

SECTION 01 91 00 – GENERAL COMMISSIONING REQUIREMENTS

PART 1: GENERAL

1.1 SUMMARY

- A. Commissioning is a process used to ensure a facility functions as intended by the contract documents. The process provides assurance that all building systems have been operated throughout their range of intended operation and anticipated failures have been initiated to verify correct operation in failure modes.
- B. Commissioning requires cooperation and direct involvement by all parties throughout the construction process. Successful commissioning requires that installation of all building systems and assemblies not only comply with contract requirements but also that it is achieved early enough in the construction phase to provide full operational check-out, testing and adjustments prior to Substantial Completion.
- C. In addition to fulfilling scheduling and planning requirements, the Contractor is responsible for documenting and demonstrating equipment and system installation as well as operational verification for all systems and assemblies. This includes a demonstration verification of all system integration in the facility.
- D. The Contractor is solely responsible for the commissioning responsibilities given in the Specifications. If the Contractor elects to outsource commissioning responsibilities, the Owner must approve the agent.

1.2 DEFINITIONS

- A. The term “Contractor”, as used herein, shall refer to the party having a contract Agreement with the Owner to provide construction services for the project. This term is to apply whether such contracting firm is engaged as a Prime Contractor, General Contractor, Construction Manager or Design/Build Contractor as appropriate to the particular contract agreement.
- B. The term “Architect” or A/E as used herein, shall refer to the Prime Design Architect/Engineer Firm responsible for providing design services for the project and for affixing professional seal and signature to the construction documents, whether their contract is with the Owner or with a Design/Build Contractor as appropriate to the particular contract agreement.
- C. The term “Subcontractor”, as used herein, shall refer to any subcontractor, vendor, supplier, etc. that has a contractual agreement with the Contractor or Owner to provide goods or services to the project.

1.3 RELATED DOCUMENTS

- A. The Uniform General and Supplementary General Conditions for University of Texas System Building Construction Contracts (UGC), applicable requirements of all Divisions of the Contract Specifications and all Contract Drawings apply to work of this Section. In the event of conflict between specific requirements of the various documents: the more restrictive, more extensive (i.e., more expensive) requirement shall govern.
- B. Technical Specifications throughout all Divisions of the Project Manual which pertain to operable and non-operable equipment and/or building systems are directly applicable to this Section, and this Section is directly applicable to them.
 - 1. Particular attention is directed to:
 - a. Division 1 General Requirements, specifically Section 01 32 00 – Construction Progress Schedule, 01 45 00 Project Quality Control and 01 77 00 – Closeout Requirements
 - b. Division 11 – 14
 - c. Divisions 21 through 48

1.4 WORK INCLUDED

- A. Summary Scope
- B. Commissioning Plan
- C. Equipment Documentation Requirements
- D. Commissioning Documentation Requirements
- E. Commissioning and Closeout Manual
- F. Test Equipment
- G. Pre-Commissioning Meeting
- H. Pre-Installation Conferences
- I. Contractor's Verification of Installation
- J. Initial Start-Up
- K. Contractor Operational Testing
- L. Integrated System Test Report/Demonstration
- M. Owner Training

