - 2. Raintight Nema Type 3R for exterior locations.
  - 3. Oiltight Nema Type 12 for interior locations where a degree of protection against dust, falling dirt and dripping water is required
  - 4. Stainless Steel Nema 4X for corrosive atmospheres in interior and exterior locations.
- G. Wireways shall not have openings except those through which conduits pass.
- H. Wireway shall be suitable for lay-in conductors. Connector cover shall be permanently attached to permit that the conductors are laid in place after the wireway has been installed as a complete system.

## **2.2 GENERAL PURPOSE NEMA TYPE 1 WIREWAY**

- A. Wireway shall be constructed with or without knockouts as indicated on Drawings.
- B. As indicated on Drawings Wireway finish shall be:
  - 1. Galvanized Sheet Steel
  - 2. Sheet Steel provided with a rust inhibiting coating and baked enamel finish.

- C. The thickness of the sheet steel shall not be less than the following:

<u>Maximum Width of the Widest Surface</u>	<u>USS Gauge</u>
Not over 6 inches	No. 16
Over 6 inches and not over 12 inches	No. 14

- D. Wireway shall have full-access screw cover mounted with corrosion resistant screws, or hinged cover. All screws installed toward the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.

### 2.3 RAIN-TIGHT NEMA TYPE 3 WIREWAY

- A. Wireway shall be of galvanized sheet steel. The thickness of the sheet steel shall not be less than the following:

<u>Maximum Width of the Widest Surface</u>	<u>USS Gauge</u>
Not over 6 inches	No. 16
Over 6 inches and not over 12 inches	No. 14

- B. Wireway shall have gasketed full-access screw cover mounted with corrosion resistant screws. All screws installed toward the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.

- C. Wireway shall have conduit hubs or equivalent provision to exclude water at the conduit entrance.

### 2.4 OIL-TIGHT

- A. Wireway shall be constructed with or without knockouts as indicated on Drawings.

- B. Wireway shall be constructed of 14-gauge steel. All metal parts shall be provided with rust inhibiting phosphatizing coating and a baked finish.

- C. Wireway shall have hinged covers with gaskets all around. Covers shall be held closed with external screw clamps or quick release latches.

- D. Oil resistant gaskets shall be provided in each joint to assure oil tight seal when lengths are joined.

- E. All straight sections and fittings shall be completely open on one side, so conductors can be laid in along an entire wireway run.
- F. Wireway joint connections shall be made with corrosion resistant screws.

## **2.5 STAINLESS STEEL TYPE 4X WIREWAY**

- A. Wireway shall be constructed of Type 304 stainless steel. 16 gauge shall be used in the covers and bodies and 10 gauge in the flanges.
- B. Wireway shall have hinged covers with gaskets all around. Covers shall be closed with external screw clamps to assure complete seal between covers and bodies.
- C. Oil resistant gaskets shall be provided in each joint to assure oil tight seal when sections and fittings are bolted together. Wireway joint connections shall be made with stainless steel screws.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify wireway locations and routing and termination of raceways prior to rough in.
- B. Coordinate the work with that of other trades to ensure that the wireways are true and level with finished ceiling, wall or floor.
- C. No electrical work shall be installed in areas where the work of other trades might cause physical damage to conductors, equipment, wireway or fittings until the work of the other trades has been completed.

### **3.2 INSTALLATION**

- A. Wireways shall be supported from the building structure. Provide supports as follows:
  - 1. Horizontal Support: At each end of the horizontal run and at each joint, and other points to maintain spacing between supports of 10 feet maximum.
  - 2. Vertical Support: At intervals not exceeding 15 feet. There shall be not more than one joint between supports.
- B. Wireways shall not be installed in concealed spaces.
- C. Where the wireway passes transversely through walls, the length passing through the wall shall be unbroken and access to the conductors shall be maintained on both sides of the wall.

### **3.3 CLEANING**

- A. Clean interior of wireways to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

**END OF  
SECTION**

**SECTION 26 05 33.33**

**RACEWAYS: JUNCTION, PULL AND CABLE SUPPORT BOXES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section includes Junction, Pull and Cable Support Boxes.

B. Related Sections:

1. Section 26 05 33.13 - Conduit System

**1.2 REFERENCES**

A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:

1. NEC - National Electrical Code
2. OSHA - Occupational Safety and Health Act
3. UL - Underwriters Laboratories
4. ANSI - American National Standards Institute
5. NEMA - National Electric Manufacturers Association

**1.3 SYSTEM DESCRIPTION**

A. Provide Junction Boxes, Pull Boxes and Cable Support Boxes as indicated on Drawings. Boxes are shown in approximate locations unless dimensioned.

**1.4 SUBMITTALS**

A. Product Data: Submit data for each type of box used in the Project.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. All materials furnished under this section shall be new, unused and delivered in original manufacturer's packaging.
- B. All materials shall be labeled and identified for intended application.
- C. All materials shall be protected from damage at all times and stored in staging areas.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Minimum size of boxes shall be as required by the National Electrical Code for the number of conduits and conductors entering and leaving it. Where intermediate cable supports are necessary because of box dimensions, insulated, removable cross brackets to support the conductors shall be provided.
- B. Where indicated on Drawings, vertical cable support boxes shall be provided. Boxes shall be large enough to accommodate the feeder conduits indicated and provide ample space to install cable supports.
- C. Where indicated on Drawings, boxes are to be equipped with steel barriers to separate the feeder circuits.
- D. Partitions shall be installed in all multipurpose pull boxes for isolating conductors of different systems.
- E. Boxes shall not have openings except those through which conduits pass.
- F. Unless otherwise indicated on Drawings the following types of boxes shall be provided:
  - 1. Interior locations: Galvanized Sheet Steel
  - 2. Outdoor locations: Galvanized Sheet Steel, Nema 3R raintight construction or Cast Metal type, as specified on Drawings.
  - 3. Wet and Damp Locations: Cast Metal type.
  - 4. Corrosive atmospheres: Type 4X Stainless Steel or Cast Metal type.
  - 5. Hazardous Areas: Cast Metal type suitable for use in the area in accordance with the classification of the area.

### **2.2 GALVANIZED SHEET STEEL BOXES**

- A. Except as otherwise indicated on Drawings boxes shall be:
  - 1. Nema Type 1 for indoor installation.
  - 2. Nema Type 3R for outdoor installation or indoor installation that needs protection for dripping water.
- B. Type 1 boxes shall have full-access screw covers mounted with corrosion resistant screws, or hinged doors, as indicated on Drawings. All flanges shall overlap at least  $\frac{1}{2}$  inch. A cover attached to a box for flush mounting shall extend at least 1-inch beyond each of the outer walls of the box proper.

- C. Type 3R boxes shall have gasketed full-access screw covers mounted with corrosion resistant screws, or gasketed hinged doors, as indicated on Drawings. Boxes shall have conduit hubs or equivalent provision to exclude water at the conduit entrance. Galvanized steel shall be painted for a double layer of corrosion protection.
- D. For boxes not over 100 cubic inches in size, the metal shall not be less than No. 14 USS gauge.
- E. For boxes over 100 cubic inches in size, the metal shall be not less than the following:

<u>Where no Surface Area Exceeds</u>	<u>Where no Single Dimension Exceeds</u>	<u>USS Gauge</u>
1000 square inches	40 inches	No. 14
1500 square inches	60 inches	No. 12
Over 1500 square inches	Over 60 inches	No. 10

### 2.3 STAINLESS STEEL BOXES

- A. Except as otherwise indicated on Drawings boxes shall be:
1. Nema Type 4X for corrosive atmospheres at indoor locations
  2. Nema Type 4X for corrosive atmospheres at outdoor locations
- B. Boxes shall have gasketed full-access screw covers mounted with stainless steel screws, or gasketed hinged doors, as indicated on Drawings. All flanges shall overlap at least  $\frac{1}{2}$  inch.
- C. For boxes not over 100 cubic inches in size, the metal shall not be less than No. 16 USS gauge.
- D. For boxes over 100 cubic inches in size, the metal shall be not less than the following:

<u>Where no Surface Area Exceeds</u>	<u>Where no Single Dimension Exceeds</u>	<u>USS Gauge</u>
900 square inches	36 inches	No. 16
2200 square inches	60 inches	No. 14
Over 2200 square inches	Over 60 inches	No. 12

### 2.4 CAST METAL BOXES

- A. In wet and damp location boxes shall have threaded hubs for conduit connections and shall be provided with neoprene gasketed covers.



- B. In hazardous areas, boxes shall be approved for the type of hazard determined in accordance with the National Electrical Code classification. At least five full threads shall be engaged on all conduit connections to box hubs.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify box locations and routing and termination of raceways prior to rough in.
- B. Coordinate the work with that of other trades to ensure that the outlet boxes are true and level with finished ceiling, wall or floor.
- C. No electrical work shall be installed in areas where the work of other trades might cause physical damage to wires, conduit, equipment, boxes or fittings until the work of the other trades has been completed.

#### **3.2 INSTALLATION**

- A. Boxes shall be securely mounted to the building structure with supporting facilities independent of the conduit entering or leaving the boxes.
- B. The mounting holes on boxes shall be of sufficient size to permit a certain amount of adjustment. If the mounting holes become too large for the screw or bolt head, properly sized washers must be used.
- C. Large boxes shall be provided with additional support. Structural leg supports from the box to the building structure or wall will be required.
- D. In long vertical runs, conductors shall be supported in pull boxes at maximum spaces as follows:

<u>Conductor Size</u>	<u>Copper</u>	<u>Aluminum</u>
1/0 or smaller	100 feet	200 feet
2/0 to 4/0	80 feet	180 feet
250 MCM to 350 MCM	60 feet	135 feet
To 500 MCM	50 feet	120 feet
To 750 MCM	40 feet	95 feet
Over 750 MCM	35 feet	85 feet

- E. Where any dimension of a Junction or Pull Box exceeds 6 feet, provisions shall be made for racking or otherwise supporting all conductors in the box.
- F. Where several feeders pass through a common pull box fireproof tags or other approved method shall identify them.
- G. Conductors of light and power systems of 600 volts or less may be installed in the same enclosure, providing only that all conductors in the enclosure are insulated for the maximum voltage of any system within the enclosure.
- H. Pull, Junction and Cable Support Boxes shall be permanently accessible. Conductors inside the box must be accessible without removing wall covering, plaster, or any other parts of the building, except those which are designed for ready removal and replacement such as removable ceiling panels, access panels, etc.

### **3.3 CLEANING**

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

**END OF  
SECTION**

**SECTION 26 05 33.29**

**RACEWAYS: OUTLET BOXES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes outlet boxes
- B. Related Sections:
  - 1. Section 26 05 33.13 - Conduit System
  - 2. Section 26 05 33.16 - Conduit Fittings

**1.2 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. NEC - National Electric Code
  - 2. OSHA - Occupational Safety & Health Act
  - 3. UL - Underwriters Laboratories
  - 4. ANSI - American National Standards Institute
  - 5. NEMA - National Electric Manufacturers Association.

**1.3 SYSTEM DESCRIPTION**

- A. Provide outlet boxes as indicated on Drawings. Outlet boxes are shown in approximate locations unless dimensioned.

**1.4 SUBMITTALS**

- A. Product Data: Submit data for each type of outlet box used in the Project.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. All materials furnished under this section shall be new, unused and delivered in original manufacturer's packaging.
- B. All materials shall be labeled and identified for intended application.
- C. All materials shall be protected from damage at all times and stored in staging areas.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. The box for each type of outlet shall be as specified in the Outlet Schedule on Drawings.
- B. Boxes shall be furnished drilled and tapped to receive a grounding screw.

### **2.2 WALL AND CEILING BOXES**

- A. Wall and ceiling boxes shall be standard square or octagonal galvanized stamped steel boxes, at least 4 inches wide and 1-½ inches deep. Each box shall be of sufficient size to provide free space for all conductors enclosed in the box and accommodate the specified conduits and wiring device or devices indicated on the Drawings.
- B. All boxes shall have plaster covers to bring openings flush with finished wall or not more than ¼ inch under wall surface.
- C. Install 3/8-inch fixture stud in lighting fixture outlet boxes as may be required.

### **2.3 BOXES IN CONCRETE SLAB**

- A. Outlet boxes installed in concrete slab shall be standard (4 inches octagonal) deep concrete rings with appropriate covers. Install concrete rings so those conduits entering sides of boxes can clear steel reinforcing rods.
- B. Install 3/8-inch fixture stud in lighting fixture outlet boxes as may be required.

### **2.4 BOXES IN EXPOSED INSTALLATION**

- A. Outlet boxes in exposed installations and when specified on Drawings shall be of the cast-metal type with threaded openings or threaded hubs.

### **2.5 BOXES IN WET AND DAMP LOCATIONS**

- A. Outlet boxes exposed to weather or in damp locations shall be of the cast-metal type with threaded hubs for conduit connections and with neoprene gasketed covers and stainless steel cover screws.

### **2.6 BOXES IN HAZARDOUS AREAS**

- A. In hazardous areas, boxes shall be approved for the type of hazard determined in accordance with the National Electrical Code classification. At least five full threads shall be engaged on all conduit connections to box hubs.

## **2.7 FLOOR BOXES**

- A. Unless otherwise indicated on Drawings, boxes for floor outlets shall be of cast-metal, threaded conduit entrance, waterproof type with means for adjusting cover plate to finished floor level. Boxes shall have an approved gasket or seal between the adjusting ring and box. Cover plates shall be of heavy brass with permanent ring and box.
- B. When a Poke-Thru System is indicated on Drawings, provide devices UL listed and classified for this type of installation in order to meet the requirements for fire classification for up to four hour floor slabs. These devices shall be installed in accordance with the manufacturer's recommendations. Provide flush or pedestal type of service box as indicated on Drawings.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify outlet locations and routing and termination location of raceways prior to rough in.
- B. Coordinate the work with that of other trades to ensure that the outlet boxes are true and level with finished ceiling, wall or floor.
- C. No electrical work shall be installed in areas where the work of other trades might cause physical damage to wires, conduit, equipment, boxes or fittings until the work of the other trades has been completed.

### **3.2 INSTALLATION**

- A. Outlets shall be located in the locations shown on the drawings. Outlet boxes shall be located so that when fixtures or other fittings are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment.
- B. The height of the outlet boxes above finished floor level shall be as indicated on Drawings.
- C. Wall lighting outlets shall be located centered in columns or in wall above doors when installed in these locations.
- D. Clock outlets and/or exit light outlets over doors shall be installed at a height, which will center the clock or exit light between top of door trim and ceiling.
- E. Wall switch outlets, when located near doors, shall be installed on the lock side of the door and at a maximum distance of 6 inches from door trim.

- F. Wall outlets shall be installed with edges plumb and level. Locate wall outlets of same type at same level in each room, except where otherwise indicated.
- G. Wall outlets of different types (receptacles, telephone, data, etc.) that are indicated in the same location and at the same height shall be located at a maximum distance of 6 inches between center of outlets, except where otherwise indicated.
- H. Where rows of ceiling outlets occur, align them carefully.
- I. Open knockouts in outlet boxes only if required for inserting conduit. Seal unused openings as approved.
- J. Boxes shall be fastened in place to prevent movement during concrete pour.
- K. Boxes located in partitions such as gypsum board, metal, lath and plaster, or any other similar partition shall be adequately supported using approved devices.
- L. The opening in outlet boxes shall be closed during the plastering and/or concrete pour of structures with plain paper or clip-on blank metal plates. The use of newspaper will not be permitted.

### **3.3 CLEANING**

- A. Clean interior of boxes to remove dust, debris and other material.

**END OF SECTION**

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Puerto Rico Industrial Development Company

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New Parking Area Construction Works  
Aguadilla, Puerto Rico

## **SECTION 26 05 43**

### **UNDERGROUND DUCT SYSTEM**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes underground duct construction for electrical distribution systems.

##### **1.2 RELATED SECTIONS**

- A. Section 26 05 26 - Grounding and Bonding

##### **1.3 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. NEC - National Electrical Code
  - 2. OSHA - Occupational Safety & Health Act
  - 3. UL - Underwriters Laboratories
  - 4. ANSI - American National Standards
  - 5. ASTM - American Society for Testing and Materials.
  - 6. NEMA - National Electric Manufacturers Association
  - 7. PREPA - Puerto Rico Electrical Power Authority
  - 8. PRHA - Puerto Rico Highway Authority

##### **1.4 SYSTEM DESCRIPTION**

- A. Provide all labor and materials to complete trenching, duct system, manholes, concrete encasement when required, backfilling, and pavement repair for the construction of electrical distribution system as indicated on drawings.
- B. As indicated on Drawings the duct installation for the electrical distribution system shall be of the following types:
  - 1. Conduit installation with concrete encasement.
  - 2. Conduit installation without concrete encasement.

##### **1.5 SUBMITTALS**

- A. Product Data: Submit data for each type of conduit, pre-fabricated manholes, conduit spacers, marking tape and accessories used in the Project.



**1.6 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Furnish one set of marked copies of contract drawings, showing exact routing and depths of all underground conduits, manholes, pull boxes and hand holes. Furnish scaled plot plans showing principal outline of buildings and structures. Reference conduits, ducts, box walls, and all bends deviating from straight line, dimensionally from fixed objects or structures.

**1.7 COORDINATION**

- A. Resolve interference with other underground ducts, piping or equipment, either new or existing.

**1.8 DELIVERY, STORAGE AND HANDLING**

- A. All materials furnished under this section shall be new, unused and delivered in original manufacturer's packaging.
- B. All materials shall be protected from damage at all times and stored in staging areas.

**PART 2 - PRODUCTS****2.1 CONDUITS**

- A. All conduits shall be provided with fittings and accessories.
- B. Conduit installation with concrete encasement: As indicated on drawings the conduit shall be:
  - 1. Rigid Steel: hot dipped galvanized
  - 2. Plastic: Polyvinyl chloride (PVC) conduit, DB-120 or Schedule 40 approved for use as raceway for 90 degree C conductors.
- C. Conduit installation without concrete encasement: As indicated on Drawings the conduit shall be:
  - 1. Plastic: Polyvinyl chloride (PVC) conduit, DB-120 or Schedule 40 approved for use as raceway for 90 degree C conductors.

**2.2 CONDUIT SPACERS**

- A. Provide conduit spacers made of plastic to maintain spacing of 3 inches (76 mm) between conduits.

**2.3 GRAVEL FILL**

- A. Clean 3 inches maximum size, not more than 70 percent passing No. 4 sieve, not more than 10 percent passing No. 200 mesh sieve.

## **2.4 CONCRETE**

- A. 3,000 psi at 28 days. Minimum 5-1/2 sacks cement, maximum 1-inch coarse aggregate. Aggregate to meet ASTM C33.

## **2.5 REINFORCEMENT**

- A. ASTM A-615 Grade 40

## **2.6 PAVEMENT**

- A. 6-inch run off crush stone base course, grading Class B.
- B. 4-inch bituminous base course B-1
- C. 2-inch bituminous surface course S-1
- D. All materials measured at depth after compaction.

## **PART 3 - EXECUTION**

### **3.1 PAVEMENT CUTTING**

- A. Cut pavement in straight lines, as required for trench excavation.
- B. Remove and legally dispose of pavement materials.

### **3.2 TRENCH EXCAVATION**

- A. Prior to opening an excavation, effort shall be made to determine whether underground installations (sewer, water, fuel, electrical lines, telephone lines, etc.) will be encountered and, if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation.
- B. Includes all earth and miscellaneous material encountered that is possible to excavate with a one-cubic yard backhoe in good working condition. Excavate to exact depth and grade with bottom tamped hard. Report wet or unstable trench bottom to Owner. Should Owner deem unsuitable, excavate to depth as directed and backfill with approved bedding material as directed by Owner. The duct structure should be kept dry until the concrete envelope has been poured. The trench must be pumped where there is an excessive amount of water.
- C. The trench bottom should be level. The levelness of the duct structure is determined by the levelness of the trench bottom. All sharp bends should be avoided in the excavation.

