

## SECTION 019113.26 - COMMISSIONING OF ELECTRICAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Federal Acquisition Regulations, and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

#### 1.2 SUMMARY

- A. The purpose of this Section is to define Contractor responsibilities in the commissioning process, which are being directed by the Contractor. Other electrical system testing is required under other Division 26 Specification Sections. National Electrical Installation Standards (NEIS) NECA 90-2004, "Recommended Practice for Commissioning Building Electrical Systems", 27<sup>th</sup> Volume of the NEIS Series, provides additional guidance for the commissioning of electrical systems.
- B. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. General Commissioning requirements and coordination are detailed in Division 01. Division 26 shall be familiar with all parts of Division 01 and the Commissioning Plan issued by the Contractor and shall execute all Commissioning responsibilities assigned to them in the Contract Documents and include the cost of Commissioning in the Contract price.
- C. Electrical systems to be commissioned include the following:
  - 1. Lighting Controls
  - 2. Photovoltaic (PV) Systems

#### 1.3 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards.

#### 1.4 DEFINITIONS

- A. Commissioning: A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Contract Documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and that Contractor has provided Government adequate system documentation and training. Commissioning includes deferred and/or seasonal tests as approved by Government.
- B. Commissioning Team: Working group made up of representative(s) from the Contracting Officer/Engineer (E); Contractor; Government's Test, Adjust, and Balance (TAB) Firm; Building Automation System (BAS) provider; specialty manufacturers and suppliers; and Government. Contractor will provide ad-hoc representation of Subcontractors on the Commissioning Team as required for implementation of the Commissioning Plan.

#### 1.5 SUBMITTALS

- A. Contractor shall prepare Prefunctional Checklists and Functional Performance Test (FPT) procedures and execute and document results. All Prefunctional Checklists and tests must be documented using specific, procedural forms in Microsoft Word or Excel software developed for that purpose. Prior to testing, Contractor shall submit those forms to the Government for review and approval.
- B. Contractor shall provide Government with documentation required for Commissioning work. At minimum, documentation shall include: Detailed Start-up procedures, Full sequences of operation, Operating and Maintenance data, Performance data, Functional Performance Test Procedures, Control Drawings, and details of Government-Contracted tests.
- C. Contractor shall submit to Government installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.
- D. Contractor shall review and approve other relative documentation for impact on FPT's of the systems:
  - 1. Shop Drawings and product submittal data related to systems or equipment to be commissioned. The Subcontractor responsible for the FPT shall review and incorporate comments from the Government and A/E via the Contractor.
  - 2. Incorporate manufacturer's Start-up procedures with Prefunctional checklists.
  - 3. Draft Electrical Testing Agency (ETA) Reports: Review and provide comments to Government.
  - 4. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPT's.
  - 5. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation: Subcontractor performing the test will review the documentation prior to commencing with the scheduled FPT's.
  - 6. Final ETA Reports: Subcontractor performing the test will review the documentation prior to commencing with the scheduled FPT's.
  - 7. Operating and Maintenance (O&M) information per requirements of the Technical Specifications and Division 01 requirements: To validate adequacy and completeness of the FPT, the Contractor shall ensure that the O&M manual content, marked-up record

Drawings and Specifications, component submittal drawings, and other pertinent documents are available at the Project Site for review.

## 1.6 RESPONSIBILITIES

- A. Refer to Section 019113.00.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

### 2.2 TEST EQUIPMENT

- A. Provide all specialized tools, test equipment and instruments required to execute Start-up, checkout, and testing of equipment.
- B. Infrared Thermographic Scanner:
  - 1. Infrared scanning equipment shall be an AGA (or approved equal) thermovision set capable of viewing an entire equipment assembly at one time and have a sensitivity of 0.2 degrees C with a liquid nitrogen reference.
  - 2. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified.
- C. Refer to Section 019113.00 for additional requirements.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Refer to Section 019113.00 for general requirements.
- B. Warranty Phase:
  - 1. Execute seasonal or deferred tests, witnessed by the Government, according to the Specifications.
    - a. Complete deferred tests as part of this Contract during the Warranty Period. Schedule this activity with Government. Perform tests and document and correct deficiencies. Government may observe the tests and review and approve test documentation and deficiency corrections.