SCOPE OF THIS SECTION

- N. It is of primary concern that all operable systems installed in the project perform in accordance with the contract documents and the specified Owner's operational needs. This is particularly critical for systems affecting life safety, building controls, plumbing, HVAC, lighting and power delivery systems. The process of assuring that such performance is achieved is commonly referred to as "Commissioning."
- O. This Section establishes minimum general and administrative requirements pertaining to start-up and commissioning of equipment, devices, and building systems. Additional technical and operational requirements for particular systems and components are established in the various technical Sections. The Contractor is solely responsible for the Commissioning process. This responsibility shall not be delegated to subcontractors, but by necessity will require participation by the subcontractors.
- P. UTD will provide the Contractor with an electronic copy of the OFPC standard *Commissioning & Close-out Manual* (C&C Manual), as a guide, to be used and completed by the Contractor for all activities associated with the commissioning effort regardless of construction contract value, or project type.
 - 1. The C&C Manual contains the necessary documentation for the commissioning process including: Equipment and Closeout matrices, Pre-installation meeting agendas, Pre-Functional Testing, Functional Testing, Equipment Start-up, Systems Integration forms, required forms from the State Fire Marshal and other inspection and test report forms. Although the C&C Manual may illustrate the extent of the commissioning effort, it does not increase it. The Owner is providing this manual to standardize the commissioning process and aid the Contractor and the Contractor shall enforce use of these forms for commissioning documentation.
- Q. The UTD Quality Assurance testing and inspection program is independent of the Commissioning program. The Contractor is required to perform all testing as specified in the other contract documents in addition to the Commissioning requirements outlined herein. Coordination of these processes by the Contractor will help minimize any duplication of effort.

1.5 COMMISSIONING PLAN

- A. The Contractor shall prepare a detailed Commissioning Plan to identify the following:
 - 1. Project Commissioning Team Members
 - a. As a minimum, these will include:
 - 1). Contractor's Representative.
 - 2). UTD's ODR.
 - 3). A/E and relevant consultants

- 4). Institution representatives
- 5). Subcontractors
- 6). Manufacturer, Vendors and Suppliers as appropriate
- 7). Owner's TAB contractor
- 8). Independent testing labs

2. Commissioning Activities

- a. These activities shall be identified and tracked by the Contractor and shall include, but not be limited to:

- 1). Pre-functional Tests
- 2). Start-up Tests
- 3). Functional Tests
- 4). System Integration Testing

3. Commissioning Responsibility Matrix

- a. All commissioning activities shall be documented in the Plan using the provided responsibility matrix template. Each activity shall be assigned to team members for action in the Contractor populated responsibility matrix. Actions required shall be assigned as:

- 1). Primary Responsibility
- 2). Coordination
- 3). Witness/Monitor

4. The Contractor shall use the necessary test documentation from the Owner provided templates. These may be modified for project specific needs with Owner approval. Test reports/checklists shall include:

- a. Pipe/Duct Pressure Test
- b. Pre-functional Checklists
- c. Equipment Start-up Request Forms
- d. Functional Test Checklists
- e. Integrated System Test Reports
- f. Other Specialized Test Reports
- g. Where applicable, and with the Owner's approval, these checklists may be combined into one test report/checklist to document the installation, operation, demonstration and Owner training for a particular system.

5. The Contractor shall be responsible for coordination and execution of all commissioning activities.

6. This Commissioning Plan shall be incorporated into the project baseline schedule to reflect dates and durations of all commissioning activities.

1.6 EQUIPMENT DOCUMENTATION REQUIREMENTS

A. Equipment List/Matrix

1. This Section requires the Contractor to prepare a complete listing of all operating equipment, devices, and systems, with certain information as herein noted, and submit to the project team at the Pre-Commissioning Meeting.
2. The Contractor shall coordinate its response to this requirement with its preparation of the Work Progress Schedule, Submittal Schedule, Schedule of Values, and list of all equipment. Refer to Sections 01 32 00 and 01 31 00.