- D. Banks and Sides: Angle or recline to sheathing, shoring and bracing as required for safety, and conforming to all applicable laws, rules, regulations, and codes.
- E. Protection: Provide lights and barricades to properly protect persons and property per all applicable laws and regulations.
- F. Disposal of excess Excavated Material: Legally dispose all excess excavated material off site.

### **3.3 INSTALLATION OF CONDUITS**

- A. Install conduit indicated to be encased in concrete with concrete, spacers, reinforcing, etc. as specified and as indicated.
- B. Install conduit runs following routing on drawings and running in straight lines as far as possible. Where deviation from a straight line becomes necessary, install bends of sufficient radius for proper rodding and installation of cables.
- C. Accomplish changes in direction of runs exceeding total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet (7.62 m), except that manufactured bends used at ends of short runs of 100 feet (30.48 m) or less and then only at or close the end of run. Long sweep bends made up of one or more curved or straight sections and/or combinations thereof. Install manufactured bends with minimum radius of 36 inches (915 mm) where larger radius cannot be used.
- D. Lay duct lines to minimum slope of 3 inches (76 mm) per 100 feet (30.48 m) and slope to manholes, as indicated. Duct lines are to slope away from buildings where possible.
- E. Stagger joints in conduits at least 6 inches (150 mm). Do not allow couplings to rest on bottom of trench. Install couplings for plastic conduit in accordance with manufacturer's recommendations.
- F. Install spacers at intervals of approximately 5 feet (1.52 m) and stagger between tiers of ducts to provide not less than 12 inches (300 mm) of longitudinal separation. The maximum intervals between spacers on curved sections should not exceed 4 feet (1.22 m). Install base spacers to provide at least 3 inches (76 mm) between bottom of trench and underside of bottom conduits. Completely fill space with concrete. Firmly tie conduits and spacers together with pieces of heavy twine (not wire) before concrete is placed.
- G. Due to magnetic induction under no circumstances shall reinforcement rod or magnetic type material be used to support conduits or used between duct lines.

- H. Prior to placing of concrete, remove all dirt, sand, and any other debris from between conduits and from trench bottoms. Hold conduits in place to prevent floating or accidental movement.
- I. Install concrete encasements so minimum clearance of 12 inches (300 mm) from concrete to parallel pipes, lines, structures, etc. is maintained. Where ducts cross, minimum clearance of 6 inches (150 mm) will be acceptable. Do not allow the top of concrete to be less than 36 inches (915 mm) below finished grade or paving. Submit special conditions, which may require lesser clearances for approval.
- J. No sharp objects, such as reinforcing rods, spades, etc. should be used for tamping the concrete envelope around the ducts. Wooden tampers are recommended. Concrete vibrators should never be used for tamping.
- K. Exposed duct ends shall be protected during pouring so that concrete cannot get inside ducts.
- L. Where a connection is made to existing ductline, firmly bond or dowel concrete encasement to existing encasement.
- M. Where electrical ducts cross under roads, encase them in concrete.
- N. Keep conduits clean of concrete, dirt, and other substances during the course of construction. After the duct lines have been completed, pull a standard flexible mandrel not less than 12 inches (300 mm) long, having a diameter approximately  $\frac{1}{4}$  inch (6 mm) less than the inside diameter of the conduit, through each conduit, after which, pull a brush with stiff bristles through each conduit to make certain that no particles of earth, sand or gravel have been left in the line. Replace conduit runs that not allow the passage of the mandrel at any additional cost to the Owner. Pneumatic rodding may be used to draw in the lead wire. Plug and seal spare conduits after cleaning.

### **3.4 TRENCH BACKFILL**

- A. Materials: Where no pavement occurs, use excavated material. Where pavement occurs, use gravel.
- B. Start after approval by Owner. Backfill should not be placed until the concrete has been allowed sufficient time to set. A minimum time of 48 hours after pouring of concrete is recommended.
- C. Place:
  - 1. Conduit encased in concrete: Material used in backfilling around duct banks should be fine and free from lumps, well tampered beneath and adjacent to the sides of the concrete envelope. Place 6-inch layers from bottom of excavation to

bottom of paving. No boulders or stones over 4 inches. Tamp each 6-inch layer with mechanical tamper.

2. Conduit without concrete encasement: Backfill shall contain no boulders or stones over 1-inch to a point 12 inches above raceways. Tamp each 6-inch layer with mechanical tamper.

- D. Compaction: Uniformly spread each layer moisten or dry, as required, and then compact so unit dry weight of the compacted material meets or exceeds 95 percent Modified Proctor, as per ASTM D-1557. Provide a minimum of 4-field density tests to verify compaction.

### **3.5 PLACING PAVEMENT**

- A. Place each layer separately and compact to depths specified. Comply with Specification Section 401 of the Puerto Rico Highway Authority.

### **3.6 MANHOLES, PULL BOXES, AND HAND HOLES**

#### **A. General**

1. Unless otherwise indicated, install tops of manhole covers in unpaved areas approximately 2 inches (25 mm) above finished grade and in paved areas install flush with finished surface of paving.
2. Install galvanized corrosion-resistant channel support with continuous slot and required fittings designed for concrete encasement.
3. Where duct lines, enter thin wall terminate conduits with end bells.
4. Damp proofing: Apply two coats of bituminous damp proofing material to exterior surfaces of wall. Apply by brush or spray, in accordance with manufacturer's instructions. Allow time between coats to permit sufficient drying.

#### **B. Prefabricated:**

1. Shall be approved by the Puerto Rico Electrical Power Authority and/or the Puerto Rico Highway Authority.

#### **C. Cast in Place:**

1. Construct them of Class A (3,000 psi) concrete cast in place, as indicated.
2. Place a 6-inch (150 mm) crushed stone base under each manhole.
3. Construct cast-in-place manholes, pull boxes, and hand holes with forms, complete with centering cores and molds to

conform to shape, form, line, and grade required, and maintain sufficiently rigid to prevent deformation under load. Make all joints leak proof and arrange horizontally or vertically. Place forms on successive units for continuous surfaces and fit to accurate alignment, assuring a smooth completed surface, free from irregularities.

4. At convenient point close to wall, drive two- (2) 5/8-inch by 8-feet long copper-clad steel ground rods into earth as indicated. Extend ground rod approximately 5 inches (125 mm) above finished manhole floor. After completion of manhole, connect 6-foot (1.83 m) length of No. 2/0 AWG bare copper wire to ground rod and coil it within manhole.
5. Size space and place reinforcing bars, as indicated and as specified.
6. Set frames to the required grade in full bed of concrete mortar, to take watertight connection.

### **3.7 CLEANING**

- A. Clean interior of manholes, pull boxes and hand holes to remove dust, debris, and other material.

**END OF SECTION**



**SECTION 26 08 00**

**ACCEPTANCE TESTING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes Acceptance Testing for Electrical Power Distribution Equipment and Systems.

**1.2 APPLICABLE REFERENCES**

- A. All inspections and field tests shall be in accordance with the latest edition of the following codes, standards, and specifications except as provide otherwise herein.

- 1. ASTM - American Society for Testing and Materials
- 2. ANSI - American National Standards Institute
- 3. IEEE - Institute of Electrical and Electronic Engineers
- 4. ICEA - Insulated Cable Engineers Association
- 5. NETA - InterNational Electrical Testing Association
- 6. NEMA - National Electrical Manufacturer's Association
- 7. NEC - National Electrical Code
- 8. NFPA - National Fire Protection Association
- 9. OSHA - Occupational Safety and Health Administration
- 10. PREPA - Puerto Rico Electrical Power Authority
- 11. UL - Underwriters Laboratories, Inc.

**1.3 EQUIPMENT AND SYSTEMS TO BE TESTED**

- A. Transformers
- B. Cables and Wires
- C. Metal-Enclosed Busways
- D. Outdoor Bus Structures
- E. Switches
- F. Circuit Breakers
- G. Switchgear and Switchboard Assemblies



- H. Instrument Transformers
- I. Metering
- J. Protective Relays
- K. Ground-Fault Protection System
- L. Surge Arrestors
- M. AC Motors
- N. AC Generators
- O. Motor Control
- P. Adjustable Speed Drive Systems
- Q. Emergency Systems
- R. Uninterruptible Power Systems
- S. Capacitors
- T. Direct-Current Systems
- U. Grounding Systems.

#### **1.4 SYSTEM DESCRIPTION**

- A. The work covered by this specification shall include furnishing all labor, material, equipment and services to perform de acceptance tests for the complete electrical system.
- B. Preliminary acceptance tests are defined as those tests and inspections required to determine that the equipment involved may be energized for final operations tests.
- C. Final acceptance will depend upon equipment performance, characteristics, ant their compliance with the intended design as determined by system operational tests defined in this and other sections of these specifications.
- D. Use the standards of the industry such as IEE, NEMA, ANSI, IPCEA, NETA and guides in testing the equipment.
- E. Follow all Puerto Rico Electrical Power Authority (PREPA) regulations.

#### **1.5 QUALIFICATIONS**

- A. The testing shall be performed by an independent testing laboratory engaged in the business of electrical acceptance testing similar to the inspections and tests specified. Testing laboratory shall have a minimum of five years experience.

- B. The testing laboratory shall submit proof of qualifications to the Owner. Proof shall include but not be limited to:
  - 1. Name of the required registered professional engineer.
  - 2. Qualifications of test personnel: Minimum of two years supervised field experience, or certified National Electrical Testing Association (NETA) test technician.
  - 3. Experience as a testing laboratory for a minimum of five years.
  - 4. Equipment available for use on this project.
- C. Membership in the NETA may be submitted in addition to the above list to substantiate qualifications.

#### **1.6 TEST PROCEDURE**

- A. The Owner will provide a set of project electrical documents to assist in ascertaining the extent of the project testing.
- B. The testing laboratory shall be responsible for tests and test record for each item to be tested.
- C. Test in the presence of the Owner's representative at the option of the Owner.
- D. Report immediately to the Owner any system, material, or workmanship which is defective, in compliance with the specifications.
- E. Provide necessary test equipment and be responsible for setting-up test equipment, wire checks of factory wiring, and any other preliminary work in preparation for the electrical acceptance tests.
- F. Having a calibration program which maintains applicable test instrumentation within rated accuracy. Accuracy shall be traceable to the National Bureau of Standards. Calibration frequency shall be in accordance with the following schedule:
  - 1. Field instruments: six months maximum
  - 2. Laboratory instruments: 12 months maximum.
- G. Dated calibration shall be visible on equipment.
- H. Test in cooperation with other affected subcontractors. The schedule of tests shall be approved by the Owner's representative. Three day notice shall be given prior to testing, unless otherwise necessary or specified.

- I. Advice the manufacturer's representative of tests performed on their equipment. Give a minimum of ten calendar day notice to permit him to witness the equipment under test, should be desire.
- J. Certain pieces of equipment have the services of a manufacturer's service engineer who will assist in performing the tests on the equipment. When this service is provided, he will verify and sign each report form.
- K. Tests shall be non-destructive and shall not exceed the manufacturer's recommended limit for the equipment being tested.
- L. Where required for the validity of tests of safety of equipment and personnel, isolate equipment to be tested from the system.
- M. All testing shall be performed according to the manufacturer instructions and test value limitation indicated by testing equipment company or equipment manufacturer.

#### **1.7 TEST REPORT**

- A. Incorporate a record of inspections and tests into the test report.
- B. The test report shall be bond and certified by the testing laboratory.
- C. Furnish seven (7) copies of the complete report to the Owner, no later than 30 days after completion of project. At the discretion of the Owner's representative, due to the installation scheduling of specific items of equipment or for other reasons, testing may be subdivided into several smaller packages. In that case, one copy of a test report shall be submitted no later than 30 days after completion of each test package, and an inclusive test report containing the package reports shall be submitted in the quantity and the time specified above for the complete project.
- D. Include the following in the test report:
  - 1. Summary of the project.
  - 2. Description of the equipment tested.
  - 3. Description of test performed.
  - 4. List of test equipment used and calibration dates.
  - 5. Test results.
  - 6. Conclusions and recommendation, if any.
- E. Where adjustment, modifications, or repairs are made to equipment in order to meet the equipment and/or system specifications, the test results and reports shall indicate the "as left" condition.

F. The test forms shall include but not be limited to the following:

1. Name plate catalog number, serial number, and rating.
2. Desired performance or performance range.
3. Measure performances.
4. Test equipment used.
5. Test personnel and date.
6. Any discrepancies or repairs made.

G. Test forms that are different than NETA copyrighted test report forms shall be approved by the Owner's representative.

## **1.8 VISUAL INSPECTION**

A. Prior to testing, equipment shall be visually inspected to determine that there is no physical damage, loose bolts or missing parts, and the equipment is supplied in agreement with the contract documents, and properly installed and connected.

## **1.9 ENVIRONMENTAL CONDITIONS**

A. Temperature

1. Test results shall be corrected to 20 degrees C both actual ambient temperature test reading and calculated, corrected to temperature, test values shall be reported.
2. Test shall not be made on any equipment when the insulation temperature is below 0 degrees C.

B. Humidity

1. Test shall not be made on any equipment where the relative humidity is above 70 percent. Deviations of this requirement will only be made by the Owner's representative, if it can be demonstrated that the higher humidity will not affect the test or that the higher humidity can be accounted for adequately in interpreting the test results.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

A. Non used

## **PART 3 - EXECUTION**

### **3.1 TRANSFORMERS**

A. Dry Type Air-Cooled, 600 volt and below - Small (167 kVA Single-Phase, 500 kVA Three-Phase, and Smaller).

1. Perform inspection and tests listed in NETA, Section 7.2.1.1
- B. Dry-Type Air-Cooled, All above 600 Volt and 600 Volt and Below-Large (Greater than 167 kVA Single-Phase and 500 kVA Three-Phase)
  1. Perform inspection and tests listed in NETA, Section 7.2.1.2
  2. Perform any additional test required by PREPA latest regulations.
- C. Liquid-Filled
  1. Perform inspection and test listed in NETA, Section 7.2.2
  2. Perform any additional test required by PREPA latest regulations.

### **3.2 CABLES**

- A. Low-Voltage, 600 Volt Maximum
  1. Perform inspection and test listed in NETA, Section 7.3.2
- B. Medium-Voltage, 69 kV Maximum
  1. Perform inspection and test listed in NETA, Section 7.3.3
  2. Perform any additional test required by PREPA latest regulations.
- C. High-Voltage
  1. Perform inspection and test listed in NETA, Section 7.3.4
  2. Perform any additional test required by PREPA latest regulations

### **3.3 METAL-ENCLOSED BUSWAYS**

- A. Perform inspection and test listed in NETA, Section 7.4.

### **3.4 OUTDOOR BUS STRUCTURES**

- A. Perform inspection and test listed in NETA, Section 7.21
- B. Perform any additional test required by PREPA latest regulations.

### **3.5 SWITCHES**

- A. Low-Voltage
  1. Perform inspection and test listed in NETA, Section 7.5.1.1
- B. Medium-Voltage, Metal-Enclosed
  1. Perform inspection and test listed in NETA, Section 7.5.1.2

2. Perform any additional test required by PREPA latest regulations.
- C. High and Medium Voltage, Open
1. Perform inspection and test listed in NETA, Section 7.5.1.3
  2. Perform any additional test required by PREPA latest regulations.
- D. Oil Switches: Medium-Voltage
1. Perform inspection and test listed in NETA, Section 7.5.2
  2. Perform any additional test required by PREPA latest regulations.
- E. Vacuum Switches: Medium Voltage
1. Perform inspection and test listed in NETA, Section 7.5.3
  2. Perform any additional test required by PREPA latest regulations.
- F. SF6 Switches: Medium Voltage
1. Visual and Mechanical Inspection
    - a. Inspect for physical damage and compare nameplate data with plans and specifications
    - b. Inspect anchorage, alignment and grounding.
    - c. Perform all mechanical operation and contact blade alignment tests on both the circuit switcher and its operating mechanism in accordance with manufacturer's instruction.
    - d. Check tightness of bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instruction for proper foot pound level.
  2. Electrical Tests
    - a. Measure contact resistance
    - b. Perform switcher travel time test if unit is properly equipped for this test.
    - c. Circuit switcher shall be tripped by operation of each protective device.
    - d. Perform insulation resistance test on each pole to ground.

- e. Perform ac or dc over potential test on each pole to ground and pole to pole.
- f. Perform insulation resistance test on all control wiring at 1000 volts dc (Do not perform this test on wiring connected to solid state relays).
- g. All tests indicated in this section shall be verified with equipment manual and manufacturer instructions and recommendations.

### 3.6 CIRCUIT BREAKERS

#### A. Low-Voltage: Insulated/Molded Case

- 1. Perform inspection and test listed in NETA, Section 7.6.1.1

#### B. Low-Voltage: Power

- 1. Perform inspection and test listed in NETA, Section 7.6.1.2

#### C. Medium-Voltage: Air

- 1. Perform inspection and test listed in NETA, Section 7.6.2.1
- 2. Perform any additional test required by latest PREPA regulations

#### D. Medium-Voltage: Oil

- 1. Perform inspection and test listed in NETA, Section 7.6.2.2
- 2. Perform any additional test required by latest PREPA regulations

#### E. Medium-Voltage: Vacuum

- 1. Perform inspection and test listed in NETA, Section 7.6.2.3
- 2. Perform any additional test required by latest PREPA regulations

#### F. Medium-Voltage: SF6

- 1. Perform inspection and test listed in NETA, Section 7.6.2.4
- 2. Perform any additional test required by latest PREPA regulations

#### G. High-Voltage: Oil

- 1. Perform inspection and test listed in NETA, Section 7.6.3.1
- 2. Perform any additional test required by latest PREPA regulations.

H. High-Voltage: SF6

1. Perform inspection and test listed in NETA, Section 7.6.3.2
2. Perform any additional test required by latest PREPA regulations.

**3.7 SWITCHGEAR AND SWITCHBOARD ASSEMBLIES**

- A. Perform inspection and test listed in NETA, Section 7.1

**3.8 INSTRUMENT TRANSFORMERS**

- A. Perform inspection and tests listed in NETA, Section 7.10

**3.9 METERING**

- A. Perform inspection and tests listed in NETA, Section 7.11

**3.10 PROTECTIVE RELAYS**

- A. Perform inspection and tests listed in NETA, Section 7.9
- B. Perform any additional test required by latest PREPA regulations.

