

# Electrical - Standard Specifications

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## COMMISSIONING SUPPORT

### STANDARD SPECIFICATIONS

This standard specification is intended to be integrated into the project specifications. The Consultant shall write the specifications to meet the project needs in consultation with the Owner. Items to be modified will be decided by consultation involving the Project Manager, the A/E, and Engineering Services. The A/E is expected to modify this and other specifications as necessary to accurately reflect commissioning requirements based upon specific conditions of the project.

### **PART 1 - GENERAL**

#### 1.01 DESCRIPTION

##### A. Purpose

1. The purpose of this section is to specify Division 26 00 00 responsibilities and participation in the commissioning process.

##### B. General

1. Commissioning support is the responsibility of the Contractor (including subcontractors and vendors).
  - a. The commissioning process requires Division 26 00 00 participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner. The Contractor is responsible to provide all support required for start-up, testing, and commissioning.
  - b. Division 26 08 00 is intended to provide an indication of the tests, which must be performed by the Contractor prior to verification by the Owner's Representative and the Commissioning Agent.
2. Work of Division 26 00 00 includes the following:
  - a. Start-up and testing of the equipment,
  - b. Assistance in testing, adjusting and balancing,
  - c. Operating equipment and systems as required for commissioning tests,
  - d. Providing qualified personnel for participation in commissioning test, including seasonal testing required after the initial commissioning,

- e. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process, which fulfill contract and warranty requirements,
- f. Providing operation and maintenance information and as-built drawings to the Test Engineer for verification, organization, and distribution,
- g. Providing assistance to the Test Engineer to develop and edit system operation descriptions,
- h. Providing training for the systems specified in this Division with coordination by the Test Engineer, Owner's Representative and Commissioning Agent.

## 1.02 RELATED SECTIONS

- A. The work under this section is subject to requirements of the Contract Documents, including the GENERAL CONDITIONS, SUPPLEMENTAL CONDITIONS, and sections under Division 01 GENERAL REQUIREMENTS.
- B. All start-up and testing procedures and documentation requirements specified within Division 26 00 00.
- C. All Division 26 08 00 commissioning procedures that require participation of Division 26 00 00.

## 1.03 REFERENCES

- A. Applicable codes, standards, and references - All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein:
  - 1. International Electrical Testing Association - NETA
  - 2. National Electrical Manufacturer's Association - NEMA
  - 3. American Society for Testing and Materials - ASTM
  - 4. Institute of Electrical and Electronic Engineers - IEEE
  - 5. American National Standards Institute - ANSI
  - 6. National Electrical Safety Code - C2
  - 7. State and local codes and ordinances
  - 8. Insulated Power Cable Engineers Association - IPCEA
  - 9. Association of Edison Illuminating Companies - AEIC
  - 10. Occupational Safety and Health Administration - OSHA 29CFR Part 1910.269
  - 11. National Fire Protection Association - NFPA
    - a. ANSI/NFPA 70: National Electrical Code
    - b. ANSI/NFPA 70B: Electrical Equipment Maintenance
    - c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
    - d. ANSI/NFPA 78: Lightning Protection Code
    - e. ANSI/NFPA 101: Life Safety Code
    - f. NFPA 99: Health Care Facilities
- B. All inspections and tests shall utilize the following references:
  - 1. Project design drawings and specifications,
  - 2. Shop drawings and submittals,

3. Manufacturer's instruction manuals applicable to each particular apparatus,
4. Applicable NETA acceptance testing work scope sections per NETA ATS 1999.

#### 1.04 COORDINATION

- A. Coordinate the completion of all electrical testing, inspection, and calibration prior to the start of commissioning activities.
- B. Coordinate factory field-testing and assistance per the requirements of this section.
- C. The ETC (Electrical Testing Contractor) shall coordinate and cooperate in the following manner:
  1. Allow sufficient time before final commissioning dates to complete electrical testing, inspection, and calibration to avoid delays in the commissioning process.
  2. During the commissioning activities, provide labor and material to make corrections when required, without undue delay.

#### 1.05 SUBMITTALS

- A. General
  1. Submittals shall be in accordance with Conditions of the Contract and Division 01 Specification Sections.

#### 1.06 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with Conditions of the Contract and Division 01 Specification Sections.

#### 1.07 SCHEDULE

- A. Complete and make fully functional all phases of Division 26 00 00 work pertinent to the Commissioning Tests, prior to the testing date determined by the Test Engineer.

#### 1.08 MEETINGS

- A. Attend Commissioning Meetings as required by the Contractor and/or the Test Engineer.

## **PART 2 - PRODUCTS**

#### 2.01 TEST EQUIPMENT

- A. Provide test equipment as necessary for start-up and commissioning of the electrical and mechanical equipment and systems.

#### 2.02 TEST EQUIPMENT - PROPRIETARY

- A. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment.

1. Manufacturer shall demonstrate its use, and assist the Test Engineer in the commissioning process.
  2. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
- B. Identify the proprietary test equipment required in the test procedure submittals and in a separate list of equipment to be included in the Operations and Maintenance Manuals.