- a. To the extent practical, the Contractor should minimize duplicating efforts in favor of a single, organized approach to all schedule documentation required for the project.
3. The equipment matrix shall be formatted as a computerized spreadsheet with capability for printing of various selected data columns (ranges) to meet documentation requirements at various stages of construction, and for different purposes as required by various technical Sections. The Matrix shall be submitted in 2 phases, initial and final. An electronic database program may be used in lieu of a spreadsheet, if approved by the Owner.
4. The matrix shall identify all operable devices and equipment to be provided, and are to be grouped by the system they primarily support. When sorted by the column for system identification, the resulting printout should identify all system components, regardless of whether they are of mechanical, electrical, or other nature.
5. The initial Equipment Matrix shall be submitted in its entirety at the Pre-commissioning meeting. The Matrix shall include the following data, as a minimum, for each device, and shall allow for additional columns for subsequent data requirements as indicated for final matrix requirements.
 - a. Brief equipment identification text
 - b. Equipment or device I.D. number
 - c. Start-up inspection required
 - d. Associated building system, if any
 - e. Governing specification section
 - f. Appropriate submittal reference number(s) and projected time of original submission of device or system
 - g. Installation location, by room number or column coordinates, as indicated in contract documents.
6. The final Equipment Matrix for each device or system shall include all data noted for the initial matrix; including any necessary corrective updates to the data, and shall, in addition, also provide the following new data in distinct columns:
 - a. Actual date of Submittal Approval
 - b. Manufacturer and model number
 - c. The date of initial equipment or device start-up by the Contractor
 - d. The date of Contractor's operational verification and initials of responsible party
 - e. Columns (3) to indicate the duration of successful operation and the high and low limits of operation
 - f. Date of successful commissioning completion for device.
7. The completed final matrix shall be placed, under a separate tab, in the Commissioning and Closeout Manual.

1.7 COMMISSIONING DOCUMENTATION REQUIREMENTS

- A. To verify the commissioning efforts, a logical sequence of documentation shall be completed by the contractor to demonstrate compliance with the contract documents. A copy of each form will be provided to the Contractor at the Pre-Construction Meeting. Every operable device/system and critical building system shall be documented to verify installation and operation. It is the Contractor's responsibility to gather all data required for completion of all forms related to the commissioning process. These forms and the related testing and/or inspections will be coordinated with the UTD ODR.

1. Pre-functional Test checklist (PFT)
 - a. This form shall be used to document acceptable installation for components of a system; i.e., motor installation, pump alignment, waterproofing membrane application, roof application, etc. All items associated with this checklist shall be completed before start-up of operable devices.
2. Equipment Start-up Request (ESR)
 - a. An ESR shall be used to request start-up of any operable device/equipment. All completed Pre-Functional Test checklists and manufacturer's start-up instructions associated with the equipment shall accompany this form when submitted to the Owner. No equipment shall be started prior to submission of this form to the Owner for witness. This test is to verify safe start-up of the system, not to allow continual operation of the equipment, even on a temporary basis. The Contractor shall provide 5-day written notification to the Owner for this start-up request.
3. Functional Test checklist (FT)
 - a. This checklist shall be used to document an individual system's performance. All associated PFT's and ESR's shall have been completed and attached to the FT when requesting the Functional test.
4. Integrated System Test Report (ISR)
 - a. This test report is required to demonstrate that all systems within a facility perform as specified through integration with other systems. Test matrices will require development of a cascading sequence of events related to specific initiating actions that follow the designed Sequence of Operations. Each project will require customization to capture and demonstrate functional operation. All associated Test checklists shall have been completed, accepted and attached to ISR when requesting the test/demonstration.
 - 1). Typically, these tests will demonstrate performance of system integration performance with fire alarm initiation, loss of permanent power, etc.
 - a). In research and medical facilities, additional testing will be required to demonstrate performance of fan failure modes, differential air pressures, BAS alarm signals, security, waste disposal, etc.

1.8 COMMISSIONING AND CLOSEOUT MANUAL

- A. The Contractor shall incorporate all commissioning and closeout documentation and/or verification into a Manual for transmittal to the Owner at the conclusion of the project. This Manual is intended to be a consolidation of documentation/verification for the project Commissioning and Closeout process. By using the Manual throughout the project, the documentation process can be expedited and monitored. The Manual will be several volumes in size and on large projects can become voluminous. Proper planning and follow-through is required to maintain and deliver this product.
- B. Included in this manual shall be (but not be limited to) the following:
 1. Copy of the Contractors Commissioning Plan
 2. Equipment List Matrix
 3. Closeout Documentation Matrix
 - a. The Contractor is required to populate this matrix with information from the individual specification sections of the contract documents listing all items/services to be delivered to the Owner at the conclusion of the project, including but not limited to, warranties beyond 1 year, spare parts, attic stock, training, service contracts, etc.