**3.11 GROUND-FAULT PROTECTION SYSTEM**

- A. Perform inspection and tests listed in NETA, Section 7.14

**3.12 SURGE ARRESTORS**

- A. Low-Voltage Surge Protection Devices
  1. Perform inspections and tests listed in NETA, Section 7.19.1
- B. Medium and High-Voltage Surge Protection Devices
  2. Perform inspections and tests listed in NETA, Section 7.19.2

**3.13 AC MOTORS**

- A. Perform inspection and test listed in NETA, Section 7.15.1.1

**3.14 AC GENERATORS**

- A. Perform inspection and test listed in NETA, Section 7.15.2.1

**3.15 MOTOR CONTROL**

- A. Motor Starters: Low Voltage
  1. Perform inspection and test listed in NETA, Section 7.16.1.1
- B. Motor Starters: Medium Voltage
  1. Perform inspection and test listed in NETA, Section 7.16.1.2



C. Motor Control Centers: Low and Medium Voltage

1. Perform inspection and tests listed in NETA, Section 7.16.2.1

**3.16 ADJUSTABLE SPEED DRIVE SYSTEMS**

- A. Perform inspection and test listed in NETA, Section 7.17

**3.17 EMERGENCY SYSTEMS**

- A. Engine Generator

1. Perform inspection and test listed in NETA, Section 7.22.1

- B. Automatic Transfer Switches

1. Perform inspection and test listed in NETA, Section 7.22.3

**3.18 UNINTERRUPTIBLE POWER SYSTEMS**

- A. Perform inspection and test listed in NETA, Section 7.22.2

**3.19 CAPACITORS**

- A. Perform inspection and test listed in NETA, Section 7.20.1

**3.20 DIRECT-CURRENT SYSTEMS**

- A. Batteries

1. Perform inspection and test listed in NETA, Section 7.18.1

- B. Battery Chargers

1. Perform inspection and test listed in NETA, Section 7.18.2

**3.21 GROUNDING SYSTEMS**

- A. Perform inspection and test listed in NETA, Section 7.13

**3.22 REFERENCES**

- A. The reference Standards are available as follows:

International Electrical Testing Association (NETA)  
P.O. Box 687, Morrison, CO 80465  
Tel: (303)697-8441; Fax (303)697-8431  
E-mail: [neta@netaworld.org](mailto:neta@netaworld.org) - Web site: [www.netaworld.org](http://www.netaworld.org)

- B. Approved Testing Companies

1. EISEC

~~RR3,~~ Box 3160

Río Piedras, PR 00928

Tel: (787)764-5015, (787)764-5130; Fax (787)751-3526

Mr. Angel González, Mr. Ramón E. León.

2. Phasor Engineering Inc.

Box 9012, Ponce, PR 00732-9012

Tel: 844-9336, 844-3040; San Juan 727-4655

Mr. Rafael Castro

3. Power

Engineering, Inc

St. D, Cataño, PR 00632

G.P.O Box 1905

San Juan, PR 00936

Tel: (787) 788-6052 (787) 788-6340, (787) 788-5121, (787) 788-6380

Mr. Félix J. Velázquez

**END OF  
SECTION**

## **SECTION 26 24 16**

### **CIRCUIT BREAKER PANELBOARD**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes Distribution and Branch Circuit Panelboards.

##### **1.2 RELATED SECTIONS**

- A. Section 26 05 26 - Grounding and Bonding.
- B. Section 26 08 00 - Acceptance Testing.

##### **1.3 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. NEC - National Electrical Code
  - 2. OSHA - Occupational Safety and Health Act
  - 3. UL - Underwriters Laboratories
  - 4. ANSI - American National Standards Institute
  - 5. NEMA - National Electric Manufacturers Association

##### **1.4 SUBMITTALS**

- A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.
- B. Product Data: Submit catalog data showing specified features of standard products.

##### **1.5 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Record actual locations of Panelboards and record actual circuit arrangement.
- B. Operation and Maintenance Data: Submit recommended maintenance procedures and intervals.

##### **1.6 MAINTENANCE MATERIALS**

- A. Furnish two of each panelboard key.

##### **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Accept panelboards on site. Inspect for damage

- B. Panelboards shall be protected from damage at all times and stored in staging areas.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Panelboards shall be dead front, safety type constructed and labeled in accordance with Underwriter's Laboratories Standard UL-67, latest revision.
- B. Panelboards shall be constructed using copper bus. Bus structure and main lugs or main breaker shall have current ratings as shown on Drawings.
- C. When indicated on Drawings Sub-Feed Lugs or Feed-Thru Lugs shall be provided.
- D. A bolted ground bus shall be included in all panelboards.
- E. Full size insulated neutral bus shall be included for panelboards shown with neutral, except as otherwise indicated on Drawings. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.
- F. Panelboard Enclosure:
1. As otherwise indicated on Drawings, enclosure shall be NEMA 1.
  2. Boxes shall be galvanized sheet steel. The rigidity and gauge of steel shall be as specified in Underwriter's Laboratories Standard UL50. The dimensions of wiring gutters shall be in accordance with Underwriter's Laboratories Standard UL67.
  3. Cabinet fronts shall be either flush or surface type as indicated on Drawings. Fronts shall be of sheet steel with rust-inhibiting primer and baked enamel finish. They shall be equipped with door, semi-concealed hinges, combination catch and flush type-lock, quarter-turn adjustable trim clamps, and directory cardholder. All locks shall be keyed alike.
  4. When indicating on Drawings, panelboards shall be provided with door-in-door construction of the cabinet front to permit access to the wiring trough without removing the cabinet front.
- G. Branch Circuit Breakers:
1. Molded case circuit breakers shall meet Underwriter's Laboratories Standard UL489. Ground Fault Circuit Interrupter breakers shall meet Underwriter's Laboratories Standard UL943.

2. Circuit breakers shall be quick-make, quick-break and trip indicating. They shall be fully interchangeable without disturbing adjacent units.
  3. All two and three pole breakers shall have common trips.
  4. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers.
  5. Individual circuit numbers shall be affixed to each breaker in a uniform position.
  6. Branch breakers shall be bolt-on type or plug-in type, as indicated on Drawings.
- H. Short-circuit Rating: Each panelboard, as a complete unit, shall have a rating equal or greater than the integrated equipment rating shown in the panelboard schedule on Drawings. Bus bracing shall be adequate to withstand the forces exerted by the let-through current.

## **2.2 DISTRIBUTION PANELBOARD AND POWER PANELBOARD**

- A. Distribution and Power Panelboards shall be suitable for the service indicated on Drawings.
- B. Main lugs or main breaker, branch circuit breakers, short-circuit rating, and enclosure shall be as indicated on Drawings.
- C. A laminated master nameplate shall be provided as indicated on Drawings.

## **2.3 LIGHTING PANELBOARD**

- A. Lighting Panelboards shall be suitable for the service indicated on Drawings.
- B. Main lugs or main breaker, branch circuit breakers, short-circuit rating, and enclosure shall be as indicated on Drawings.
- C. Branch circuit breakers shall be listed as Type SWD for lighting circuits.
- D. A laminated master nameplate shall be provided as indicated on Drawings.

## **2.4 RECEPTACLE PANELBOARD**

- A. Receptacle Panelboards shall be suitable for the service indicated on Drawings.
- B. Main lugs or main breaker, branch circuit breakers, short-circuit rating, and enclosure shall be as indicated on Drawings.

- C. A laminated master nameplate shall be provided as indicated on Drawings.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Recessed panelboards mounted in walls shall be so installed that the front edge of the panelboard will not set back of the finished surface more than  $\frac{1}{4}$  inch.
- B. Surface mounted panelboards shall be mounted with structural steel backing members that provide a one-inch minimum spacing from the wall.
- C. When panelboards are mounted on a rack the installation shall be done as indicated on the drawing details.
- D. Install filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuit changes.
- F. Install engraved master nameplates as indicated on Drawings.
- G. Install spare conduits out of each recessed panelboard to accessible locations above ceiling. Minimum spare conduits: 5 empty 1-inch. Identify each as SPARE.
- H. Ground and bond panelboard enclosure according to Section 26 05
26. Connect equipment ground bars of panels in accordance with NEC Article 517.

#### **3.2 CLEANING**

- A. Clean interior of panelboards to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

**END OF  
SECTION**

## **SECTION 26 27 26**

### **WIRING DEVICES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes wall switches; wall dimmers; receptacles; and device plates.
- B. Related Sections:
  - 1. Section 26 05 26 - Grounding and Bonding
  - 2. Section 26 05 33.23 - Raceways: Surface Raceways
  - 3. Section 26 05 33.29 - Raceways: Outlet Boxes
  - 4. Section 26 05 39 - Raceways: Underfloor Duct

##### **1.2 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. NEC - National Electrical Code
  - 2. OSHA - Occupational Safety and Health Act
  - 3. UL - Underwriters Laboratories
  - 4. ANSI - American National Standards Institute
  - 5. NEMA - National Electric Manufacturers Association

##### **1.3 SUBMITTALS**

- A. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

##### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. All materials furnished under this section shall be new, unused and delivered in original manufacturer's packaging.
- B. All materials shall be labeled and identified for intended applications.
- C. All materials shall be protected from damage at all times and stored in staging areas.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Manufacturers: As indicated in the Outlet Schedule on Drawings.

### **2.2 WALL SWITCHES**

- A. Standard switches shall be specification grade with terminals arranged for side and back wiring and shall be single-pole, double-pole, three-way or four-way, as indicated on Drawings. Color and ratings as indicated in the Outlet Schedule.
- B. Where more than one switch is shown at an outlet, switches shall be installed under a gang plate in an order, which is appropriate to the outlet location.

### **2.3 WALL DIMMERS**

- A. Wall dimmers shall be for incandescent lamps, fluorescent lamps, low voltage lamps, or high-intensity discharge lamps, as indicated on Drawings. Types, colors, and ratings as indicated in the Outlet Schedule.

### **2.4 RECEPTACLES**

- A. Single and duplex receptacles shall be specification grade, three wire grounding type and shall have terminals arranged for side and back wiring. Color and ratings as indicated in the Outlet Schedule.
- B. Split-circuit duplex receptacles shall be specification grade, three wire grounding type with break-off arrangement for two-circuit wiring and shall have terminals arranged for side and back wiring. Where indicated on the plans one half of the receptacle shall be switch controlled while the other remains energized at all times. Color and ratings as indicated in the Outlet Schedule.
- C. Special purpose receptacles shall be of the rating and type as indicated in the Outlet Schedule.

### **2.5 WALL PLATES**

- A. Furnish and install wall plates of appropriate type and size for all wiring and control devices, signal and telephone outlets. Plates shall be of the types indicated in the Outlet Schedule.
- B. When wiring devices are installed in exposed conduit fittings or outlet boxes, the plates or covers shall be of a type designed for the fittings or boxes.



## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and completely covered by wall plates.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

### **3.2 PREPARATION**

- A. Clean debris from outlet boxes.

### **3.3 INSTALLATION**

- A. Install devices plumb and level. Alignment tolerance of the device plate axis shall be 1/16 inch.
- B. Plates shall be installed with all four edges in continuous contact with finished wall surface without the use of mats or similar devices.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmer.
- F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- G. Connect wiring devices by wrapping solid conductor around screw terminal. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device termination. Do not place bare stranded conductors directly under device screws.

### **3.4 INTERFACE WITH OTHER PRODUCTS**

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.29 to obtain mounting heights as indicated on Drawings.
- B. Coordinate installation of wiring devices with underfloor raceway service fittings provided under Section 26 05 39.
- C. Coordinate installation of wiring devices with floor box service fittings provided under Section 26 05 33.29.

### **3.5 FIELD QUALITY CONTROL**

- A. Inspect each wiring device for defects.

- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

### **3.6 ADJUSTING**

- A. Adjust devices and wall plates to be flush and level.

### **3.7 CLEANING**

- A. Clean exposed surfaces to remove splatters and restore finish.

**END OF  
SECTION**

## **SECTION 26 28 19**

### **ENCLOSED SWITCHES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes fusible and nonfusible switches, for use as disconnects in service and distribution system rated 600 volts or less.
- B. Related Sections:
  - 1. 26 05 26 - Grounding and Bonding
  - 2. 26 08 00 - Acceptance Testing
  - 3. 26 28 13 - Fuses

##### **1.2 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. NEC - National Electrical Code
  - 2. OSHA - Occupational Safety and Health Act
  - 3. UL - Underwriters Laboratories
  - 4. ANSI - American National Standards Institute
  - 5. NEMA - National Electric Manufacturers Association
  - 6. NETA - InterNational Electrical Testing Association

##### **1.3 SUBMITTALS**

- A. Product Data: Submit catalog data showing switch ratings and enclosure dimensions.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

##### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. All enclosed switches shall be new and unused.
- B. Enclosed switches shall be protected from damage at all times and stored in staging areas.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Manufacturers: As indicated on Drawings.
- B. Enclosed switches shall be heavy-duty types. Poles, ampere ratings, volts, and fuses as indicated on Drawings.
- C. Enclosed switches shall have quick-make and quick-break operating handles and mechanism, which shall be an integral part of the box, not the cover.
- D. Furnish an interlock mechanism such that the switch door cannot be opened when the switch is "ON" or the switch operated when the door is open. Switch blade ends shall be visible when in the "OFF" position with the enclosure cover open.
- E. Provisions shall be made for padlocking the switch in the "OFF" position only, with at least three padlocks. It shall be possible to place the padlocks only after the switch mechanism has positively operated.
- F. Furnish switches with current carrying parts entirely copper.
- G. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
- H. Switch Ratings:
  - 1. Horsepower rating for ac or dc as indicated on Drawings.
  - 2. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere); 100,000 rms symmetrical amperes when used with or protected with Class L fuses (800-1200 ampere); 200,000 rms symmetrical amperes when used with or protected with Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection scheme); 200,000 rms symmetrical amperes when used with or protected with Class L fuses (800-1200 amperes).
- I. Switch Enclosure: Except as otherwise indicated on Drawings switches shall be provided in the following enclosures:
  - 1. Interior Dry Locations: NEMA Type 1, General Purpose.
  - 2. Outdoor Locations: NEMA Type 3R, Raintight Construction.
  - 3. Wet and Damp Locations: NEMA Types 4/4X, Stainless Steel Construction.
  - 4. Hazardous Locations: NEMA Types 7-9.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Set enclosures plumb and symmetrical with surrounding equipment.
- B. Support enclosures as indicated on Drawings.
- C. Switch enclosures shall have ½ inch air space between walls and enclosure back; arrange this by means of pipe sleeves slipped over securing bolts or other approved means.
- D. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.
- E. Install engraved plastic nameplates as indicated on Drawings.
- F. Apply adhesive tag inside door of each fused switch indicating NEMA fuse class and size installed.
- G. Ground and bond switch enclosure according to Section 26 05 26.

### **3.2 FIELD QUALITY CONTROL**

- A. Perform inspection and tests listed in NETA, Section 7.5.1.1 (Switches: Low Voltage), Section 7.13 (Grounding System).

### **3.3 CLEANING**

- A. Clean interior of switch enclosures to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

**END OF  
SECTION**

**SECTION 26 56 00**

**EXTERIOR LUMINAIRES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Exterior luminaires, poles, and accessories.

**1.2 REFERENCES**

- A. All work shall be in accordance with all applicable codes and standards to include, but not limited to, the following:
  - 1. NEC - National Electrical Code
  - 2. OSHA - Occupational Safety & Health Act
  - 3. UL - Underwriters Laboratories
  - 4. ANSI - American National Standards
  - 5. NEMA - National Electric Manufacturers Association
  - 6. CBM - Certified Ballast Manufacturers
  - 7. PREPA - Puerto Rico Electrical Power Authority

**1.3 SUBMITTALS**

- A. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.
- B. Product Data: Submit dimensions, ratings, and performance data.

**1.4 DELIVERY, STORAGE AND HANDLING**

- A. All materials furnished under this section shall be new, unused and delivered in original manufacturer's packaging.
- B. All materials shall be protected from damage at all times and stored in staging areas.

**1.5 COORDINATION**

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories indicated on Drawings in the Luminaire Schedule.
- B. Manufacturers: As indicated on Drawings in the Luminaire Schedule.

### **2.2 BALLASTS**

- A. Integral ballast protection shall be provided for all luminaires. The power factor of the lamp-ballast shall not drop below 90 percent at any lamp voltage for plus or minus 10 percent line voltage variation.
- B. Fluorescent Luminaires:
  - 1. Electronic Ballast less than 10% Total Harmonics Distortion (THD) or High-power-factor electromagnetic ballast (as indicated in the Luminaire Schedule) certified by Certified Ballast Manufacturers, Inc. to comply with ANSI C82.1, suitable for lamps specified, with voltage to match luminaire voltage.
- C. High Intensity Discharge (HID) Luminaires: ANSI C82.4 metal halide or high pressure sodium lamp ballast, suitable for lamp specified, with voltage to match luminaire voltage.

### **2.3 LAMPS**

- A. All luminaires shall be furnished with lamps. Type of lamps as indicated on Drawings in the Luminaire Schedule.

### **2.4 POLES**

- A. Manufacturers: As indicated on Drawings in the Luminaire Schedule.
- B. Material and Finish: As indicated on Drawings in the Luminaire Schedule.
- C. Section Shape and Dimensions: As indicated on Drawings in the Luminaire Schedule.
- D. Height: As indicated on Drawings in the Luminaire Schedule.
- E. Base: As indicated on Drawings in the Luminaire Schedule.
- F. Accessories: As indicated on Drawings in the Luminaire Schedule.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that foundations are ready to receive fixtures.

#### **3.2 INSTALLATION**

- A. Install concrete bases for lighting poles at locations as indicated on Drawings, and in accordance with the base detail shown on Drawings.
- B. Install poles plumb. Install shims or double nuts to adjust plumb. Grout around each base.
- C. Install lamps in each luminaire.
- D. Bond and ground luminaires. Install supplementary grounding electrode at each pole.

#### **3.3 FIELD QUALITY CONTROL**

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

#### **3.4 ADJUSTING**

- A. Aim and adjust luminaires as indicated on Drawings.

#### **3.5 CLEANING**

- A. Clean photometric control surfaces as recommended by manufacturer.
- B. Clean finishes and touch up damage.

**END OF  
SECTION**



**SECTION 31 20 00**

**EARTH MOVING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Examination of existing conditions.
- B. Preparation of subgrade.
- C. Excavation - general.
- D. Excavation for walks and pavements.
- E. Subgrade inspection.
- F. Unauthorized excavation.
- G. Storage of soil materials.
- H. Installation of backfill.
- I. Installation of fills.
- J. Soil moisture control.
- K. Compaction of soil backfills and fills.
- L. Grading.
- M. Protection.
- N. Disposal of surplus and waste materials.
- O. Field quality control.

**1.2 RELATED SECTIONS**

- A. Division 1 - General Requirements.
- B. Section 32 11 23 - Aggregate Base Course: Placement of base course over prepared subgrade of asphalt or portland cement concrete paving.
- C. Section 32 13 13 - Concrete Paving: Proofrolling base courses.
- D. Section 03 30 00 - Cast In Place Concrete.

**1.3 REFERENCES**

- A. Geotechnical Report by ASE - \_Lockheed-Martin\_CFI\_File 1882\_Oct\_2019
- B. Environmental Quality Board (EQB) - Approved CES Plan.
- C. EPA - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

- D. AASHTO M145 - The Classification of Soils and Soils - Aggregate Mixtures for Highway Construction Purposes.
- E. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.
- F. ASTM D1140 - Amount of Material in Soils Finer than the No. 200 Sieve.
- G. ASTM D1556 - Test Method for Density of Soil in Place by the Sand - Cone Method.
- H. ASTM D1557 - Test Method for Moisture-Density Relations of Soils and Soil- Aggregate Mixture Using 10-lb. Hammer and 18-inch Drop.
- I. ASTM D1586 - Test Method for Penetration Test and Split Barrel Sampling of Soils.
- J. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- K. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- L. ASTM D2940 - Graded Aggregate Material for Bases or Subbases for Highways or Airports.
- M. ASTM D3740 - Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineered Design and Construction.
- N. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- O. ASTM E329 - Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- P. ASTM E548 - Guide for General Criteria Used for Evaluating Laboratory Competence.
- Q. OSHA 29 CFR, Part 1926; Occupational Safety and Health Standards - Excavations.
- R. SAE J-732 - Specification Definitions: Loaders.
- S. SAE J-1179 - Hydraulic Excavator and Backhoe Digging Forces.

#### **1.4 DEFINITIONS**

- A. Backfill: Approved excavated soil material or borrow soil used to fill an excavation.
- B. Borrow Soil: Soil imported from offsite (Classified as A-2-4 or better) for use as fill or backfill.