## **PART 3 - EXECUTION**

### 3.01 REQUIREMENTS

- A. Work prior to commissioning:
1. Complete all phases of work so the system can be started, tested, adjusted, balanced, and otherwise commissioned.
    - a. Division 26 00 00 has primary start-up responsibilities with obligations to complete systems, including all sub-systems so they are fully functional.
    - b. This includes the complete installation of all equipment, materials, conduit, wire, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
  2. A commissioning plan will be developed by the Test Engineer and approved by the Commissioning Agent.
    - a. Division 26 00 00 is obligated to assist the Test Engineer in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation.
    - b. If system modifications/clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.
    - c. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor and the Test Engineer will notify the Commissioning Agent and Owner's Representative for approval.
  3. Specific pre-commissioning responsibilities of Division 26 00 00 are as follows:
    - a. Inspection, calibration and testing of the following equipment:
      - i. Transformers
      - ii. Primary switchgear and substations
      - iii. Secondary switchgear
      - iv. Automatic transfer switches
      - v. Emergency power systems
      - vi. Electrical distribution systems
      - vii. Lighting control systems and lighting level verification
      - viii. Fire alarm systems
      - ix. Security systems

- x. Clock system
  - xi. Special laboratory electrical systems
  - xii. Variable frequency drives
  - xiii. Uninterruptible power supplies
4. Normal start-up services required to bring each system into a fully operational state:
- a. These include cleaning, testing, motor rotation check, control sequences of operation, full and part load performance, etc.
  - b. The Test Engineer will not begin the commissioning process until each system is complete, including normal Contractor start-up and the TAB work has been completed.
5. Commissioning is intended to begin upon completion of a system.
- a. Commissioning may proceed prior to the completion of systems, or sub-systems, and will be coordinated with the Electrical Contractor and Electrical Testing Contractor.
  - b. Start of commissioning before system completion will not relieve Division 26 00 00 from completing those systems as per the schedule.

### 3.02 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start up all systems within Division 26 00 00.
- 1. These same technicians shall be made available to assist the Test Engineer and Commissioning Agent in completing the commissioning program as it relates to each system and their technical specialty.
  - 2. Work schedules, time required for testing, etc., will be requested and coordinated by the Test Engineer.
  - 3. Division 26 00 00 will ensure that the qualified technician(s) are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustment, and/or problem resolutions.
- B. System problems and discrepancies may require additional technician time, Test Engineer time, Commissioning Agent time, redesign and/or reconstruction of systems and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.
- C. The Owner's Representative and Commissioning Agent reserve the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Test Engineer to get the job done.

### 3.03 WORK TO RESOLVE DEFICIENCIES

- A. In some systems, misadjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems.

1. This work will be completed under the direction of the Architect and Owner's Representative, with input from the Contractor, equipment supplier, Test Engineer, and Commissioning Agent.
  2. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Architect will have final jurisdiction on the necessary work to be done to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process.
1. Experimentation to render system performance will be permitted.
  2. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Agent will notify the Owner indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities.
  3. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem.
  4. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

### 3.04 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall.
1. Initial commissioning will be done as soon as contract work is completed, regardless of season.
  2. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.
- B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance.
1. Heating equipment will be tested during winter design extremes.
  2. Cooling equipment will be tested during summer design extremes, with a fully occupied building.
  3. Each Contractor and supplier will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance, as scheduled by the Test Engineer, with three day (minimum) advance notification.
- C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use.
1. All equipment and systems effected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance.
  2. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

## RECOMMISSIONING

- A. After the initial and peak season commissioning is completed, there may be additional work required to serve new or revised loads. This work is not part of the contract.

### 3.05 TRAINING

- A. Participate in the training of the Owner's engineering and maintenance staff, as required in Divisions 01 and 26 08 00, on each system and related components. Training, in part, will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.
- B. Training will be conducted jointly by the Test Engineer, Commissioning Agent, Owner's Representative, the design engineers, the Contractor, and the equipment vendors. The Test Engineer will be responsible for highlighting system peculiarities specific to this project.

### 3.06 SYSTEMS DOCUMENTATION

- A. In addition to the requirements of Division 01, update contract documents to incorporate field changes and revisions to system designs to account for actual constructed configurations.
  - 1. All drawings shall be red-lined on two sets.
  - 2. Division 26 00 00 as-built drawings shall include architectural floor plans, elevations and details, and the individual mechanical or electrical systems in relation to actual building layout.
- B. Maintain as-built red-lines as required by Division 01.
  - 1. Given the size and complexity of this project, red-lining of drawings at completion of construction, based on memory of key personnel, is not satisfactory.
  - 2. Continuous and regular red-lining is considered essential and mandatory.

### 3.07 MISCELLANEOUS SUPPORT

- A. Division 26 00 00 shall remove and replace covers of electrical equipment, open access panels, etc., to permit Contractor, Architect and Owner's Representative to observe equipment and controllers provided.
- B. Furnish ladders, flashlights, tools and equipment as necessary.