4. Paint/Finish Schedule
 - a. This schedule shall include all paints, flooring, finishes, etc. used on the project.
 - 1). Provide manufacturer, model #, color formula, location on project, purchase source and any other information helpful to the Institution's maintenance personnel.
 5. Spare Parts, Attic Stock and Keys Checklist
 6. All Pre-functional Test checklists (w/attachments)
 7. All Equipment Start-up Request
 8. All Functional Test checklists (w/attachments)
 9. All Integrated System Test Reports (w/attachments)
 10. Owner Training Reports
- C. The Contractor will include a copy of all the test reports/checklists and matrix in the Commissioning and Closeout Manual.
- D. Within 90 days of the Notice to Proceed for construction, the Contractor shall produce and print 2 copies of the Manual. One shall be transmitted to the UTD ODR for use during the project. The Contractor shall maintain their copy for transmittal to the UTD ODR upon completion.
 1. This documentation shall be inserted into the Commissioning and Closeout Manual in tabbed formatting according to the Table of Contents for each project.
 2. The manual shall be bound in heavy-duty 3-ring vinyl-covered binders including pocket folders for folded sheet information. Mark binder identification on both front and spine of each.
- E. Equipment and System submittals shall be submitted separately as required elsewhere in the Contract Documents.
- F. Operating and Maintenance Manuals for each system, equipment, and device shall be submitted separately as required elsewhere in the Contract Documents.

PART 2: PRODUCTS

2.1 TEST EQUIPMENT

- A. Contractors and subs shall provide all specialized tools, test equipment and instruments required to execute start-up, checkout and functional performance testing of equipment under their contract.
- B. Test equipment shall be of sufficient quality and accuracy to test and/or measure system performance within tolerances specified. A testing laboratory shall have calibrated test equipment within the previous 12 months. Calibration shall be NIST traceable. Equipment shall be calibrated according to manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3: EXECUTION

3.1 PRE-COMMISSIONING MEETING

- A. As soon as practicable from the effective date of the Notice to Proceed for the construction phase that includes building operational systems, the Contractor will schedule, plan and conduct a meeting with all parties involved in the Commissioning process. At a minimum, this should include the major sub-contractors, specialty manufacturers/suppliers, the A/E, mechanical and electrical consultants, the Owner's test and balance firm, and representatives from UTD.
 1. The Contractor shall prepare for the meeting by creating drafts of the following documents to be reviewed at the meeting:

- a. The Contractor prepared Commissioning Plan
 - b. The *Commissioning and Closeout Manual* including the Equipment and Closeout Matrixes
 - c. Progress schedule incorporating Commissioning Milestones.
2. The Contractor shall conduct the meeting and review all aspects of the Commissioning specification. All documentation will be discussed and test procedures and forms reviewed for approval with the Owner.
 3. The Contractor-produced Commissioning Plan shall be reviewed with all parties to ensure understanding of responsibilities and schedule impact.
 4. The Commissioning and Closeout Manual shall be reviewed with all attendees and the scope of work discussed. The Contractor should be prepared to distribute copies of the pertinent sections to the various subcontractors involved in the Commissioning process.
 5. Commissioning target dates for the project will be presented and reviewed. These dates and durations shall be incorporated in the detailed project schedule in accordance with Section 01 32 00.
 6. Commissioning shall be an agenda item on all project progress meetings.