- C. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Geotechnical Engineer and/or Architect-Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the work.
  2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
  3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Geotechnical Engineer and/or Architect-Engineer. Unauthorized excavation, as well as remedial work directed by Geotechnical Engineer and/or Architect-Engineer, shall be without additional compensation.
- D. Fill: Approved soil materials used to raise existing grades.
- E. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cubic yard for bulk excavation or  $\frac{3}{4}$  cubic yard for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator, equipped with 42-inch wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power and bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
  2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510 lbf breakout force with a general purpose bare bucket; measured according to SAE J-732.
- F. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material  $\frac{3}{4}$  cubic yard or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D1586.
- G. Structures: Building, footing, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, aggregate base course (asphalt paving or portland cement concrete paving), or topsoil materials.
- I. Subbase Course: Course placed between the subgrade and aggregate base course for asphalt paving, or course between the subgrade and a portland cement concrete paving.
- J. Aggregate Base Course: Course placed between the subgrade or subbase and the base course of asphalt paving; or course placed between the subgrade or subbase and portland cement concrete paving.
- K. Working Platform: A layer of compacted crushed rock or natural stone that replaces the in-situ soil to provide a stable, uniform bearing foundation for construction equipment to facilitate further site construction. Material and thickness of working platform shall be at the discretion of the Contractor.

## **1.5 QUALITY ASSURANCE**

- A. Section 01 40 00 - Quality Requirements.
- B. Compaction: Unless noted otherwise, the term "compaction" refers to the percentage of maximum dry density as determined by ASTM D1557. Field tests of compacted density will be in accordance with ASTM D1556 or ASTM D2922.
- C. Quality Control Testing During Construction: Geotechnical Engineer shall observe proofrolling, test and approve fill material, (borrow and previously excavated soil material), subgrades and each fill layer before further construction work is performed. Testing and approval of each fill layer shall be done to demonstrate conformance to compaction and other requirements.
- D. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E329 to conduct soil materials testing, as documented according to ASTM D3740 and ASTM E548.
- E. Lines and Grades
  - 1. The drawings indicate horizontal and vertical control points for use by Contractor.
  - 2. The Contractor shall employ a Licensed Surveyor to layout and maintain all lines and grades required for locations of all structures, roads, pavements, walks, and parking areas requiring excavation, filling and backfilling as indicated on the drawings.

## 1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to AASHTO M145 for each on-site and borrow soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D1557 for each on-site and borrow soil material proposed for fill and backfill.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements.
- B. Deliver and store materials in a manner to prevent contamination or segregation.

## PART 2 - PRODUCTS

### 2.1 MATERIALS - SOILS

- A. General Requirements: Shall be free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the location of intended use.
- B. Backfill and Fill: AASHTO M145, Subgroup A-2-4 or better, with a maximum ASTM D4318 liquid limit of 35, maximum ASTM D4318 plasticity index of 12 and a maximum of 25 percent by weight passing ASTM D1140, No. 200 sieve.
- C. Subbase Material: AASHTO M145, Subgroup A-2-4 or better, with a maximum ASTM D4318 liquid limit of 35, maximum ASTM D4318 plasticity index of 12 and a maximum of 25 percent by weight passing ASTM D1140, No. 200 sieve.
- D. Base Course: Naturally or artificially grade mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95 percent passing a 1½-inch sieve and not more than 8 percent passing a No. 200 sieve.
- E. Unsatisfactory Soil Material: Soil Classification Groups: A-2-6, A-2-7, A-4, A-5, A-6 and A-7 according to AASHTO M145, or a combination of these groups. Unsatisfactory soils also includes fills or backfills not maintained within 2 percent or optimum moisture content at time of compaction.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.
- B. The Contractor and its subcontractors shall visit and examine the job site prior to beginning work to verify accuracy and suitability of conditions for the work.
- C. Any defects or errors which would cause defective installation/application of products, or cause latent defects in workmanship and/or function shall be identified to the Owner's On Site Representative and corrected prior to installation.

### **3.2 PREPARATION**

- A. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.
- B. Protect and maintain erosion and sedimentation controls during earthwork operations.

### **3.3 PROTECTION**

- A. Bench Marks: Protect all bench marks, monuments and any other reference points during the execution of the work. If disturbed, restore to original condition at no cost to the Owner.
- B. Excavation: Provide and maintain at all times excavation protection in strict accordance with OSHA 29 CFR, Part 1926.
- C. Surface Drainage:
  - 1. Completely drain construction site during periods of construction to keep soil materials sufficiently dry to permit construction operations to successfully progress.
  - 2. Provide ditches, swales, and other drainage features and equipment as required to maintain dry soils at all times.
  - 3. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove the unsuitable material and provide new soil material as specified herein.
- D. Dewatering:
  - 1. The Contractor shall provide and maintain at all times adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work.

2. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
  3. All excavations for concrete structures or trenches which extend down to or below ground water shall be dewatered by lowering and keeping the ground water level beneath such excavations 12 inches or more below the bottom of the excavation.
  4. The Contractor shall be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.
  5. Do not use excavated trenches as temporary drainage ditches.
- E. Blasting: No blasting or other form of explosives for excavation will be permitted.

### **3.4 EXCAVATION - GENERAL**

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.
1. Excavation shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms.
  2. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.
  3. Excavate to the contours, elevation, and dimensions indicated. Reuse excavated materials meeting the specified requirements for the material type required at the intended location.
  4. Keep excavations free from water.
  5. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather; refill with fill

material and compact to 95 percent of ASTM D1557 maximum density.

6. Unless specified otherwise, refill excavations cut below indicated depth with fill material and compact to 95 percent of ASTM D1557 maximum density.
7. Unauthorized excavation, as well as remedial work directed by the Architect/Engineer and/or the Geotechnical Engineer, shall be at the expense of the Contractor.

C. Additional Excavation:

1. When excavation has reached required subgrade elevations, the Geotechnical Engineer will make an inspection of conditions. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Geotechnical Engineer.
2. Removal and disposal of unsuitable material below required subgrade elevations and its replacement as directed will be paid on the basis of contract conditions relative to changes in the work.

D. Utilization of Excavated Material:

1. Satisfactory excavated material, classified as A-2-4 or better, required for filling and backfilling operations shall be stockpiled in approved on-site locations, until the material is ready to be placed.
2. All unsatisfactory materials and excess satisfactory excavated materials not required for filling and backfilling operations shall be removed in a legal manner from Owner's property.
3. No satisfactory excavated material shall be wasted without specific written authorization from the Owner's On Site Representative.

E. Shoring:

1. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures and utilities.
2. Shoring, bracing and sheeting shall be removed, unless otherwise directed by the Owner's On-Site Representative as excavations are backfilled in a manner to prevent caving.
3. Shoring of excavations shall be in accordance with OSHA safety requirements.

F. Erosion and Sediment Control:



1. Erosion and sediment control measures shall be provided by the Contractor during excavation operations in conformance with applicable codes and laws.
2. Methods of erosion and sediment control shall include straw or hay bales, temporary ditches, porous dikes or other procedures as indicated by the CES Plan, to minimize the erosion of, or transport and deposit of sediment beyond the limits of the work of this project.

### **3.5 EXCAVATION - STRUCTURES**

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Excavations for Footings and Foundations:
  1. Do not disturb bottom of excavation.
  2. Excavate by hand to final grade just before placing concrete reinforcement.
  3. Trim bottoms to required lines and grades to leave solid base to receive other work.

### **3.6 EXCAVATION - PAVEMENTS**

- A. Excavate surfaces under pavements to indicated lines, cross sections, elevations, and subgrades.
- B. Proofroll subgrades.

### **3.7 SUBGRADE INSPECTION**

- A. Notify Geotechnical Engineer when excavations have reached required subgrade.
- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 miles per hour.
  2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

### **3.8 UNAUTHORIZED EXCAVATION**

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect-Engineer and/or Geotechnical Engineer.
- B. Fill unauthorized excavations under other construction as directed by Architect.

### **3.9 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### **3.10 INSTALLATION - BACKFILL**

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  1. Construction below finish grade including, where applicable, subdrainage, dampproofing and waterproofing.
  2. Surveying locations of underground utilities for Record Documents.
  3. Testing and inspecting underground utilities.
  4. Removing concrete formwork.
  5. Removing trash and debris.
  6. Removing temporary shoring and bracing, and sheeting.
  7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

- B. Place backfill on subgrades free of mud or any other deleterious materials.
- C. Backfilling shall be placed in such a manner as to minimize wedging action or eccentric loading upon or against any foundation or structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the backfill material. During backfilling operations and in formation of embankments, equipment that will overload the structure in passing over and compacting the backfill material shall not be used.
- D. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation walls than a distance equal to the height of backfill above the top of the footing; the area remaining shall be compacted by power driven hand tampers suitable for the materials being compacted. Backfill shall not be placed against foundation walls prior to seven (7) days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall.

### **3.11 INSTALLATION - FILL**

#### **A. General Requirements:**

- 1. Satisfactory material A-2-4 or better shall be used in bringing fills to lines and grades as shown on the drawings, and for replacing unsatisfactory material.
- 2. Fill materials shall be placed in layers not exceeding 8 to 10 inches (loose measure). Compaction shall be to 95 percent Modified Proctor Maximum Density (ASTM D1557).
- 3. Compaction shall be accomplished by rolling with tamping or pneumatic tired rollers, 3-wheel power rollers or other acceptable rollers.
- 4. The slope of the original ground upon which the fill is to be placed shall be plowed or scarified to a depth as approved by the Geotechnical Engineer and/or his authorized representative.
- 5. Each layer of fill shall be spread evenly and shall be thoroughly mixed during the spreading operations.
- 6. Each layer shall be leveled and smoothed, before starting the next layer, by means of power-driven graders, bulldozers or other suitable equipment. Hauling and spreading equipment shall be operated over the full width of each layer.
- 7. When fill material includes rock, no large rock shall be allowed to nest and all voids shall be carefully filled with small stone or earth and properly compacted. No rocks in excess of 6 inches in largest dimension, shall be permitted within thirty inches (30") of the finish grade.

8. Each layer of fill material shall be moistened or dried to a uniform moisture content suitable to obtain the maximum compacted density.
  9. Fill slopes shall be compacted by means of sheeps foot rollers or other suitable equipment.
  10. In limited areas hand tampers may be used in lieu of large compaction equipment.
- B. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Bench sloped surfaces steeper than one vertical to six horizontal. When existing ground surface has a density less than that specified under compaction for the particular area, break up the ground surface, pulverize, moisture-condition to the optimum moisture condition, and compact to required depth and percentage of maximum density.
- C. Fill: Provide for the general site and pavements. Place in 6 inch lifts. Place backfill adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.
- D. Crushed Stone (Base Course): Provide under sidewalks, curbs, curb and gutters, cross gutters and concrete pads.

### **3.12 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
- B. Do not place backfill or fill soil material or surfaces that are muddy.
- C. Remove and replace, or scarify and air dry otherwise soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### **3.13 COMPACTION - SOIL BACKFILLS AND FILLS**

- A. Proofroll, under the full-time observation of the Geotechnical Engineer, the subgrade in all cut areas beneath pavements, walks, ramps, structures, behind earth retaining structures and all areas to receive fills or embankments.
  1. Areas to be proofrolled shall be tested with a minimum of a two-pass coverage in each direction of a rubber-tired proofroller or other heavy rubber tired construction equipment conforming to loading per HS-15 or greater, unless failure occurs during the first coverage.

2. An area will be considered covered when the out to out dimension of the wheels of the proofroller has passed over it four times. An additional coverage may be required by the Geotechnical Engineer to ensure that a suspicious area is stable.
  3. The roller shall be operated in a systematic manner so that the member of coverages over all areas designated can be readily determined.
  4. The equipment shall be operated at speed not to exceed five (5) miles per hour not be less than 2½ miles per hour.
  5. Proofrolling shall be done only in the presence of the Geotechnical Engineer.
  6. Proofrolling shall not be done where water is ponded on the surface or when rainfall has occurred within the previous 24 hours.
  7. Excavate those areas where, in the opinion of the Geotechnical Engineer, proofrolling indicates unstable subgrade, inadequate bearing or excessive rutting occurs. Both moisture content and density shall be evaluated along with visual soil classification. The elevation or depth of excavation shall be that necessary to correct the unstable condition or as directed by the Geotechnical Engineer. Reconcile volumes of cut and fill material daily between all parties.
- B. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
1. General Site: Compact underneath areas designated for vegetation and areas outside the 5-foot line of the structure to 85 percent.
  2. Under Structures: Scarify and recompact top 12 inches of existing subgrade and each layer of fill or backfill material at 95 percent.
  3. Adjacent Areas: Compact areas within 5 feet of structures to 90 percent.

4. Under Pavements: Scarify and recompact top 12 inches of existing subgrade and each layer of fill or backfill material at 95 percent.
5. Under Lawn and Unpaved Areas: Scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

### **3.14 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  1. Provide a smooth transition between adjacent existing grades and new grades.
  2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  1. Unpaved Areas: Plus or minus 1 inch.
  2. Pavements: Plus or minus ½ inch.

### **3.15 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  1. Scarify or remove and replace soil material to depth as directed by the Geotechnical Engineer and/or Architect-Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

### **3.16 DISPOSITION OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove surplus soil and waste material, including trash and debris and legally dispose of it off Owner's property.
- B. Landfill Manifesto: Submit to the Owner copy of manifesto of approved landfill accepting surplus and waste material.

### 3.17 FIELD QUALITY CONTROL

#### A. Section 01 40 00 - Quality Requirements.

#### B. General

1. Geotechnical Engineer shall observe fill and subgrades during proofrolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Owner's On Site Representative regarding suitability or unsuitability of areas where proofrolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to the Owner's On Site Representative extent of removal and replacement of unsuitable materials and observe proofrolling of replaced areas until satisfactory results are obtained.
2. Geotechnical Engineer shall provide full time observation of fill placement and compaction and field density testing in building areas to verify that earthwork compaction obtained is in accordance with Contract Documents.
3. Geotechnical Engineer shall provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract Documents.
4. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
5. Allow Geotechnical Engineer to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

#### C. Testing Compaction

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used in compliance with ASTM D1557 Method A.
2. Make field density tests in accordance with ASTM D1556; ASTM D2167; or ASTM D2922.
3. ASTM D1140 for material finer than No. 200 sieve; ASTM D4318 for liquid limit and ASTM D4318 for plastic limit; ASTM D1557 for moisture density relations.

#### D. Field Density Tests:

1. Overall and Site Grading: One (1) density test shall be taken per 5,000 square feet per 6 inches of fill at locations as approved by the Owner's On site Representative.

2. Pavement Subgrade: One (1) test for each 3000 square feet of compacted fill layer, but in no case fewer than two (2) tests per layer.
  3. Footing Subgrade: At least one (1) test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to Geotechnical Engineer or his authorized representative. In each compacted fill layer below wall footings, perform one (1) field density test for every 100 feet of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlated actual soil conditions observed with those indicated by test borings.
- E. When Testing Agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.
- F. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in each footing subgrade.
- G. Testing Materials: Test suitability of on-site and off-site borrow as directed by the Geotechnical Engineer or his authorized representative.

**END OF SECTION**



**SECTION 32 11 23**

**AGGREGATE BASE COURSE**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Preparation of surface.
- B. Placing of aggregate base course.
- C. Field quality control.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 31 20 00 - Earth Moving.
- C. Section 32 12 16 - Asphalt Paving.

**1.3 REFERENCES**

- A. AASHTO T27 - Sieve Analysis of fine and Course Aggregate.
- B. AASHTO T84 - Specific Gravity and Absorption of Fine Aggregate.
- C. AASHTO T85 - Specific Gravity and Absorption of Coarse Aggregate.
- D. AASHTO T96 - Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.
- E. AASHTO T104 - Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
- F. AASHTO T180 - Moisture Density Relative of Soils Using a 4.54 Kg (10 lb) Rammer and a 457 mm (18 in) Drop.
- G. AASHTO T191 - Density of Soil In-Place by the Sand - Cone Method.
- H. AASHTO T205 - Density of Soil In-Place by the Rubber-Balloon Method.
- I. AASHTO T238 - Density of Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).

**1.4 QUALITY ASSURANCE**

- A. Section 01 40 00 - Quality Requirements.
- B. Source of Materials: The Contractor shall furnish the Architect-Engineer with the exact location of the source of the aggregate which he proposes to use.

- C. Testing: Testing laboratory will take samples from the selected source for testing for conformance with the specified quality and gradation requirements. After the aggregate source has been accepted, the Architect-Engineer has the option of further sampling and testing of materials delivered to the project site and this cost shall be borne by the Contractor.
- D. Basis of Acceptance: Any material that fail to meet specification requirements following delivery and placement shall be removed at the Contractor's expense and shall be replaced by acceptable material. Any new source of materials proposed by the Contractor requires sampling, testing and acceptance by the Architect-Engineer prior to delivery of materials to the project site.

### 1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Procedures for submittals.
- B. Test Reports: Results of field test shall be submitted. Test shall include material gradation, liquid limit and plastic limit.

## PART 2 - PRODUCTS

### 2.1 MATERIALS - AGGREGATE BASE COURSE

- A. Aggregate Base Course: Hard durable particles of fragments of crushed stone, or crushed or natural gravel conforming to the following grading requirements:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieve</u>
1½-inch	100
1-inch	-
½-inch	40-75
No. 4	30-60
No. 10	-
No. 200	5-12

and meeting the following requirements:

1. Material shall be free from lumps of clay, vegetable matter or other objectionable matter.
2. The course aggregate not passing the No. 8 sieve shall have a percentage of wear, when tested by AASHTO T96, of not more than 45.
3. Maximum number of pieces with elongated faces shall not exceed 15 percent. An elongated face is one where the ratio of the longest dimension to the shortest dimension exceeds 5.

4. The fraction passing the No. 200 sieve shall not be greater than two-thirds ( $2/3$ ) of the fraction passing the No. 40 sieve.
5. The fraction passing the No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6.
6. When crushed aggregate is used, not less than 50 percent by weight of the particles retained in the No. 4 sieve shall have at least one fractured face.

B. Filler Material: If additional material is necessary for meeting the grading requirement or for satisfactory bonding of the material, it shall be uniformly blended with the base course material at the screening and crushing plant. Such filler material shall be obtained from the crushing of stone or gravel.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION OF SURFACE**

- A. The subgrade or subbase on which the base course is to be placed shall have been completed and the surface finished in accordance with the requirements of Section 02310. Immediately before placing base course material, the subgrade or subbase shall be checked as to conformity with grade and cross section.
- B. No base course shall be placed on the subgrade or subbase unless it is reasonably dry and free from impounded water, and the surface finish accepted by the Owner's On Site Representative or his authorized representative.

#### **3.2 PLACING - AGGREGATE BASE COURSE**

- A. The base course material shall be spread on the prepared surface and compacted in layers not exceeding 6 inches in thickness. When more than one layer is required, each layer shall be shaped and compacted before the succeeding layer is placed.
- B. Placing shall be from spreader boxes or from vehicles equipped to distribute the material in a uniform layer or windrow without segregation of size. The layer or windrow shall be of such size that when spread and compacted, the layer shall have the required thickness. Spreading may be by motor grader.

#### **3.3 MIXING AND SPREADING**

- A. If after the layer of base course material has been placed and spread as indicated above, it is found that it is not uniform, it shall be thoroughly mixed to its full depth by means of power graders, traveling mixers or other mixing equipment approved by the Owner's On Site Representative or his authorized representative. During the mixing, water shall be added in the

amount necessary to provide the optimum moisture content for compaction.

- B. When mixed, the material shall be spread smoothly to a uniform thickness and in the case of the top course, to the cross section shown on the plans. Spreading and compaction shall be completed within 24 hours after mixing.
- C. Filler material, when added on the roadbed, shall be thoroughly mixed into the aggregate layer as in paragraph 3.3 A.