- b. If any check or test cannot be completed prior to Substantial Completion due to the building structure, required occupancy condition, or other condition, execution of such test may be delayed to later in the Warranty Period, upon approval of the Government. Contractor shall reschedule and conduct these unforeseen deferred tests in the same manner as deferred tests.
  2. Correct deficiencies and make necessary adjustments to O&M manuals, Commissioning documentation, and as-built drawings for applicable issues identified in any seasonal testing.
- C. Electrical Testing Agency (ETA):
1. When requested by Government, the Contractor shall retain an independent Electrical Testing Agency (ETA). Their specific testing responsibilities are delineated in Division 01 and 26. This generally requires checking and testing of the electrical power distribution equipment per National Electrical Testing Association (NETA).
  2. Attend Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Contractor to facilitate the Commissioning process.
  3. Obtain all required manufacturer's data to facilitate tests.
  4. Provide assistance to the Contractor in preparation of the specific Prefunctional Checklist and Functional Performance Test procedures specified in Division 01 and 26. Generally ETA shall provide their standard forms to document the NETA tests to be incorporated into the Prefunctional Checklist and Functional Performance Tests record.
  5. During related tests, execute and document the tests in the approved forms and/or test record.
  6. Perform and clearly document all completed Start-up and system operational checkout procedures, providing a copy to the Contractor.
  7. Clearly indicate any deficiencies identified during testing and add to an action list for resolution and tracking. The field technicians shall keep a running log of events and issues. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, Contract interpretation requests and lists of completed tests to the Contractor at least twice a week and provide technical assistance in the resolution of deficiencies.
  8. Provide skilled technicians to execute testing. Ensure that they are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.
  9. Warranty Phase: Perform thermographic imaging of PV System Inverter at time designated by Electrical SubContractor or Contractor.

### 3.2 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.

### 3.3 TESTING

- A. Prefunctional Checklists and Start-up:

1. Follow the Start-up and initial checkout procedures listed in this Section and in Division 01. Start-up and complete systems and sub-systems so they are fully functional, meeting the requirements of the Contract Documents.
2. Prefunctional Checklists shall be complete prior to commencement of a Functional Performance test.
3. Refer to Division 019113.00 for specific details on required Prefunctional Checklists.

B. Functional Performance Tests:

1. Functional Performance Tests are conducted after system Start-up and checkout is satisfactorily completed.
2. Refer to Division 019113.00 for specific details on the required Functional Performance Tests.

C. Coordination Between Testing Parties:

1. Factory Start-ups: Factory Start-ups are specified for certain equipment. Factory Start-ups generally are Start-up related activities that will be reviewed and checked prior to Functional Performance Tests. All costs associated with factory Start-ups shall be included with the contract price unless otherwise noted. Notify the Commissioning Team of the factory Start-up schedule and coordinate these factory Start-ups with witnessing parties. The Commissioning Team members may witness these Start-ups at their discretion.
2. Independent Testing Agencies: For systems that specify testing by an independent testing agency, the cost of the test shall be included in the Contract price unless otherwise noted. Testing performed by independent agencies may cover aspects required in the Prefunctional Checklists, Start-ups, and Functional Performance Tests. Coordinate with the independent testing agency so that Government and/or A/E can witness the test to ensure that applicable aspects of the test meet requirements.

### 3.4 TRAINING

A. Submit a written training plan to the Government and Contracting Officer/Engineer for review and approval. Contractor's training plan shall cover the following elements:

1. Equipment included in training.
2. Intended audience.
3. Location of training.
4. Objectives.
5. Subjects covered.
6. Duration of training on each subject.
7. Instructor for each subject.
8. Methods (classroom lecture, video, Site walk-through, actual operational demonstrations, written handouts, etc.).
9. Instructors and qualifications.

B. Contractor shall have the following training responsibilities:

1. Provide a training plan ten (10) calendar days prior to the scheduled training, in accordance with Division 01.

2. Provide Government personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned mechanical equipment or system.
  3. Training shall start with classroom sessions, if necessary, followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including Start-up, shutdown, fire/smoke alarm, power failure, etc.
  4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
  5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This representative may be the Start-up technician for the piece of equipment, the installing contractor, or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
  6. The training sessions shall follow the outline in the Table of Contents of the O&M manual and illustrate whenever possible the use of the O&M manuals for reference.
  7. Training shall include:
    - a. Usage of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    - b. Review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include Start-up, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
    - c. Discussion of relevant health and safety issues and concerns.
    - d. Discussion of warranties and guarantees.
    - e. Common troubleshooting problems and solutions.
    - f. Explanation of information included in the O&M manuals and the location of all plans and manuals in the facility.
    - g. Discussion of any peculiarities of equipment installation or operation.
  8. Hands-on training shall include Start-up, operation in all modes possible, including manual, shutdown, and any emergency procedures and maintenance of all pieces of equipment
  9. Training shall occur after Functional Performance Tests are complete and shall be scheduled with the Government's Project Manager.
- C. Provide training on each system/piece of equipment according to the following schedule:

<u>HOURS</u>	<u>SYSTEM</u>
<u>  4  </u>	LIGHTING CONTROLS
<u>  4  </u>	PHOTOVOLTAIC SYSTEM

- D. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION 019113.26