3.2 PRE-INSTALLATION MEETING

- A. As a minimum, the Contractor shall schedule a pre-installation meeting for the work of each major building system. The pre-installation meeting shall be scheduled, in writing, a minimum of 5 days in advance, and shall be scheduled so that the Owner and Architect/Engineer can attend. This meeting shall be convened following approval of system submittals and prior to commencement of system installation work.
 1. The Contractor shall arrange for all subcontractors, suppliers, and manufacturers involved in the system to be present or adequately represented.
 2. The Contractor shall bring the following to this meeting, as a minimum, for review and discussion:
 - a. The portion of the Initial Equipment Matrix applicable to the system under discussion.
 - b. Current Work Schedule data pertaining to the beginning, start-up, inspection, and turn-over phases anticipated for the particular system.
 - c. Copy of all approved submittals for the system.
 - d. Draft of a proposed plan for start-up and inspection of the system under review to include all necessary test checklist report forms to be completed prior to start-up and initial procedures for system operational verification.
 3. The purpose of this Meeting is for the Contractor and all applicable subcontractors, suppliers and/or factory representatives to discuss all aspects of the installation of the particular system. Special attention is to be directed to the scheduled order of work and any impact on or by any other building systems. Further, a game plan for start-up, inspection and acceptance is to be developed, based on the Contractor's Commissioning Plan and checklist, so that all parties are aware of what is expected and/or acceptable.

3.3 CONTRACTOR'S VERIFICATION OF INSTALLATION

- A. The Contractor shall perform a review of all test/checklists forms to ensure correct completion. This verification shall include, but not be limited to, first-hand knowledge of the following items:
 1. Each component device has been installed in accordance with the governing specifications and codes as well as the manufacturer's written recommendations.

2. All shop drawings and product data submittals have been approved for each component device.
3. All valve charts, wiring diagrams, control schematics, electrical panel directories, etc. have been submitted, approved, and installed in accordance with specifications.
4. All tabulated data has been submitted for each system and/or device as required by other sections.
5. All test reports and/or certifications required have been submitted and accepted. If required, provide certification of acceptance from manufacturer representative and/or engineering technician.
6. The Contractor shall be responsible for correction of all noted deficiencies. Any request for inspection of a test or re-test of a device or system shall first be confirmed as being in compliance by the Contractor before requesting inspection/re-inspection.

3.4 INITIAL START-UP

A. Start-up of Independent Devices

1. The Contractor shall not energize or activate, or allow being so activated, any operable device prior to submission of an ESR for that device to the Owner to witness the start-up. It is permissible to “bump” motors prior to submission of the ESR to verify rotation/electrical phasing.
2. The Contractor and manufacturer’s representative and/or engineering technician (if required by the contract documents) shall inspect and accept the installation. The installation shall not vary from provisions of the applicable specifications and the manufacturer's written recommendations for start-up.
 - a. This process shall be documented using the PFT checklist which shall be attached to the ESR.

B. Start-up of Building Systems

1. The Contractor shall not energize or activate any building system until the following conditions have been met:
 - a. The Contractor shall submit an ESR, with all relevant PFTs attached, to the UTD ODR 5 days prior to requested start-up of the system.
 - b. As a minimum, the Contractor shall verify:
 - 1). That all wiring and support components for equipment are complete and have been tested in accordance with the technical specifications and/or the manufacturer's written recommendations.
 - 2). That each component device has been checked for proper lubrication, vibration isolation, drive rotation, belt tension, control sequence, or other conditions that may cause damage.
 - 3). That all tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer and are in compliance with applicable specifications.
2. The Contractor shall execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturer's instructions as specified in the contract documents.
3. Successful completion of the above for the system is required before any system can be placed into operation, even on a temporary basis.
4. The Contractor shall coordinate and schedule system(s) start-up in a timely manner so they can operate each system for a period of time sufficient to evaluate and adjust performance as necessary, prior to

demonstrating the system to the Owner and A/E. All building systems shall be operational, and shall have been successfully inspected by the Owner's representatives prior to the Contractor requesting Substantial Completion inspections for the project.