### **3.4 COMPACTION**

- A. Immediately following spreading and smoothing, each layer shall be compacted to its full width. Compaction effort shall continue until the base aggregate material reaches a density of at least 83 percent of its solid volume density. The solid volume density of the aggregate shall be computed on the basis of its bulk specific gravity as determined by AASHTO T 84 and T 85, and the dry weight of the aggregate. The in-place density of the compacted aggregate base shall be determined by the use of AASHTO T 191, T 205 or T 238.
- B. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregate firmly keyed. If required, water shall be uniformly sprinkled over the base materials during compaction in the amount necessary for proper consolidation.
- C. Any irregularities or depressions that develop under rolling shall be corrected by loosening the material at these places and adding or removing material until the surface is smooth and uniform.
- D. Along curbs, headers, and walls, and at all places not accessible to the roller, the base course material shall be thoroughly compacted with mechanical tampers.

### **3.5 THICKNESS REQUIREMENTS**

- A. The thickness of the completed base course shall not vary by more than  $\frac{1}{4}$ -inch from that called for in the plans. Test holes shall be dug, at the discretion of the Owner's On Site Representative or his authorized representative, at the center and sides of the base course to determine if its compacted thickness is within the allowed tolerance. Any areas not within the allowable tolerance shall be corrected by removing or adding material as necessary and shaping and compacting it as specified.
- B. The Contractor shall refill the test holes in such manner as to leave the finished surface compacted, smooth and uniform, to the satisfaction of the Engineer.

### **3.6 SURFACE FINISH REQUIREMENTS**

- A. The finished surface of the base course shall conform so nearly to that required by the plans that it will nowhere vary by more than  $\frac{1}{4}$ -inch when tested with a 10-foot straightedge. Straightedges shall be furnished by the Contractor at no extra cost and shall remain the property of the Contractor.
- B. Any areas where the surface variation exceeds the  $\frac{1}{4}$ -inch tolerance shall be reworked by the Contractor until the variation falls within this limit.
- C. The finished surface shall be rolled as necessary to maintain a smooth, even, uniformly compacted base until any surface or treatment that may be provided for in the same contract is placed thereon.

### **3.7 FIELD QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements.
- B. Determine maximum density and optimum moisture content for aggregate base material in accordance with AASHTO T180, method D.
- C. Make a minimum of three (3) field density tests on each day's final compaction on each aggregate course in accordance with AASHTO T191.
- D. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).

**END OF  
SECTION**

## **SECTION 32 12 16**

### **ASPHALT PAVING**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Preparation of subgrade.
- B. Placement of base and surface course.
- C. Protection of finishes surfaces.
- D. Field quality control.

##### **1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 31 20 00 - Earth Moving: Preparation of site for paving.
- C. Section 32 11 23 - Aggregate Base Course.
- D. Section 32 17 23 - Painted Pavement Markings.

##### **1.3 REFERENCES**

- A. Asphalt Institute Manual MS-4 - The Asphalt Handbook.
- B. Asphalt Institute Manual MS-8 - Asphalt Paving Manual.
- C. Puerto Rico Transportation and Highway Authority - Specification Section 401 Hot Plant Mix Bituminous Pavement.
- D. Puerto Rico Transportation and Highway Authority - Specification Section 703 Aggregates.
- E. AASHTO T27 - Sieve Analysis of Fine and Coarse Aggregate.
- F. AASHTO T96 - Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- G. ANSI A10.17 - Safe Operating Practice for Asphalt Pavement Construction.
- H. ASTM F1188 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin Coated Specimens.
- I. ASTM D1559 - Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

##### **1.4 QUALITY ASSURANCE**

- A. Perform all work specified herein in accordance with Specification 401 of the Puerto Rico Highway Authority.

- B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.

### **1.5 SUBMITTALS**

- A. Mix Design: Submit each type of mix design to be used on the project.

### **1.6 JOB CONDITIONS**

- A. Paving materials shall be placed only during dry weather and on dry surfaces.
- B. Traffic Control: Vehicular traffic including heavy equipment shall not be permitted in the pavement until the surface temperature has cooled to at least 120 degrees Fahrenheit. Surface temperature shall be measured by approved surface thermometers or other satisfactory methods.
- C. Conduct mixing and delivery of bituminous materials and paving operations in accordance with ANSI A10.17.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General: Asphalt paving materials shall conform to the requirements of Specification 401 of the Puerto Rico Highway Authority and to requirements of the Asphalt Institute which specifications shall apply hereto as though written in full herein.
- B. Base Course: Hot Plant Mix Bituminous Course Type B-1 (75). Thickness to be as indicated on the drawings.
- C. Surface Course: Hot Plant Mix Bituminous Course Type S-1 (75). Thickness to be as indicated on the drawings.

## **PART 3 - EXECUTION**

### **3.1 SURFACE PREPARATION**

- A. Excavate to subgrade level.
- B. Proof roll excavated surface using 10-ton rubber tired rollers or 3-ton vibratory rollers. Compact subgrade to at least 95 percent of Modified Proctor of ASTM D1557.
- C. Remove spongy and yielding materials which will not compact and replace with aggregate base course as directed by the Architect/Engineer.
- D. Prior to laying of the asphalt paving, clean underlying course of all foreign or objectionable matter with power blowers or power

brooms, supplemented by hand brooms on other cleaning method where necessary.

### **3.2 PLACEMENT - BASE COURSE**

- A. Spread aggregate in continuous layers so that it will compact to required thickness.
- B. Compact with power roller weighing at least 10 tons. Compact from sides to center. Along curbs, headers or other areas not accessible to roller compact with mechanical or hand tampers.

### **3.3 PLACEMENT - SURFACE COURSE**

- A. Spread surface course in continuous layers so that it will compact to required thickness.
- B. Roll continuously from outer edges to center. Continue rolling to uniform texture and compaction, true to level and cross section. Trim edges neatly.

### **3.4 THICKNESS OF ASPHALT PAVING**

- A. In place compacted thickness will not be acceptable if exceeding allowable variation from thickness shown on drawings, when tested in conformance of Specification 401 of the Puerto Rico Highway Authority.

### **3.5 SURFACE SMOOTHNESS**

- A. Test finished surface of each asphalt paving course for smoothness, using a 10-foot straightedge applied parallel to and at right angles to center line of paved areas.
- B. Surface will not be acceptable if exceeding the following:
  - 1. Base Course: 1/4 inch in 10 feet.
  - 2. Surface Course: 1/4 inch in 10 feet.
  - 3. Crowned Surfaces: Test crowned surfaces with a crown template, centered and at right angles to the crown. Surfaces will not be acceptable if varying more than 1/4-inch from the template.

### **3.6 FINISHED GRADES**

- A. The finish grades of each course placed shall not vary from the finish elevations, profiles, and cross sections indicated on the drawings by more than 1/2 inch. The finished surface of the final wearing course will be tested by the Architect/Engineer by running lines of levels at intervals of 25 feet or less longitudinally and transversely to determine elevations of completed pavement. Within 45 days after completion of final placement, the Contractor shall perform a level survey at the specified grid spacing and plot the results on a plan drawn to the same scale as the drawings.



Elevating not in conformance with the specified tolerance shall be noted on the plan in an approved manner. The survey shall be performed by a Registered Land Surveyor paid by the Contractor. The Contractor shall correct deficient paved areas by removing existing work and replacing with new materials meeting the specifications without additional cost to the Owner. Skin patching for correcting low areas will not be permitted.

### **3.7 CLEANING AND PROTECTION**

- A. Any foreign material which may have accumulated on the surface of any course shall be removed before the course is rolled or subsequent courses are placed thereon.
- B. Protect curbs, bumpers, buildings, fencing, automobiles, etc., from airborne or splashed bituminous material.
- C. Maintain roads used by construction vehicles and personnel passable throughout the construction period.
- D. Remove dirt, mud, debris and other objectionable materials from roads at the end of the job.

### **3.8 FIELD QUALITY CONTROL**

- A. Aggregate: Sample and test aggregate in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
- B. Temperature: Check temperatures of each load of asphalt concrete at mixing plant and at site of paving operation.
- C. Density: Make a minimum of two (2) field density tests in accordance with ASTM D1188 and comparative 50-blow Marshall tests in accordance with ASTM D1559 of asphalt base and surface course for each day's paving operation.

**END OF  
SECTION**

**SECTION 32 13 13**

**CONCRETE PAVING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Subgrade preparation.
- B. Concrete paving and sidewalks, curbs, curb and gutter, cross gutter, wheelchair ramps and paving with reinforcement, formed joints, curing and finishing.
- C. Cleaning and protection.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 31 20 00 - Earth Moving: Preparation of site, for paving.
- C. Section 32 11 23 - Aggregate Base Course.
- D. Section 32 32 16 - Asphalt Paving.
- E. Section 32 17 23 - Painted Pavement Marking.

**1.3 REFERENCES**

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- C. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C94 - Ready Mixed Concrete.
- F. ASTM C150 - Portland Cement.
- G. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

**1.4 QUALITY ASSURANCE**

- A. Section 01 40 00 - Quality requirements.
- B. Perform work in accordance with ACI 301.
- C. Obtain materials from same source throughout.

**1.5 SUBMITTALS**

- A. Section 01 33 00 - Submittal procedures.

- B. Submit product data of all material specified herein.

## **PART 2 - PRODUCTS**

### **2.1 MLTERIALS - CONCRETE**

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

### **2.2 MATERIALS - FORMWORK**

- A. Conform to ACI 301.
- B. Wood or Steel form material, profiled to suit conditions.

### **2.3 MATERIALS - REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615; 60 ksi yield grade.

### **2.4 MATERIALS - ACCESSORIES**

- A. Curing Compound: ASTM C309, Type 2, Class A. Established standard: Sealtight Liquid Membrane Concrete Curing Compound WP40 as manufactured by W. R. Meadows, Inc.
- B. Joint Filler: Sealtight Cera-Rod Non-Gassing, Heat Resistant Backer Rod as manufactured by W. R. Meadows, Inc.
- C. Joint Sealant (Concrete Paving): ASTM D1850; FS SS-S-158.
  - 1. Sealtight #158 Cold Applied Rubberized Asphalt Sealer; W.R. Meadows, Inc.
- D. Joint Sealant (Sidewalks): ASTM C920, Type M. Grade P, Class 25, Use T.
  - 1. Sealtight Gardox Horizontal Joint Sealant; W.R. Meadows, Inc

### **2.5 CONCRETE MIX**

- A. Mix concrete in accordance with ASTM C94.
- B. Provide concrete of the following characteristics:
  - 1. Paving:
    - a. Compressive Strength: 4000 psi
    - b. Slump: 4 inches maximum.
    - c. Water Cement Ratio: 0.50 maximum.
  - 2. Sidewalks, Headwalls & Ramps:
    - a. Compressive Strength: 3000 psi

- b. Slump: 4 inches maximum.
- c. Water Cement Ratio: 0.50 maximum.
- 3. Cross Gutter
  - a. Compressive Strength: 4000  
psi b. Slump: 4 inches  
maximum.
  - c. Water Cement Ratio: 0.50 maximum.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify compacted subgrade and/or granular base is ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Beginning of installation means acceptance of existing conditions.

#### **3.2 PREPARATION**

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Notify Architect/Engineer minimum 24 hours prior to  
commencement  
of concreting operations.

#### **3.3 INSTALLATION- FORMING**

- A. Place and secure forms to correct location, dimension,  
and profile.
- B. Assemble formwork to permit easy stripping and dismantling  
without damaging concrete.
- C. Place joint fillers vertical in position, in straight  
lines.  
Secure to formwork during concrete placement.

#### **3.4 INSTALLATION - REINFORCING STEEL**

- A. Provide reinforcement and doweled joints as indicated on  
the drawings.

#### **3.5 INSTALLATION - JOINTS**

- A. Construction Joints: At the end of pours and at location where  
placement operations are stopped for a period of more than 1/2  
hour, except where such pours terminate at expansion joints.

Construct joints as shown on the drawings or, if not shown, use standard metal keyway-section forms.

- B. Expansion Joints: Provide premolded joint filler for expansion joints of concrete surfaces abutting concrete curbs, curb and gutters, cross gutters, inlets, curb inlets, manholes, structures, walls, around drains, hydrants, lamps, sign poles, and other stationary objects, between sidewalks and driveways. Extend joint filler full width and not less than 1/2 inch or more than 1 inch below the finished pavement surface where joint sealer is indicated. Furnish joint filler in one piece lengths for the full width being placed. Where more than one length is required, lace or clip joint filler sections together. Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material.

1. Provide expansion joints every 60 feet maximum apart on sidewalks.

- C. Control Joints: Form tooled joints in the fresh concrete by grooving the top portion with a recommended cutting tool and finish edges with a jointer. Cut 1/3 into depth of slab.

1. At every 3 feet on sidewalks

### **3.6 PLACING CONCRETE**

- A. Place concrete in accordance with ACI

301. B. Hot Weather Placement: ACI 301.

- C. Ensure reinforcement and formed joints are not disturbed during concrete placement.

- D. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

### **3.7 FINISHING**

- A. Paving: Light Broom.

- B. Sidewalks: Floated finish (magnesium float) and then provide a light broom finish, radiused and trowel joint edges. Provide a transverse slope of 1/4 inch per foot. Broom transverse to traffic.

- C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

### **3.8 PREPARATION OF JOINTS**

- A. The following joints shall be sealed:

1. Expansion joints of sidewalks.

- B. Immediately before installation of the sealant, the joints shall be thoroughly cleaned until all laitance, curing compound, and protrusions of the hardened concrete are removed from the sides and upper edges of the joint space. The cap shall not be removed until immediately prior to sealing.

### **3.9 FIELD QUALITY CONTROL**

- A. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

### **3.10 PROTECTION**

- A. Immediately after placement, protect concrete from premature drying, excessive hot temperatures, and mechanical injury.
- B. Replace broken or defective paving and sidewalks as directed by the Site Representative.
- C. Sweep concrete surfaces and wash free of stains, discoloration, dirt, and any other foreign material as needed.

**END OF  
SECTION**

## **SECTION 32 16 14**

### **CONCRETE CURBS**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Verification of compacted subgrade.
- B. Preparation of base.
- C. Installation of formwork.
- D. Installation of construction, contraction and expansion joints.
- E. Placement of concrete.
- F. Finishing.
- G. Sealing of joints.
- H. Field quality control.
- I. Protection of installed work.

##### **1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 03 30 00 - Cast In Place Concrete.
- C. Section 31 23 16 - Earthwork.

##### **1.3 REFERENCES**

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- C. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C94 - Ready Mixed Concrete.
- F. ASTM C150 - Portland Cement.
- G. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- H. ASTM C494 - Chemical Admixtures for Concrete.
- I. ASTM D1752 - Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

#### **1.4 QUALITY ASSURANCE**

- A. Section 01 40 00 - Quality Requirements.
- B. Perform work in accordance with ACI 301.
- C. Obtain cementitious materials from same source throughout.

#### **1.5 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit data on joint filler, sealants, admixtures and curing compounds.
- C. Concrete Mix Design: Submit concrete mix design in accordance with Section 03 30 00.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS - CONCRETE**

- A. Cement: ASTM C150 Normal-Type I. Portland type, gray color.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.
- D. Chemical Admixtures: ASTM C494, Type A - Water Reducing; Type B - Retarding; Type C - Accelerating; Type D-Water Reducing and Retarding; Type E - Water Reducing and Accelerating; type F - Water Reducing, High Range Admixtures; Type G - Water Reducing, High Range, and Retarding Admixtures.

#### **2.2 MATERIALS - FORMWORK**

- A. Conform to ACI 301.
- B. Wood or Steel form material, profiled to suit conditions.

#### **2.3 MATERIALS - ACCESSORIES**

- A. Curing Compound: ASTM C309, Type 2, Class A. Established standard: Sealtight Liquid Membrane Concrete Curing Compound WP40 as manufactured by W. R. Meadows, Inc.
- B. Joint Filler: ASTM D1752; Sealtight Cera-Rod Non-Gassing, Heat Resistant Backer Rod as manufactured by W. R. Meadows, Inc.
- C. Joint Sealant: ASTM D1850; FS SS-S-158.
  - 1. Sealtight #158 Cold Applied Rubberized Asphalt Sealer; W.R. Meadows, Inc.

#### **2.4 CONCRETE MIXES**

- A. Mix concrete in accordance with ASTM C94.
- B. Provide concrete of the following characteristics:



1. Curbs:
  - a. Compressive Strength: 3000 psi
  - b. Slump: 4 inches maximum at point of placement.
  - c. Water Cement Ratio: 0.50 maximum.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify compacted subgrade is ready to support curbs.
- C. Verify gradients and elevations of base are correct.
- D. Beginning of installation means acceptance of existing conditions.

#### **3.2 PREPARATION**

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

#### **3.3 INSTALLATION - FORMWORK**

- A. Place and secure forms to correct location, dimension, and profile.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint fillers vertical in position, in straight lines. Secure to formwork during concrete placement.

#### **3.4 INSTALLATION - FORMED JOINTS**

- A. Construction Joints:
  1. At the end of pours and at location where placement operations are stopped for a period of more than 1/2 hour, except where such pours terminate at expansion joints.
  2. Construct joints as shown on the drawings or, if not shown, use standard metal keyway-section forms.
- B. Contraction Joints:
  1. Locate contraction joints at every 10 feet on centers for curb.
  2. Form tooled joints in the fresh concrete by grooving the top portion with a recommended cutting tool and finish edges with a jointer. Cut 1/3 into depth of slab.

### **3.5 PLACEMENT - CONCRETE**

- A. Place concrete in accordance with ACI 301.
- B. Hot Weather Placement: ACI 301.
- C. Place concrete using the slip form technique.
- D. Ensure formed joints are not disturbed during concrete placement.
- E. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

### **3.6 FINISHING**

- A. Curbs: Light broom. Work edges of gutter, back top edge of curb, and transverse joints, with an edging tool, and round to 1/4 inch radius.
- B. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

### **3.7 INSTALLATION - JOINT SEALING**

- A. The following joints shall be sealed:
  - 1. Contraction joints of curb.
- B. Immediately before installation of the sealant, the joints shall be thoroughly cleaned until all laitance, curing compound, and protrusions of the hardened concrete are removed from the sides and upper edges of the joint space. The cap shall not be removed until immediately prior to sealing.

### **3.8 FIELD QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements.
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken. Refer to Section 03 30 00.

### **3.9 PROTECTION OF INSTALLED WORK**

- A. Immediately after placement, protect concrete from premature drying, excessive hot temperatures, and mechanical injury.
- B. Replace broken or defective curbs as directed by the Owner's on Site Representative. Patching of curbs with plaster or grout is not permitted.
- C. Sweep concrete surfaces and wash free of stains, discoloration, dirt, and any other foreign material as needed.

**END OF  
SECTION**

## **SECTION 32 17 13**

### **PRE-CAST CONCRETE PARKING BUMPERS**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Installation of pre-cast concrete parking bumpers.
- B. Anchorage.

##### **1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 03 63 13 - Nonshrink Grout.

##### **1.3 REFERENCES**

- A. ANSI/ASTM C150 - Portland Cement.
- B. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- C. ASTM C33 - Concrete Aggregates.

##### **1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide unit configuration, dimensions.

##### **1.5 COORDINATION**

- A. Section 01 30 00 - Administrative Requirements.
- B. Coordinate the work with pavement placement.

#### **PART 2 - PRODUCTS**

##### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Atlantic Pipe Co.
- B. Puerto Rico Precast Co.

##### **2.2 MATERIALS - PARKING BUMPERS**

- A. Cement: ANSI/ASTM C150, Portland Type I - Normal gray color.
- B. Concrete Materials: ASTM C33 water and sand.
- C. Reinforcing Steel: ASTM A615, deformed steel bars; unfinished finish, strength and size commensurate with precast unit design.
- D. Concrete Mix: Minimum 5000 psi 28 day strength.

