

COMMISSIONING GUIDE SPECIFICATIONS

SECTION 16995 ELECTRICAL SYSTEMS COMMISSIONING

Spec writer:

The following guide specifications are intended to be reviewed, modified and inserted into the noted specification section to meet the specific commissioning needs and requirements for the current project. Any modifications to these specifications shall only be made after consultation with the Owner's representative and with approval of the engineer of record. Where there are check boxes or fill-in blanks, fill in as appropriate and delete all but the choice(s) that apply. Delete all direction boxes.

SECTION 16995

ELECTRICAL SYSTEMS COMMISSIONING

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PART 1 - GENERAL

1.1 DESCRIPTION

- A. The purpose of this section is to specify Division 16 responsibilities in the commissioning process which are being directed by the CA. Other electrical systems testing is required under the direction of the CM.
- B. The list of commissioned equipment and systems is found in Section 17100.1.7.
- C. Commissioning requires the participation of Division 16 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Division 17. Division 16 shall be familiar with all parts of Division 17 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.2 RESPONSIBILITIES

- A. Electrical Contractors. The commissioning responsibilities applicable to the electrical contractor are as follows (*all references apply to commissioned equipment only*):

Construction and Acceptance Phases

- 1. Include the cost of commissioning in the contract price, if not yet let.
- 2. In each purchase order or subcontract written, include requirements for submittal data, O&M data and training.
- 3. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
- 4. Contractors shall provide normal cut sheets and shop drawing submittals to the CA of commissioned equipment.
- 5. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.
 - a. Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.
 - b. The Commissioning Agent may request further documentation necessary for the commissioning process.
 - c. This data request may be made prior to normal submittals.

The above information about special commissioning submittals is repeated in Section 01300. Maintain consistency.

- 6. Provide a copy of the O&M manuals submittals of commissioned equipment, through normal channels, to the CA for review and approval.

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7. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
8. Provide assistance to the CA in preparation of the specific functional performance test procedures specified in Section 16997. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
9. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists from the CA. Submit manufacturer's detailed start-up procedures and the full start-up plan and procedures and other requested equipment documentation to CA for review.
10. During the startup and initial checkout process, execute and document the electrical-related portions of the prefunctional checklists provided by the CA for all commissioned equipment.
11. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
12. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
13. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. 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.
14. Perform functional performance testing under the direction of the CA for specified equipment in Section 16997 and 17100. Assist the CA in interpreting the monitoring data, as necessary.
15. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, CM and A/E and retest the equipment.
16. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
17. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing). Prepare red-line as-built drawings for all drawings and final as-builts for contractor-generated coordination drawings.
18. Provide training of the Owner's operating personnel as specified.
19. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

Warranty Period

1. Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
2. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

B. Electrical Designer/Engineer

1. Refer to Section 17100 for the responsibilities of the Electrical Designer/Engineer.

1.3 RELATED WORK

- A. Refer to Section 17100, Part 1.5 for a listing of all sections where commissioning requirements are found.

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- B. Refer to Section 17100 Part 1.4 for systems to be commissioned and section 17100 Part 1.6 and 16997 for functional testing requirements.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Division 16 shall provide all test equipment necessary to fulfill the testing requirements of this Division.
- B. Refer to Section 17100 Part 2.1 for additional Division 16 requirements.

PART 3 - EXECUTION

3.1 SUBMITTALS

- A. Division 16 shall provide submittal documentation relative to commissioning to the CA as requested by the CA. Refer to Section 17100 Part 3.3 for additional Division 16 requirements.

3.2 STARTUP

- A. The electrical contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 17100 Part 3.4. Division 16 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.
- B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems, or sub-systems at the discretion of the CA and CM. Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all prefunctional checklists as soon as possible.

3.3 FUNCTIONAL PERFORMANCE TESTS

- A. Refer to Section 17100 Part 1.4 for a list of systems to be commissioned and to Part 3.6 for a description of the process and to Section 16997 for specific details on the required functional performance tests.

3.4 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

- A. Refer to Section 17100 Part 3.4 for specific details on non-conformance issues relating to prefunctional checklists and tests.
- B. Refer to Section 17100 Part 3.7 for issues relating to functional performance tests.

3.5 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Division 16 shall compile and prepare documentation for all equipment and systems covered in Division 16 and deliver to the GC for inclusion in the O&M manuals, according to Section 01730.
- B. The CA shall receive a copy of the O&M manuals for review.

3.6. TRAINING OF OWNER PERSONNEL

~~A. The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 17100 for additional details.~~

~~B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 17100 for additional details.~~

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C. Electrical Contractor. The electrical contractor shall have the following training responsibilities:

1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 17100, Part 3.9.
2. Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical 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 startup, 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 person 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 operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
7. Training shall include:
 - a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.
 - b. Include a 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, shut-down, seasonal changeover and any emergency procedures.
 - c. Discuss relevant health and safety issues and concerns.
 - d. Discuss warranties and guarantees.
 - e. Cover common troubleshooting problems and solutions.
 - f. Explain information included in the O&M manuals and the location of all plans and manuals in the facility.
 - g. Discuss any peculiarities of equipment installation or operation.

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- h. The format and training agenda in *Guidelines for Commissioning HVAC Systems*, ASHRAE, 1989R, 1996 is recommended.
 - i. Classroom sessions shall include the use of overhead projections, slides, video and audio taped material as might be appropriate.
- 8. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and maintenance of all pieces of equipment.
 - 9. The electrical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not *controlled* by the central control system.
 - 10. Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.
 - 11. Duration of Training. The electrical contractor shall provide training on each piece of equipment according to the following schedule.

- _____ Fire Alarm System
- _____ Lighting Controls
- _____ Emergency Generator
- _____ UPS
- _____ Security System
- _____ Telecom and Data
- _____ Paging System
- _____

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The Spec Writer should list and specify training for all equipment not listed here.

3.7. DEFERRED TESTING

- A. Refer to Section 17100, Part 3.10 for requirements of deferred testing.

3.8 WRITTEN WORK PRODUCTS

- A. Written work products of Contractors will consist of the startup and initial checkout plan described in Section 17100 and the filled out startup, initial checkout and prefunctional checklists.

END OF SPECIFICATION SECTION