3.5 CONTRACTOR'S OPERATIONAL TESTING

- A. The Contractor shall submit an FT checklist, with all relevant PFTs attached, to the UTD ODR five (5) days prior to the requested testing of the system.
- B. The Contractor shall operate, or cause to be operated, each system, device, or equipment item, both intermittently and continuously, for duration as indicated in the specification section(s) for such item and/or in accordance with the manufacturer's written recommendations. This operation shall be documented using the Functional Test Checklist.
- C. Each component device and each building system shall be exercised to the full extent of its capability, from minimum to maximum, and under automatic control, where it is applicable, as well as checking manual operation.
- D. The Contractor and, where applicable manufacturer's representatives, shall supervise and coordinate adjustments and balancing of all devices and systems for proper operation prior to requesting system inspection(s).
 - 1. Where final balancing of a system is to be performed by Owner or Owner's consultants, such as final air balancing, Contractor is to provide all services indicated in the applicable technical sections and, under this section, shall provide the following before the balancing work can start:
 - a. All test documentation associated with the system has been completed and presented to the UTD ODR. This encompasses operational verification of all component devices and of the total system, including automatic controls motors, fans, dampers, and other operable devices are performing in compliance with specifications throughout their operable range, and that all such devices are controlled as described in specified sequence of operation.
 - b. All tabulated data, motor amperage readings, valve tag verifications, and other data as required by technical specifications.
 - 2. Where final balancing of a system or particular components thereof are not specifically indicated to be performed by Owner or Owner's consultants, the Contractor is to provide final balancing and adjustments for operation within specified tolerances prior to demonstration of such system.

3.6 INTEGRATED SYSTEM DEMONSTRATION

- A. After successful completion and subsequent documentation of all system operation by Functional Test checklists, the Contractor shall schedule a meeting with the Project Commissioning Team to review the proposed procedures for a demonstration of all integrated systems within the facility.
- B. Development of integrated system demonstrations may vary with each project. They typically run through the facility fire alarm, emergency power and mechanical systems. Discussions with the design team will ensure thorough performance demonstration is achieved. Demonstrations shall include not only normal operating conditions over entire operating ranges, but also failure modes such as major component failure or loss of power. All sequence of operation for all modes of operation shall be executed and/or verified by the Contractor before demonstration to the Owner.
- C. Following compliance with all provisions noted above and following submission of Operating & Maintenance Manuals for the all systems to be demonstrated, the Contractor shall provide the Owner with a 5-day notice of their intent to perform a system integration demonstration and document it with the Integrated System Report. These reports will require some customization for each project and necessitate review with design engineer and other Owner consultants. The Contractor is responsible for coordination of this effort.

3.7 OWNER TRAINING

- A. Training shall consist of classroom type sessions followed by on-site demonstrations of system operation. See specific specification technical sections for requirements. If a system/equipment requires both demonstration and training, they may be combined if the Contractor is prepared and the Owner approves.
- B. The Contractor shall be responsible for coordination, scheduling and completion of the training for all equipment as specified in the contract documents. The training will be conducted by the installing subcontractor and/or manufacturer's representative for that specific piece of equipment.
- C. Use the Operating & Maintenance Manuals and the equipment matrix as a basis for instructing Owner's personnel regarding system operation. Review contents of O&M Manuals and review equipment data and performance verification from the FT checklists. This instruction and data review should be held in a classroom environment.
- D. Demonstrate in the field: start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of the system(s) and each component device.
- E. Demonstrate point-by-point check-out at each stage of sequence of operation. Promptly correct any deficiencies noted during the demonstration/inspection.
- F. Contractor shall participate in demonstration of Owner-furnished/contractor-installed equipment to the extent of verification of contract requirement compliance.
- G. As a minimum, the Contractor shall perform training on all Life Safety systems including, but not limited to the following (if system is part of the project):
 - 1. HVAC and Controls
 - 2. Fire Alarm
 - 3. Fire Sprinkler Systems (including pumps)
 - 4. Elevator/Escalator
 - 5. Smoke Purge
 - 6. Stairwell Pressurization
 - 7. Communications Systems
 - 8. Emergency Power/Generator/UPS
 - 9. Facility Security System
 - 10. Medical Gas Systems

END OF SECTION 01 91 00

REVISION LOG

The following is provided for convenience to the Owner, Architect/Engineer and Contractor to track changes between annual document issuances and is not to be considered by any party to be contractual or 100% complete.

Date	Paragraph Revised