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- E. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
- F. Embed reinforcing steel, and drill or sleeve for two dowels.
- G. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

### **2.3 MATERIALS - ACCESSORIES**

- A. Dowels (Asphalt Paving): Steel, unfinished 1/2 inch diameter, 18 inch long, pointed tip.

### **2.4 CONFIGURATION**

- A. Nominal Size: 4½ inches high, 9 inches wide, 6 feet long.
- B. Profile: Manufacturer's standard.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION - PARKING BUMPERS**

- A. Install units without damage to shape or finish. Replace damaged units.
- B. Install units in alignment with adjacent work.

### **3.2 ANCHORAGE - PARKING BUMPERS**

- A. Asphalt Paving: Fasten units in place with 2 or 3 dowels per bumper.
  - Top of dowels shall be one inch below bumper top surface.
  - Fill hole solidly with non-shrink grout.

**END OF  
SECTION**

## **SECTION 32 17 23**

### **PAINTED PAVEMENT MARKINGS**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Layout of the work.
- B. Application of pavement markings.
- C. Tolerances.
- D. Corrective measures.
- E. Schedule of pavement markings.

##### **1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 32 12 16 - Asphalt Paving.

##### **1.3 REFERENCES**

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. FS TT-P-115E - Paint, Traffic, Highway, White, and Yellow.

##### **1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Technical data sheets indicating manufacturer's catalog member, paint type description, and VOC content for each paint type specified.
- C. Certificates: Manufacturer certificate that Products meet or exceed specified requirements.
- D. Test Reports: Manufacturer Material Safety Data Sheets (MSDS) for each paint type specified.

##### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 60 00 - Product Requirements.
- B. Deliver traffic paint in unbroken original packages bearing the manufacturer's name and brand designation, specification number, batch number, color, and manufacturer's instructions for application.
- C. Restrict storage of paint and the mixing of coatings to the locations directed.

- D. Provide storage facilities at the jobsite for maintaining materials at temperatures recommended by the manufacturer.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - TRAFFIC PAINT**

- A. Ready-mixed, pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispensing to a complete homogeneous mixture providing good flowing and breaking properties capable of drying or curing free of streaks or sags. Dry to traffic and touch in two hours.
- B. Traffic Paint: Flat, water base, acrylic
  - 1. First Coat:
    - a. Devoe: Traffic Line Interior - Exterior Water Based Traffic Marking Paint, 416XX; MDF 7 mils.
    - b. Glidden: Ultra Hide Waterbased Traffic Paint, MDF 7 mils.
    - c. Sherwin-Williams: Setfast Vinyl Acrilyc Waterbase Traffic Marking Paint, MDF 7 mils.
  - 2. Second Coat:
    - a. Devoe: Traffic Line Interior - Exterior Water Based Traffic Marking Paint, 416XX, MDF 7 mils.
    - b. Glidden: Ultra Hide Waterbased Traffic Paint, MDF 7 mils.
    - c. Sherwin-Williams: Setfast Vinyl Acrilyc Waterbase Traffic Marking Paint, MDF 7 mils.

## **PART 3 - EXECUTION**

### **3.1 EQUIPMENT**

- A. Use atomizing spray-type equipment, guides, and templates designed for the purpose and designed to apply strips with clear-cut edges and uniform thickness for the coverage specified.

### **3.2 LAYOUT OF THE WORK**

- A. Provide sufficient control points to permit application of parking space delineations as shown, on the drawings, within the tolerances specified.

### **3.3 APPLICATION - PAVEMENT MARKINGS**

- A. Surface Conditions: Do not apply paint to new asphaltic paving surfaces until 7 days after pavement is placed.
- B. Weather: If the pavement is wet, allow the surface to dry for a minimum of 8 hours after it appears surface dry.

- C. Cleaning: Clean the surface of areas to be painted of dust, dirt, laitance, oil, curing compounds, and any other foreign substances that may impair the bond of traffic paint to either asphalt or concrete paving.
- D. Traffic Maintenance: Furnish, install, and maintain traffic cones, barricades, lights, and other protective devices required to protect traffic, workmen, and completed pavement marking, and remove when marking has set to such degree that they will not be damaged.
- E. Scheduling of the Work: Schedule marking operations to permit paint to set and harden before the area is open to traffic.
- F. Paint Coverage: Apply paint evenly to the pavement surface to be coated at the rate of 100 square feet per gallon.
- G. Painting: Apply paint during daylight hours. Suspend painting operations when wind conditions are such that blowing spray applied paint and deposit of dust on new applied paint is unlikely. Clean painting equipment, guides, and templates at the end of each day's work or more often, if necessary, to obtain application of pavement marking of the quality specified.
- H. Drying Time: The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.

### **3.4 TOLERANCES**

- A. Width and Length of Lines: Minus zero, plus 1/8 inch.

### **3.5 CORRECTIVE MEASURES**

- A. Repair or remove, and reapply any pavement markings that fail to satisfy the requirements indicated.
- B. Submit proposed means of cleaning, removing, or obliterating unsatisfactory markings for approval prior to commencing corrective work.
- C. Use materials for cleaning pavement of spills, spatter, or overspray that will not insure the paved surface.

### **3.6 SCHEDULE OF PAVEMENT MARKINGS**

- A. Paint the following items with colors indicated below:
  - 1. Lane Stripping Where Separating Traffic in Opposite Directions: Yellow.
  - 2. Parking Stalls: Yellow.

3. Handicap Signs & Parking Stallas: Blue.

**END OF  
SECTION**



**SECTION 32 91 19**

**LANDSCAPE GRADING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Examination of subgrade.
- B. Surface preparation.
- C. Placement of topsoil.
- D. Protection.
- E. Schedule of topsoil placement areas.
- F. Field quality control.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 32 92 19 - Hydroseeding: Finish ground cover.

**1.3 REFERENCES**

- A. ASTM D2974 - Test methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
- B. U. S. Department of Agriculture (DOA) - Soil Survey Investigation Report (SSIR) No. 1, Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples, Soil Conservation Service.

**1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Procedures for Submittal.
- B. Submit five copies of topsoil composition tests in accordance with DOA SSIR.

**PART 2 - PRODUCTS**

**2.1 MATERIAL - TOPSOIL**

- A. Topsoil:
  - 1. On-site topsoil or off-site topsoil.
  - 2. Fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth.
  - 3. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site.
  - 4. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4 inches; do not

obtain from bogs or marshes. Composition shall be from 5 to 20 percent organic matter as determined by the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR.

5. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4-inch screen. Other components shall conform to the following items:

Ph	5.5 to 7.0
Solubre Salts	600 ppm maximum
Silt	25 to 50
Clay	10 to 30
Sand	20 to 35

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify building and trench backfilling has been inspected.
- C. Verify substrate base has been contoured and compacted.

#### **3.2 SUBSTRATE PREPARATION**

- A. Eliminate uneven areas and low spots.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove subsoil contaminated with petroleum products.
- C. Scarify subgrade to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment is used for hauling and spreading topsoil and has compacted subsoil.

#### **3.3 PLACING TOPSOIL**

- A. Place topsoil in areas where hydroseeding is indicated or specified to thickness as scheduled. Place topsoil during dry weather.
- B. Fine grade topsoil eliminating rough or low areas. Maintain profiles and contour of subgrade.
- C. Remove roots, weeds, rocks and foreign material while spreading.
- D. Manually spread topsoil close to trees and plants to prevent damage.
- E. Lightly compact placed topsoil.
- F. Remove surplus subsoil and topsoil from site.
- G. Leave stockpile area and site clean and raked, ready to receive landscaping.

#### **3.4 TOLERANCES**

- A. Section 01 40 00 - Quality Requirements.

- B. Top of Topsoil: Plus or minus 1/2 inch.

### **3.5 PROTECTION**

- A. Protect landscaping and other features remaining as final work.
- B. Protect existing structures, fences, sidewalks, utilities, paving and curbs.

### **3.6 SCHEDULE OF INSTALLATION - TOPSOIL**

- A. Compacted topsoil thickness at the following areas:
  - 1. Seeded Grass: 6 inches.

### **3.7 FIELD QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements.
- B. Independent testing laboratory will test topsoil for organic materials, pH, phosphate, potash content and gradation of particles.
  - 1. Test for organic materials by using ASTM D2974.
  - 2. Determine percent of silt, sand, clay, and foreign materials such as rocks, roots and vegetation.

**END OF  
SECTION**

## **SECTION 32 92 19**

### **HYDROSEEDING**

#### **PART 1 - GENERAL**

##### **1.1 SECTIONS INCLUDES**

- A. Examination of prepared soil base.
- B. Installation of fertilizer.
- C. Installation of hydroseeding.
- D. Seed protection.
- E. Maintenance.

##### **1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 32 91 16 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.

##### **1.3 REFERENCES**

- A. FS O-F-241 - Fertilizers, Mixed, Commercial

##### **1.4 DEFINITIONS**

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

##### **1.5 QUALITY ASSURANCE**

- A. Section 01 40 00 - Quality Requirements.
- B. Provide seed mixture in containers showing percentage of seed mix, year or production, net weight, date of packaging, and location of packaging.

##### **1.6 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Procedure for submittals.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

## **1.7 REGULATORY REQUIREMENTS**

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 60 00 - Product Requirements.
- B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- C. Deliver fertilized in waterproof bags showing weight, chemical analysis, and name of manufacturer.

## **1.9 MAINTENANCE SERVICE**

- A. Section 01 73 00 - Execution and Cleanout Requirements.
- B. Furnish maintenance of seeded areas for three (3) months from Date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 SEED**

- A. Seed:
  - 1. Bermuda Grass

### **2.2 MATERIALS - TOPSOIL**

- A. Topsoil: As specified in Section 32 91 16.

### **2.3 MATERIALS - ACCESSORIES**

- A. Mulching Material: Hermlock species wood cellulose fiber, dust or chip form, free of growth or germination inhibiting ingredients.
- B. Fertilizer: FS O-F-241, Type I, Grade A; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.
- C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.
- D. Herbicide: As recommended by Landscape Architect.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify that prepared soil base is ready to receive the work of this Section.

### **3.2 FERTILIZING**

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

### **3.3 INSTALLATION - HYDROSEEDING**

- A. Apply seeded slurry with a hydraulic seeder at a rate of 2 lbs per 1000 sq ft evenly in two intersecting directions.
- B. Do not hydroseed area in excess of that which can be mulched on same day.
- C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
- D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

### **3.4 SEED PROTECTION**

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 6 inches. Space stakes at 6 inches.

### **3.5 MAINTENANCE**

- A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings after mowing and trimming.
- D. Water to prevent grass and soil from drying out.
- E. Roll surface to remove minor depressions or irregularities.

- F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- G. Immediately reseed areas which show bare spots.
- H. Protect seeded areas with warning signs during maintenance period.

**END OF  
SECTION**

**SECTION 32 93 00**

**EXTERIOR PLANTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Preparation of subsoil and topsoil.
- B. Topsoil bedding.
- C. Trees, plants, and ground cover.
- D. Mulch.
- E. Fertilizer.
- F. Pruning.
- G. Maintenance.

**1.2 RELATED SECTIONS**

- A. Division 1 Sections - General Requirements.
- B. Section 31 20 00 - Earthwork.
- C. Section 32 91 19 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the Work of this section.
- D. Section 32 92 23 - Sodding.

**1.3 REFERENCES**

- A. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices.
- B. ANSI Z60.1 - Nursery Stock.

**1.4 DEFINITIONS**

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Weeds: Vegetative species other than specified species to be established in given area.
- C. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.



## **1.5 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit list of plant material sources, data for fertilizer and other accessories.
- C. Submit minimum 10 oz sample of topsoil proposed. Forward sample to testing laboratory in sealed containers to prevent contamination.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Include pruning objectives, types and methods; types, application frequency, and recommended coverage of fertilizer.

## **1.7 QUALITY ASSURANCE**

- A. Tree Pruning: ANSI A300 Pruning Standards for Woody Plants.

## **1.8 QUALIFICATIONS**

- A. Nursery: Company specializing in growing and cultivating plants with three years documented experience.
- B. Installer: Company specializing in installing and planting plants with three years documented experience.
- C. Tree Pruner: Company specializing in performing work of this section with minimum three years documented experience.
- D. Maintenance Services: Performed by installer.

## **1.9 PRE-INSTALLATION MEETINGS**

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

## **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Protect and maintain plant life until planted.
- D. Deliver plant life materials immediately prior to placement. Keep plants moist.

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- E. Plant material damaged as a result of delivery, storage or handling will be rejected.

#### **1.11 ENVIRONMENTAL REQUIREMENTS**

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install plant life when ambient temperatures may rise above 90 degrees F.
- C. Do not install plant life when wind velocity exceeds 30 mph.

#### **1.12 COORDINATION**

- A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
- B. Install plant life after and coordinate with installation of underground irrigation system piping and watering heads specified in Section 02811.

#### **1.13 WARRANTY**

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish one year manufacturer warranty for trees, plants, and ground cover.

#### **1.14 MAINTENANCE SERVICE**

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.
- B. Maintain plant life for three months after Date of Substantial Completion.
- C. Maintain plant life immediately after placement until plants are well established and exhibit vigorous growing condition. Continue maintenance until termination of warranty period.
- D. Maintenance includes:
  - 1. Cultivation and weeding plant beds and tree pits.
  - 2. Applying herbicides for weed control. Remedy damage resulting from use of herbicides.
  - 3. Remedy damage from use of insecticides.
  - 4. Irrigating sufficient to saturate root system.
  - 5. Pruning, including removal of dead or broken branches.
  - 6. Disease control.

7. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.
8. Replacement of mulch.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - TREES, PLANTS, AND GROUND COVER**

#### **A. Planting Stock:**

1. Species: In accordance with Standardized Plant Names, official code of American Joint Committee on Horticulture Nomenclature.
2. Identification: Label individual plants or each bundle of plants when tied in bundles.
3. Plants: No. 1 Grade conforming to "American Standard for Nursery Stock" of American Association of Nurserymen (AAN); well-branched, vigorous and balanced root and top growth; free from disease, injurious insects, mechanical wounds, broken branches, decay and other defects.
4. Trees: Furnish with reasonably straight trunks, well balanced tops, and single leader.
5. Deciduous plants: Furnish in dormant state, except those specified as container grown.

- B. Trees, Plants and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

### **2.2 MATERIALS - SOILS**

- A. Topsoil: As specified in Section 32 91 19.

### **2.3 MATERIALS - SOIL AMENDMENT**

- A. When soil tests indicate soil amendment, apply soil conditioners or fertilizers to amend soil to specified conditions.
1. Tree Fertilizer: Containing fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis.
- B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.
- C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.

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- D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.
- E. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of plants.
- F. Herbicide: As recommended by Landscaping Contractor.
- G. Pesticide: As recommended by Landscaping Contractor.

#### **2.4 MATERIALS - MULCH**

- A. Mulching Material: Composted, shredded hardwood bark, dark brown in color.
- B. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

#### **2.5 ACCESSORIES**

- A. Wrapping Materials: Burlap.
- B. Stakes: Softwood lumber, pointed end. Mild steel angle, galvanized, pointed end.
- C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.
- D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.
- E. Decorative Cover: Fir bark chips.
- F. Membrane: 20 mil thick, clear polyethylene.
- G. Wrapping: Waterproof fabric.
- H. Tree Protectors: Metal or Plastic with galvanized rings.

#### **2.6 TOP SOIL**

- A. Top Soil: Uniform mixture of 1 part peat and 3 parts topsoil by volume.

#### **2.7 SOURCE QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Test and analyze imported or existing topsoil.
- C. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter; pH value.

- D. Provide recommendation for fertilizer and soil amendment application rates for specified planting as result of testing.
- E. Testing is not required when recent tests are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify prepared subsoil and planters are ready to receive work.
- C. Saturate soil with water to test drainage.

#### **3.2 PREPARATION OF SUBSOIL**

- A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoil to depth of 3 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Dig pits and beds three times wider than plant root system.

#### **3.3 PLACING TOPSOIL**

- A. Spread topsoil to minimum depth of 4 inches over area to be planted. Rake smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- E. Install topsoil into pits and beds intended for plant root balls, to minimum thickness of 6 inches.

#### **3.4 FERTILIZING**

- A. Apply starter fertilizer at rate recommended by Landscape Contractor.
- B. Apply after initial raking of topsoil.

- C. Mix thoroughly into upper 2 inches of topsoil.
- D. Lightly water soil to aid dissipation of fertilizer.

### **3.5 PLANTING**

- A. Place plants for best appearance for review and final orientation by Architect/Engineer.
- B. Set plants vertical.
- C. Remove non-biodegradable root containers.
- D. Set plants in pits or beds, partly filled with prepared plant mix, at minimum depth of 6 inches under each plant. Remove burlap, ropes, and wires, from top half of root ball.
- E. Place bare root plant materials so roots lie in natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.
- F. Saturate soil with water when pit or bed is half full of topsoil and again when full.

### **3.6 PLANT RELOCATION AND RE-PLANTING**

- A. Relocate plants as indicated by Architect/Engineer.
- B. Ball or pot removed plants when temporary relocation is required.
- C. Replant plants in pits or beds, partly filled with prepared topsoil mixture, at minimum depth of 6 inches under each plant. Remove loosen burlap, ropes, and wires, from top half of root ball.
- D. Place bare root plant materials so roots lie in natural position. Backfill soil mixture in 6 inch layers. Maintain plant materials in vertical position.
- E. Saturate soil with water when pit or bed is half full of topsoil and again when full.

### **3.7 INSTALLATION OF ACCESSORIES**

- A. Place decorative cover, where indicated on Drawings, at base of plant to nominal diameter of 24 inches.
- B. Wrap deciduous shade and flowering tree trunks and place tree protectors.

### **3.8 PLANT SUPPORT**

- A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

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Tree Caliper	Tree Support Method
1 inch	1 stake with one tie
1 - 2 inches	2 stakes with two ties
2 - 4 inches	3 guy wires with eye bolts and turn buckles
Over 4 inches	4 guy wires with eye bolts and turn buckles

### **3.9 TREE PRUNING**

- A. When pruning trees is required, lightly prune trees in accordance with ANSI A300 Maintenance Pruning Type: Crown Cleaning.

### **3.10 FIELD QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

### **3.11 SCHEDULE - PLANT LIST**

- A. Refer to Landscaping Drawings.

**END OF SECTION**



# ***ADVANCED SOIL ENGINEERING***

GEOTECHNICAL CONSULTING ENGINEERING  
CONCRETE AND MATERIAL TESTING LABORATORIES

*ON THE GEOTECHNICAL EXPLORATION  
PERFORMED AT THE SITE OF THE PROPOSED PARKING  
LOT AREA AT BUILDING T-0772-0-66 (LOCKHEED MARTIN),  
CAMASEYES WARD, AGUADILLA, PUERTO RICO*

*SUBMITTED TO:*

*JTO ENGINEERING*

*C/O: JOSUÉ TORRES ORTIZ, P.E. – PROJECT DESIGNER*

*BY:*

*NELSON MUÑOZ, P.E.*

*ADVANCED SOIL ENGINEERING  
GEOTECHNICAL CONSULTING ENGINEERS*

*OTOBER 24, 2019*

*FILE NO. 1882*



**ON THE GEOTECHNICAL EXPLORATION  
PERFORMED AT THE SITE OF THE PROPOSED PARKING  
LOT AREA AT BUILDING T-0772-0-66 (LOCKHEED MARTIN),  
CAMASEYES WARD, AGUADILLA, PUERTO RICO**

**1.0 INTRODUCTION:**

*This report covers the results of a geotechnical exploration conducted at the site of the proposed Parking Lot Area at Building T-0772-0-66 (Lockheed Martin), Camaseyes Ward, Aguadilla, Puerto Rico.*

*The investigation was made following instructions from Josué Torres Ortiz, PE, from JTO Engineering, project designer. The study was performed in general accordance with the scope of work included in our Proposal No.17, dated June 27, 2019.*

*This report has been prepared to summarize the data obtained during this study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction of the proposed structure are included in the report.*

*This report has been prepared for the exclusive use of the owner, their designers and others involved in the construction and preparation of the plans and specifications of the project.*

## 2.0 SITE LOCATION AND PROJECT DESCRIPTION:

The site of the proposed project is located at State Road PR 107 interior, Camaseyes Ward, Aguadilla, Puerto Rico. According to information provided to this office, the proposed project considers the construction of a new parking lot. The following **Figure 1** shows portion of US Geological Survey Service Topographic Map of the Aguadilla Quadrangle with the site location enclosed.



**Figure 1: Site Location Map**

### **3.0 SCOPE OF INVESTIGATION:**

#### Field Exploration:

*A joint visit was conducted with the project designer to confirm boring locations. All boring locations were adjusted based on utilities interference and client's requests. The field exploration consisted of drilling three (3) test borings along the proposed construction area. The location borings was as close as possible to the staked locations, subject to utilities interference and drilling convenience. Test borings were drilled to depths varying from 6.0 to 12.0 ft. with a total footage of 24.0 lin. ft.*

*The borings were performed using the rotary hollow-stem auger technique in accordance with ASTM D 1452. Samples were obtained using the "Standard Penetration Test (SPT)", as specified in ASTM D 1586.*

*Please refer to **Appendix No. 1 (Boring Location Map)**, for boring location.*

### **4.0 SUBSOIL CONDITIONS:**

*The general subsoil conditions as disclosed from the test borings drilled at the subject site consist of strong brown silty clay trace sand on boring No.1, strong brown sandy clay some limestone fragments on boring No.2, extending both at a depth of 2.0 ft; and a man-made fill deposit composed of pale yellow sandy limestone fragments trace silt on boring No.3, extending to a depth of 4.0 ft., below existing ground elevation.*

*The above described layer is resting over brownish yellow limestone fragments some sand – clay on boring No.1, strong brown silty clay trace sand on boring No.2, extending both at a depth of 4.0 ft.; and strong brown silty clay on boring No.3, extending to a depth of 10.0 ft.*

*Underlying the aforementioned stratum and extending to the end of the test holes, the exploratory work shows very pale brown limestone formation decomposed into rock fragments.*

*The ground water level of the explored site was not encountered within the depths drilled during the time of our field exploratory work, thus indicating that it must be present at a greater depth.*

*Test boring refusal, presumably bedrock, was met at a depth of 6.0 ft. on boring No.1 and No.2, and 10.0 ft. on boring No.3 below existing grade. Core drilling work must be request for proper rock description and parameters for the bedrock.*

*The ground water level of the explored site was not encountered within the depths drilled during the time of our field exploratory work, thus indicating that it must be present at a greater depth. However, temporary bodies of water or perched water might be or be found entrapped within the fill deposit or between the zone of transition of fill deposit and virgin soil.*

*Subsurface water observations were limited to the depths explored using dry auger drilling techniques and within these depths, groundwater was not observed. The borehole was backfilled upon completion of the water level measurements.*

*The absence of free water at these boring locations should not necessarily be construed that subsurface water is not present at the site or is deeper than the boring depth. The short-term field observations generally do not permit an accurate evaluation of the subsurface water levels at this location and should not be interpreted as a groundwater study. It is not unusual to encounter groundwater in the granular silty and clayey sands during and after periods of rainfall. It should be noted that the observations made during this investigation may not represent conditions at the time of construction and the presence of groundwater may affect certain construction activities and long-term performance of the foundations. The quantity of transient water is variable and is highly dependent on climatic conditions before and during construction. The foundation contractor should check the subsurface water conditions just prior to foundation excavation activities.*

*The above information corresponds to a general description of the subsoil conditions of the area, however, for detailed description regarding the soil profile, field and laboratory test results, please refer to **Appendix No. 2 (Boring Logs)**. For detailed description of the procedures followed for the drilling of the test borings and laboratory testing, please refer to **Appendix No. 3 (Field and Laboratory Testing Procedures)**.*



## 5.0 U.S. GEOLOGICAL SURVEY MAPS:

The Department of the Interior through its U.S. Geological Survey offices published a Geologic Map No. I-569 The Aguadilla Quadrangle.



**Figure 2: U.S. Geological Survey Map**

*This was surveyed by Watson H. Monroe and published on 1969. The proposed project lies in a formation described as:*

*QTbs – Blanket sand deposits: Mixtures of fine to medium grained quartz sand and light to moderate brown clay; all material mapped in this category has been lowered by solution of underlying limestone (Briggs, 1966). 0-30? m thick.*

*Tay – Aymamón Limestone: Lower member, white to very pale orange, locally pale-yellow and grayish-pink very pure fossiliferous limestone; generally indurated into finely crystalline rather dense limestone (Monroe, 1966), locally a recemented solution breccia. Surface has been dissolved into abundant sharp spires a fraction of a meter high. Thin-bedded granular limestone and chalk like underlying Aguada Limestone is exposed on Highway 2 north-northeast of Canteras Aguadilla. Formation rests with sharp contact on underlying Aguada Limestone. 110 m thick*

## **6.0 RESULTS AND RECOMMENDATIONS:**

*Recommendations for the geotechnical aspects of the project are based on the subsoil study presented in this report. This office warrants that our recommendations are in the line with the generally accepted practice in the field of Soil Mechanics and Foundation Engineering. This is our only warranty, either expressed or implied.*

*The use of the subsoil information and recommendations herein detailed for other structures or areas, except when done by specialist, may lead to serious design errors and should not be attempted.*

*The deposits encountered as disclosed by these test borings, not necessarily represent the most critical conditions of the site, and might vary from one boring to another. These recommendations are based on the subsoil conditions as encountered on the test borings rather than the worst conditions of the site.*

#### **6.1 Pavement Design Recommendations:**

*A pavement section is a layered system designed to distribute concentrated traffic loads to the subgrade. Performance of the pavement structure is directly related to the physical properties of the subgrade soils and traffic loadings. Soils are represented for pavement design purposes by means of a soil support value for flexible pavements and a modulus of subgrade reaction for rigid pavements. Both are empirical related to strength. The pavement section thickness design (asphalt and aggregate base) shall be properly calculated by the project designer based on estimated daily traffic volumes.*

*The site preparation prior to any filling or construction operation is to consist of stripping the topsoil supporting any existing vegetation, shrubs, grasses, and unstable material. The exposed grade resulted concluded when the removal of topsoil layer and unstable material shall be proof rolled to detect soft spots and then be brought to an unyielding surface by compaction. Depth of topsoil and clay material removal should average one (1) feet, excepted where any other foreign matter exists that could require deeper removal.*

*Prior to placing the pavement section, the entire subgrade area should be proof rolled, moisture conditioned and properly compacted to detect weak spots before any filing is done below the proposed pavement section. Recompact the exposed subgrade to detect any surficial weak spots and place at least 1.0 ft. of a*



*selected fill material classified as A-1-a (aggregate base course) and compacted until final asphalt base elevation is reached. The exposed grade shall be proof rolled to detect weak spots before any filling is done. Any weak spot encountered during the initial operation shall be excavated and replaced with selected fill, is a matter that has to be dealt with during the progress of the proof rolling operations.*

*The exposed sub-grade shall be proof rolled to detect weak spots before any filling is done. Any weak spot encountered during the initial operation shall be excavated and replaced with selected fill, is a matter that has to be dealt with during the progress of the proof rolling operations.*

***A minimum 1.0 ft. thick of selected fill material classified as A-1-a (aggregate base course as PRHTA Standard Specifications) is necessary at all areas below final asphalt base elevation. Following the procedures of FILLING OPERATIONS AND COMPACTION SECTION. In the event that modification to grading is incorporated, we shall be consulted to re-evaluate the submitted recommendations.***

*The purpose of using the A-1-a material as base is to increase the overall stiffness of the structure of asphalt pavements. The increase in the overall stiffness of the asphalt pavement reduce deflections thereof, thereby reducing efforts and unit deformations which increases the fatigue life of the asphalt layers.*

*The use of an A-1-a type of material properly placed and compacted at the streets and parking area of this project subgrade construction would permits the design of a flexible type of pavement on the basis of a subgrade CBR value of about 40 to 45. This CBR values are based on past experience with this type of material. However, the material to be used at the project has to be tested to obtain its*

*parameters by means of laboratory tests.*

*At areas subjected to concentrated and repetitive loading conditions as delivery, dumpster and loading dock areas we recommend reinforced concrete pavement with a thickness of at least 8 in. underlain by at least 8 in. of aggregate base course material. The modulus of subgrade reaction,  $k$ , to design floor slab and pavement is 150 kips per cu. ft.*

*Construction joints shall be provided in order to minimize crack development and to prevent differential movements between these elements. The project designer will decide on construction joints provisions and arrays.*

*The proposed road area shall be design with its appropriate drainage and slopes to avoid accumulation of runoff water at the surface. A well-designed drainage system shall constitute an important part of the pavement design itself. A drainage system should be developed to control storm water run-off that may enter from outside or fall within the road curses. Concrete ditches along the roadways may prove to be efficient for collecting storm water run-off that develops on slopes. However, the hydraulic capacity of these will govern their shape and size; therefore, hydrologic and hydraulic analyses shall be performed by the designer before sizing the necessary drainage structures.*

## **6.2 General Site Development Recommendations:**

*All relocation of existing underground utilities should be completed before grading begins. The ends of abandoned underground utilities should be permanently sealed to prevent the inadvertent introduction of fluids into the construction area. Any septic tanks and drain fields within proposed construction*

areas and 20 feet outside the construction limits should be excavated and removed.

We recommend any / all utility lines be located outside of planned construction areas, the trenches cleaned of backfill soils, and, after utility emplacement, the trench backfilled with compacted fill. Past experience indicates utility trench backfill is often poorly compacted. Also, cracked or deteriorated pipes can collapse, leak or serve as conduits for subsurface erosion. Any of these conditions can result in excessive settlement of foundations and pavements.

Due to the nature of the native soils it will be necessary to protect the site from runoff rain events. Runoff should be prevented from accumulating on the graded surface by ditching or other suitable means. Access route around the perimeter should be created.

The removal of any heterogeneous fill material and natural clay material shall be performed under the direct supervision of a geotechnical engineer from this office or his representative. The aerial extent and depth of removal shall be established by the soil inspector at the field, and notify the soils engineer to make the pertinent recommendations if deemed necessary.

The exposed sub-grade shall be proof rolled to detect weak spots before any filling is done. Any weak spot encountered during the initial operation shall be excavated and replaced with selected fill, is a matter that has to be dealt with during the progress of the proof rolling operations.

The fill material shall be placed in layers not exceeding eight (8) inches uncompacted and each lift be compacted to attain a minimum density of 95% of the fill material maximum dry density obtained on typical compaction test made

*according to ASTM Designation D-1557 and meeting the requirements of an A-1-a classification or better material.*

*The controlled fill construction technique discussed should be followed until final grade elevations are reached and under the direct supervision of Advanced Soil Engineering laboratory personnel.*

## **7.0 EARTHQUAKE CONSIDERATIONS:**

*Analysis of the relative density and consistency of the ground based on the SPT N values; it is our opinion that for seismic design this site corresponds to a soil profile type **Sc** according to the International Building Code (IBC-2009). Shear wave testing of the soils can be used to provide a more thorough evaluation of the seismic classification of site. A 100-foot deep boring was not required by the structural engineer due to size and height of the proposed structure.*

## **8.0 MONITORING OF FOUNDATION WORKS:**

*It should be brought to the consideration of all parties involved, the fact that no matter how well-designed the project is, it shall be necessary to provide full time supervision for the foundation works with special interest in the construction of embankments, cuts, and retaining structures.*

*It is in the execution of these aspects of the suggested work that most of the problems of development construction can be minimized.*

*It is highly suggested to carefully visual inspect any surrounding structures including taking photos and/or videos recording conditions of said structures before any vibratory roller is attempted. By doing so, frivolous damage claims against all concerned parties could be avoided in the future, and if not avoided, the proper documentation said photos and/or videos shall constitute, should serve in proofing against any such claim.*

*Monitoring of the vibrations to be induced by the vibratory roller operation shall be continuously executed. If excess wave velocities are recorded, the project geotechnical engineer shall formulate recommendations to mitigate the risk any excess vibration could pose to any surrounding structures.*

#### **9.0 PROTECTION OF EXCAVATIONS:**

*All Excavations at the site should be performed in accordance with 29 CFR Part 1926, “**Occupational Safety and Health Standards – Excavations; Final Rule,**” published by the U.S. Department of Labor, Occupational Safety and Health Administration. Based on the information obtained from the soil borings drilled at the site, we classify the surficial soils as **Type B** soils. Stockpiles of excavated material should be setback from the edge of the excavation by distance at least equal to the excavation depth.*

**THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY EXCAVATIONS AT THE SITE.** *This includes the design of any required temporary slopes, dewatering, and shoring and bracing, as necessary.*

*Positive surface gradients should be provided to divert surface runoff water*

away from excavations for foundations and constructions areas. Ponding of water should be avoided to reduce damage of properly graded areas.

#### **10.0 CONSTRUCTION CONSIDERATIONS:**

*The following considerations shall be taken into account in the construction of this project.*

- 1. The earthwork shall be conducted under the observation and inspection of a Geotechnical Engineer or his representative working for the project owner.*
- 2. All relocation of existing underground utilities should be completed before grading begins. The ends of abandoned underground utilities should be permanently sealed to prevent the inadvertent introduction of fluids into the construction area. Any underground utility not removed will be subjected to new pressures that can damage it and also affect the new structure. Any septic tanks and drain fields within proposed construction areas and 20 feet outside the construction limits should be excavated and removed.*

*We recommend any / all utility lines be located outside of planned construction areas, the trenches cleaned of backfill soils, and, after utility emplacement, the trench backfilled with compacted fill. Past experience indicates utility trench backfill is often poorly compacted. Also, cracked or deteriorated pipes can collapse, leak or serve as conduits for subsurface erosion. Any of these conditions can result in excessive settlement of foundations and pavements.*

3. A Geotechnical Engineer from this office (**Advanced Soil Engineering**) shall observe the bottom of any excavation to verify its conditions with respect to those obtained with borings. Proof-rolling of the excavation bottom may be required, depending on the exposed ground conditions. Any old deleterious fill, organic matter, or soft spot of soil detected at the bottom of any excavation shall be removed and backfilled as specified in Appendix 3.
4. The project excavations shall proceed in an expedite manner to prevent such disturbance of the foundation soil, and they shall be performed under dry conditions. The contractor shall take the required provisions to prevent the seepage and accumulation of water (runoff or temporary groundwater) into the excavations.
5. This report is submitted for the planning and design of the project and it provides some construction considerations that shall be reviewed by the contractor. However, the contractor shall not use this report as the only information to base his bid for the project. This office shall not be held responsible if the contractor uses this information without limitations. The contractor bidding for this project should conduct a careful review of the geotechnical data and documents given in this report. However, we will not be responsible for his interpretation and conclusions made from these data. The contractor shall visit the project area prior to bidding to become acquainted with the actual conditions of the site.
6. The contractor shall take care to prevent damage onto surrounding structures and utilities due to the construction operations.

7. *The contractor will be solely and completely responsible for his construction method, his method of excavation and support system, the working conditions at the job site, and the project safety measures. This requirement applies continuously and it is not limited to normal working hours.*

## **11.0 EXCAVATION PROCEDURES:**

*On the basis of the drilling effort rendered in advancing the test holes and the "N" values recorded whenever sampling was attempted, all excavations should be performed by heavy excavators, ripper and bulldozer to down grade the area to the required footing foundation base elevation. Rock formation outcrops found will require heavy capacity equipment such as hydraulic power chisel, in order to be ripped to down grade the area to the required grading elevation.*

*The geotechnical engineer for the project must be fully aware of the following utmost facts during the whole excavation process: first, though no ground water level has been recorded at any of the test borings along the site higher grounds nor any seepage or spring were noticed during our field inspections along said area, sometimes the like could show-up during the excavation process and/or at the long run. If this condition arises, further evaluation of the site development shall be considered at once to revise or modify the recommendations given. Some migrating bodies of infiltrated water may be encountered on excavations after prolonged rain events.*

*The contractor will be solely and completely responsible for his construction method, his method of excavation and support system, the working conditions at the job site, and the project safety measures. This requirement applies continuously*



*and it is not limited to normal working hours.*

*This report is submitted for the planning and design of the project and it provides some construction considerations that shall be reviewed by the contractor. However, the contractor shall not use this report as the only information to base his bid for the project. This office shall not be held responsible if the contractor uses this information without limitations. The contractor bidding for this project should conduct a careful review of the geotechnical data and documents given in this report. However, we will not be responsible for his interpretation and conclusions made from these data. The contractor shall visit the project area prior to bidding to become acquainted with the actual conditions of the site.*

## **12.0 SITE IMPROVEMENTS:**

*The site preparation prior to any filling or construction operation is to consist of stripping the topsoil supporting any existing vegetation, shrubs, grasses, and unstable material. Depth of topsoil removal should average one (1) feet, excepted where any other foreign matter exists that could require deeper removal.*

*Any weak spot uncovered shall be fully excavated and its space replaced in uncompacted layers not exceeding eight (8) inches and each lift be imparted with a minimum percent of compaction of 95% of the fill material maximum dry density as obtained from laboratory compaction test conducted according to ASTM Standard D-1157.*

*The removal of the topsoil shall be performed under the direct supervision of a geotechnical engineer from this office (Advanced Soil Engineering Corp.) or his*

representative. The aerial extent and depth of removal shall be established by the soil inspector at the field.

If any filling is needed to reach final floor elevation follow the recommendation of the section **FILLING OPERATIONS AND COMPACTION SECTION**. Always start filling from lower ground elevations and continue up the slope. No down slope filling shall be allowed. As filling up the slope progresses, benches or terraces are to be cut into the receiving soil every meter difference in elevation. Minimum width of terraces shall be 6.0 ft.

All cut or fill slopes shall be constructed for a geometry not steeper than 2:1 (H:V). **Steeper fill slopes are not recommended.** Wherever horizontal space requirement for high earth fill embankments and natural cut slopes cannot be met (as per above slope ratio requirements), special engineered structures shall be provided in order to maximize its stability.

### **13.0 FILLING OPERATIONS AND COMPACTION:**

The fill layers required to reach final grading shall be placed and compacted following the recommendations below:

- 1) Remove any construction debris existing on the area prior to start any filling operation.
- 2) Place the fill material in layers not exceeding eight (8) inches and each layer shall be imparted with a degree of compaction of 95 percent of the maximum dry density as obtained from the Modified

*Compaction Curve Test made according to ASTM D 1557.*

- 3) *The fill material shall consist of a non-expansive and inorganic soil material similar to a classification A-1-a or better material approved by the consultant engineer.*
- 4) *The placement and compaction of the fill layers shall be made under the direct supervision of a soils laboratory.*

#### **14.0 ADDITIONAL COMMENTS:**

*At the time of this report our project general analysis, evaluations and earthwork construction recommendations, have been formulated using preliminary drawings; and final grading elevations of the proposed parking lot has not been submitted.*

*We strongly recommend that the recommendations covered on this soil report be revised after grading, type of structure, loading condition, flexibility and final floor elevations have been established, so that revised final recommendations can be submitted for design and construction.*

*All recommendations herein given are based on the spot checks which constitute the test borings made within the investigated area of the parcel and were considered as representative subsoil conditions which are/or might be present along the project.*

*However, the fact does not exclude the disclosures of a different one that those found, once the construction phase alerts.*

*Any abnormal condition encountered between borings during the over excavation and construction phase, shall be notified to the soils engineer for further evaluation and to make the pertinent recommendations.*

*Advanced Soil Engineering (ASE) should be retained to review the project plans and specifications for conformance with the recommendations provided in our report. We are also available to assist the design team in preparing specifications for geotechnical aspects of the project, and performing additional studies if necessary to accommodate possible changes in the proposed construction.*

*We recommend that ASE be retained to provide observation and testing services to document that the intent of this report and the requirements of the plans and specifications are being followed during construction, and to identify possible variations in subsurface conditions from those encountered in this study so that we can re-evaluate our recommendations, if needed.*

## **15.0 LIMITATIONS OF THIS REPORT:**

### **15.1 Limitations:**

*The recommendations and conclusions within this report are based on current information regarding the proposed Parking Lot Area at Building T-0772-0-66 (Lockheed Martin) project, located at State Road PR 107 interior, Camaseyes*

Ward, Aguadilla, Puerto Rico. The conclusions and recommendations of this report are invalid if:

- Structure loads change from those stated or the structures are relocated.
- The Additional Services section of this report is not allowed
- This report is used for adjacent or other property.
- Changes of grade or groundwater occur between the issuance of this report and construction other than those anticipated in this report.
- Any other change that materially alters the project from that proposed at the time this report was prepared.

Findings and recommendations in this report are based on selected points of field exploration, geologic literature, laboratory testing, and our understanding of the proposed project. Our analysis of data and recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific exploratory locations. Variations in soil conditions can exist between and beyond the exploration points or groundwater elevations may change. If detected, these conditions may require additional studies, consultation, and possible design revisions.

***This report contains information that may be useful in the preparation of contract specifications. However, the report is not worded in such a manner that we recommend its use as a construction specification document without proper modification. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.***

*This report was prepared according to the generally accepted geotechnical engineering standards of practice that existed in Puerto Rico at the time the report was prepared. No express or implied warranties are made in connection with our services.*

*This report should be considered invalid for periods after two years from the report date without a review of the validity of the findings and recommendations by our firm, because of potential changes in the Geotechnical Engineering Standards of Practice.*

*These services were performed consistent with our agreement with our client. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of our services. The client has responsibility to see that all parties to the project including, designer, contractor, and subcontractor are made aware of this entire report. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client unless noted otherwise. Any reliance on this report by a third party is at the party's sole risk. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.*

### **15.2 Additional Services:**

*We recommend that a qualified geotechnical consultant be retained to provide the tests and observations services during construction. The geotechnical engineering firm providing such tests and observations shall become the geotechnical engineer of record and assume responsibility for the project.*

*The professional opinions presented in this report are based on the assumption that:*

- *Consultation during development of design and construction documents to check that the geotechnical professional opinions are appropriate for the proposed project and that the geotechnical professional opinions are properly interpreted and incorporated into the documents.*
- *Advanced Soil Engineering will have the opportunity to review and comment on the plans and specifications for the project prior to the issuance of such for bidding.*
- *Observation, inspection, and testing by the geotechnical consultant of record during site clearing, grading, excavation, placement of fills, building pad and subgrade preparation, and backfilling of utility trenches.*
- *Observation of foundation excavations and reinforcing steel before concrete placement.*
- *Other consultation as necessary during design and construction.*

*We emphasize our review of the project plans and specifications to check for compatibility with our professional opinions and conclusions. Additional information concerning the scope and cost of these services can be obtained from our office.*

*The above recommendations are given based on the interpretation of an arbitrary selected, limited number of soil samples rather than on a precise knowledge of actual conditions. Should subsoil between borings vary and different conditions that those described be encountered, the owner or contractor is urged to contact the writer for a field inspection, as the recommendations have to be varied to accommodate undisclosed conditions.*

*Respectfully submitted,*  
ADVANCED SOIL ENGINEERING

NELSON MUÑOZ, P.E.



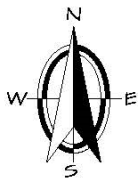
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October 24, 2019

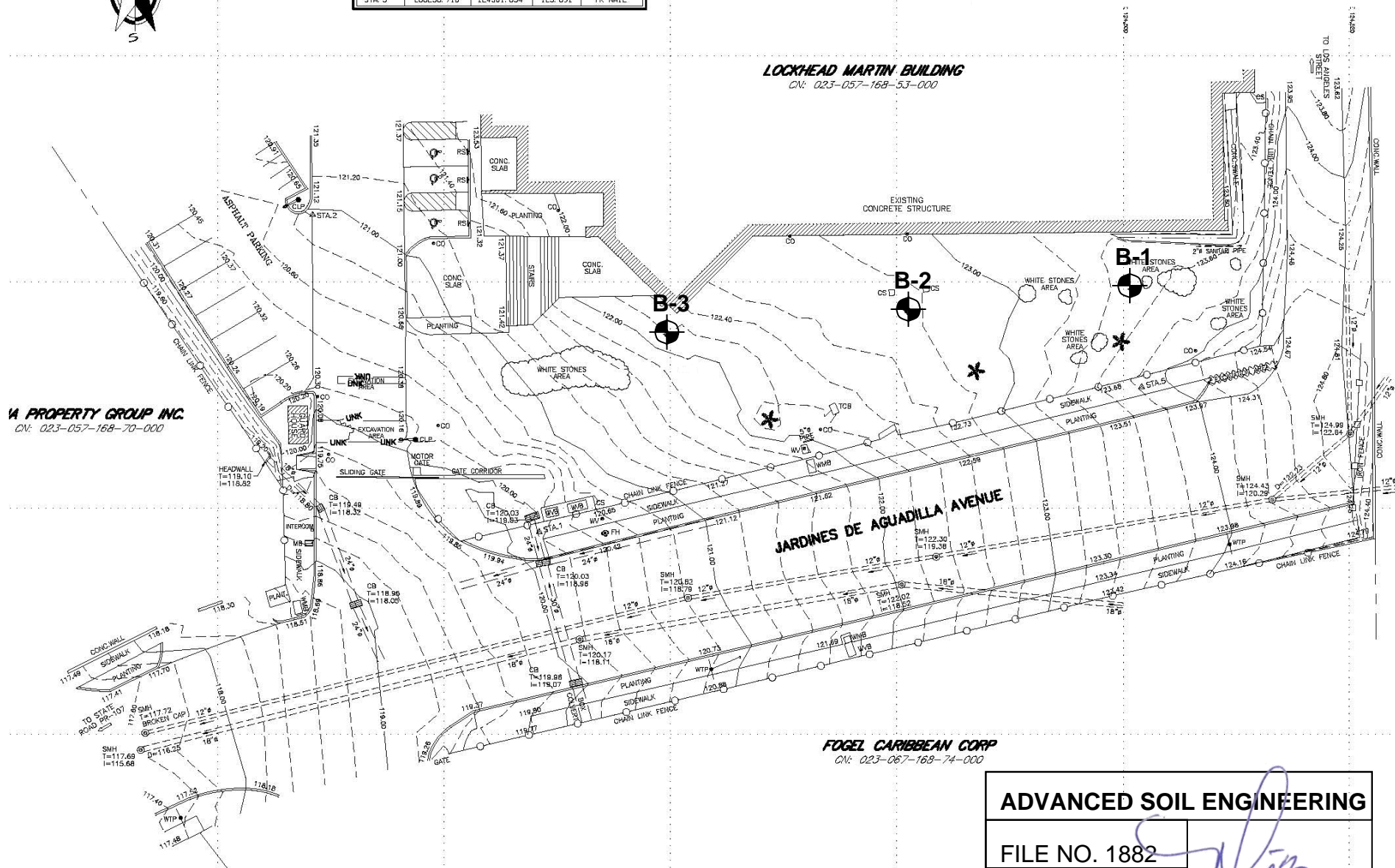


***APPENDIX NO. 1***  
***BORING LOCATION MAP***

# BORING LOCATION MAP



HORIZONTAL & VERTICAL CONTROL STATIONS				
STATION	COORDINATES		ELEVATION	DESCRIPTION
	NORTH (Y)	EAST (X)		
STA. 1	268237.886	124448.394	120.275	PK NAIL
STA. 2	268255.931	124428.368	120.995	PK NAIL
STA. 3	268250.710	124501.634	123.891	PK NAIL



## NOTES:

1. Boring locations are approximate.
2. Base drawing provided by Client.
3. Scale: NTS



BORING LOCATION

***APPENDIX NO. 2***

***BORING LOGS***

# SUBSURFACE EXPLORATION LOG



**ADVANCED SOIL ENGINEERING**

P.O. BOX 1286

ISABELA, P.R. 00662

TEL & FAX: (787) 830 - 0366

FILE NO. **1882**

BORING NO. **1**

PAGE 1 OF 1

CLIENT: JTO ENGINEERING  
 PROJECT: PARKING LOT AREA AT BUILDING T-0772-0-66 (LOCKHEED MARTIN)  
 LOCATION: AGUADILLA, PUERTO RICO  
 GROUND ELEVATION:  
 DATE STARTED: 09/27/19  
 DATE FINISH: 09/27/19  
 GROUND WATER DEPTH:

DRILLER: A. FERRER  
 LAB. TECH: E. RODRÍGUEZ  
 BORING TYPE: AUGER  
 BORING DIAMETER: 4"

DEPTH (FT)	SAMPLER	SAMPLE NO.	BLOWS / 6"	SPT N VALUE	SYMBOL	VISUAL - MANUAL DESCRIPTION	USCS CLASS	W (%)	Qu	Qp	$\gamma$	$\phi$	LL	PI
		SS-1	3 - 5 - 5	10		Strong brown silty clay trace sand		28						
		SS-2	50/5"	50/5"		Brownish yellow limestone fragments some sand - clay		16						
5		SS-3	50/0"	50/0"		Very pale brown limestone formation decomposed into rock fragments		8						
						END OF BORING								
10														
15														
20														
25														
30														
35														

N = BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

W = NATURAL MOISTURE CONTENT - %

Qu = UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

Qp = CALIBRATED PENETROMETER READING - T.S.F.

WH = WEIGHT OF HAMMER

SYMBOL (SEE APPENDIX NO.4 FOR MORE DETAILS)

$\gamma$  = ESTIMATED UNIT WEIGHT - P.C.F.

$\phi$  = ANGLE OF INTERNAL FRICTION - DEGREES

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

(\*) ELEVATIONS TAKEN FROM PLANS PREPARED BY DESIGNER

# SUBSURFACE EXPLORATION LOG



**ADVANCED SOIL ENGINEERING**

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FILE NO. **1882**

BORING NO. **2**

PAGE 1 OF 1

**CLIENT:** JTO ENGINEERING  
**PROJECT:** PARKING LOT AREA AT BUILDING T-0772-0-66 (LOCKHEED MARTIN)  
**LOCATION:** AGUADILLA, PUERTO RICO  
**GROUND ELEVATION:**  
**DATE STARTED:** 09/27/19  
**DATE FINISH:** 09/27/19  
**GROUND WATER DEPTH:**

**DRILLER:** A. FERRER  
**LAB. TECH:** E. RODRÍGUEZ  
**BORING TYPE:** AUGER  
**BORING DIAMETER:** 4"

DEPTH (FT)	SAMPLER	SAMPLE NO.	BLOWS / 6"	SPT N VALUE	SYMBOL	VISUAL - MANUAL DESCRIPTION	USCS CLASS	W (%)	Qu	Qp	$\gamma$	$\phi$	LL	PI
		SS-1	10 - 6 - 4	10		Strong brown sandy clay some limestone fragments (FILL)		28						
		SS-2	5 - 48 - 50	98		Strong brown silty clay trace sand		25						
5		SS-3	50/0"	50/0"		Very pale brown limestone formation decomposed into rock fragments								
						END OF BORING								
10														
15														
20														
25														
30														
35														

N = BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

W = NATURAL MOISTURE CONTENT - %

Qu = UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

Qp = CALIBRATED PENETROMETER READING - T.S.F.

WH = WEIGHT OF HAMMER

SYMBOL (SEE APPENDIX NO.4 FOR MORE DETAILS)

$\gamma$  = ESTIMATED UNIT WEIGHT - P.C.F.

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PI = PLASTICITY INDEX

( \* ) ELEVATIONS TAKEN FROM PLANS PREPARED BY DESIGNER



# SUBSURFACE EXPLORATION LOG



**ADVANCED SOIL ENGINEERING**

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FILE NO. **1882**

BORING NO. **3**

PAGE 1 OF 1

CLIENT: JTO ENGINEERING  
 PROJECT: PARKING LOT AREA AT BUILDING T-0772-0-66 (LOCKHEED MARTIN)  
 LOCATION: AGUADILLA, PUERTO RICO  
 GROUND ELEVATION: DRILLER: A. FERRER  
 DATE STARTED: 09/27/19 LAB. TECH: E. RODRÍGUEZ  
 DATE FINISH: 09/27/19 BORING TYPE: AUGER  
 GROUND WATER DEPTH: BORING DIAMETER: 4"

DEPTH (FT)	SAMPLER	SAMPLE NO.	BLOWS / 6"	SPT N VALUE	SYMBOL	VISUAL - MANUAL DESCRIPTION	USCS CLASS	W (%)	Qu	Qp	$\gamma$	$\phi$	LL	PI
		SS-1	5 - 11 - 14	25		Pale yellow sandy limestone fragments trace silt		16						
		SS-2	14 - 6 - 5	11		As above.		11						
5		SS-3	5 - 5 - 4	9		Strong brown silty clay trace sand		7						
		SS-4	8 - 7 - 8	15		As above.		24						
		SS-5	3 - 6 - 12	18		As above.		8						
10		SS-6	50/0"	50/0"		Very pale brown limestone formation decomposed into rock fragments								
						END OF BORING								
15														
20														
25														
30														
35														

N = BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

W = NATURAL MOISTURE CONTENT - %

Qu = UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

Qp = CALIBRATED PENETROMETER READING - T.S.F.

WH = WEIGHT OF HAMMER

SYMBOL (SEE APPENDIX NO.4 FOR MORE DETAILS)

$\gamma$  = ESTIMATED UNIT WEIGHT - P.C.F.

$\phi$  = ANGLE OF INTERNAL FRICTION - DEGREES

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

(\*) ELEVATIONS TAKEN FROM PLANS PREPARED BY DESIGNER

***APPENDIX NO. 3***

***FIELD AND LABORATORY TESTING PROCEDURES***

## **APPENDIX NO. 3**

### **FIELD AND LABORATORY TESTING PROCEDURES**

#### **FIELD TESTING**

##### **DRILLING**

Auger Borings (ASTM D 1452). These are performed by turning a hollow-stem auger into the ground a short distance. As the auger advances into the ground, the cutting rise to the surface on the auger spirals, although the depth from which the material comes cannot be accurately determined. By using hollow-stem augers, samples can be recovered from the bottom of the auger, thus eliminating the need for driving casings.

Wash Borings. The wash boring process consist of driving a section of 2.5 inches casing into the ground by a drop-hammer operation, as in pile driving. After each length of casing has been driven the earth material inside the casing is cleaned out by a chopping and washing similar to jetting. This is accomplished by flowing water under pressure through rods or pipes which are operated inside the casing. A chisel shaped chopping bit is attached to the end of the rods, and the whole string alternatively is raised and chopped so that the resultant chopping and jetting action loosens the soil. The return flow of water bring the cuttings to the surface.



## STANDARD PENETRATION TEST

Standard Penetration Test (SPT) and Split Barrel Sampling (ASTM D 1452). The samples are secured from the bottom of the cleaned hole by a 1.375 inches ID x 24 inches long split spoon samples. With the sampler in, resting on the bottom of the hole, it is driven with the drop of a 140 pounds hammer from a 30 inches height. The number of blows for every 6 inches of sampler penetration is recorded, and the number of blows between 6 and 18 inches of penetration is reported as the N-value. The N-value gives an indication of the consistency of cohesive soils and relative density of granular soils.

Undisturbed Sampling. Undisturbed samples are obtained with thin wall Shelby tube samplers, 3 inches OD by 30 inches long. The sampler is forced into the soil by static force or downward pressure and is pulled out also statically. These samplers are sealed in the field with wax and shipped to the laboratory. Samples are then extruded at the time of testing by pushing in the same direction that the samples penetrated the sampler. Special care is taken in handling these samples to minimize disturbance.

**COHESIVE SOILS**

<b><i>N-Values</i></b> <b><i>Blows / ft.</i></b>	<b><i>Consistency</i></b>	<b><i>Unconfined Compressive</i></b> <b><i>Strength (tsf)</i></b>
<i>Less than 2</i>	<i>Very Soft</i>	<i>Less than 0.25</i>
<i>2 - 4</i>	<i>Soft</i>	<i>0.25 - 0.50</i>
<i>4 - 8</i>	<i>Medium</i>	<i>0.50 - 1.00</i>
<i>8 - 15</i>	<i>Stiff</i>	<i>1.00 - 2.00</i>
<i>15 - 30</i>	<i>Very Stiff</i>	<i>2.00 - 4.00</i>
<i>Over 30</i>	<i>Hard</i>	<i>Over 4.00</i>

**GRANULAR SOILS**

<b><i>N-Values</i></b> <b><i>Blows / ft.</i></b>	<b><i>Relative Density</i></b>
<i>0 - 5</i>	<i>Very Loose</i>
<i>5 - 10</i>	<i>Loose</i>
<i>10 - 30</i>	<i>Medium</i>
<i>30 - 50</i>	<i>Dense</i>
<i>Over 50</i>	<i>Very Dense</i>

## **LABORATORY TESTING**

Natural Moisture (Water) Content (ASTM D 2216). The natural moisture (water) content is determined by finding the quantity of water present in the natural condition and expressing it as a percentage of the dry weight of the solid soil particles of the sample. The water present in the sample is determined by subtracting the weight of the wet soil from the weight of the specimen after been oven dried in an oven at 110 °C for a minimum period of 16 hours.

Atterberg Limits (ASTM D 4318). These limits and related indices are commonly used in geotechnical engineering for soil identification and classification purposes. However, these are also empirically correlated to various parameters which are used for preliminary analyses. The procedure used to determine liquid and plastic limits are described in the referenced ASTM Standard.

Unconfined Compression Test (ASTM D 2166). The cohesive soil specimens obtained from split spoon samples can not be considered as undisturbed samples, nevertheless, the approximate unconfined compressive strength can be easily determined. Unconfined compressive strength tests were performed by subjecting suitable soil samples to axial loads until failure. The compressive strength is defined as the ratio of maximum axial load required to failure to the corrected area and is expressed in units of tons per square feet.

Description and Identification of Soils (ASTM D 2488). The description of soils include the color, type (gravel, sand, silt, clay, organic), consistency (if soil is fine-grained), size and roundness (if soil is coarse-grained) and some other special characteristics which can assist in the identification and classification of the soil. The latter are those recommended for field classification (dilatancy, dry strength, shine and toughness). To approximate the consistency of fine-grained soils (soft, medium, stiff, hard) a simple test is performed with the thumb. The description of coarse-grained soils (sands and gravels) include size (fine, medium, coarse) and roundness (angular, sub-angular, sub-round, round). The relative amount of coarse fractions in fine-grained soils is estimated by placing a representative sample of some 50 grams in a graduated cylinder filled with water. The mix is shaken and allowed to settle. Particles of a size larger than fine sand are visible to the naked eye, while silts and clays are not. In this manner, estimates of the relative amount of the coarse fractions are made and reported as:

Trace	1 - 10%
Some	10 - 20%
Gravelly, sandy	20 - 35%
And	35 - 50%

***APPENDIX NO. 4***

***GEOLOGIC LEGEND***

## ***APPENDIX NO. 4***

### ***GEOLOGIC LEGEND***

#### ***SYMBOLS***



Top  
soil



Fill



Sand



Clay



Silt



Silty clay/  
Clayey silt



Clayey sand/  
sandy clay



Sandy silt/  
Silty sand



Rock



Organic  
matter