

SECTION 01 75 00 – STARTING AND ADJUSTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes building system commissioning, including :
 1. Pre-Commissioning Meeting to Review the Commissioning Plan.
 2. Equipment Documentation Requirements.
 3. Contractor's Verification of Installation.
 4. Commissioning and Closeout Manual.
 5. Pre-Installation Conferences.
 6. Initial Start-Up.
 7. Operational Testing & Adjustment.
 8. System Inspection.
 9. Commissioning Report.

1.3 RELATED WORK

- A. Related Work of Other Sections:
 1. Division 01 Section – Summary of Work: Sequence of construction, access and use of the premises.
 2. Division 01 Section – Substitution Procedures: Substitution procedures after receipt of Bids
 3. Division 01 Section – Project Management and Coordination: Requirements for coordination of installation of various portions of the Work.
 4. Division 01 Section – Project Meetings.
 5. Division 01 Section – Construction Progress Documentation: Requirements for construction scheduling and reporting of progress of the Work.
 6. Division 01 Section – Submittal Procedures: Requirements for review and approval of shop drawings, product data and samples prior to installation of respective work.
 7. Division 01 Section – Product Requirements: General procedures for delivery, storage, and handling of materials and equipment.
 8. Division 01 Section – Closeout Procedures: Closeout procedures and submittals.
 9. Division 01 Section – Operating and Maintenance Data.
 10. Division 01 Section – Demonstrating and Training: System demonstration and Owner training.
 11. Division 8 Sections – Openings: Operating assemblies related to exterior building enclosure.
 12. Division 10 Sections – Specialties: Operating assemblies.
 13. Division 11 Sections – Equipment: Operating and non-operating assemblies.
 14. Division 14 Sections – Conveying Equipment
 15. Division 21 Sections – Fire Suppression
 16. Division 22 Sections – Plumbing
 17. Division 23 Sections – HVAC
 18. Division 26 Sections – Electrical

1.4 REFERENCES

- A. Referenced Standards: Except as otherwise noted, comply with applicable provisions of the following:
- B. ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers.
 - 1. ASHRAE Guideline 1 – 1996, The HVAC Commissioning Process

1.5 DEFINITIONS

- A. Commissioning: The process of ensuring systems are designed, installed, functionally tested, and operated in conformance with the design intent expressed in the Contract Documents. Commissioning begins with planning and includes design, construction, start-up, acceptance, and training and can be applied throughout the life of the building. Furthermore, the commissioning process encompasses and coordinates the traditionally separate functions of system documentation, equipment start-up, control system calibration, testing and balancing, and performance testing.
- B. Commissioning Team: The commissioning team shall be made up of representatives from the Contractor's Superintendent, Commissioning Agent, Owner, Architect, HVAC engineer, plumbing engineer, electrical engineer, sprinkler and standpipe system engineer, major equipment suppliers, mechanical trades, and other trades as appropriate. The lead tradesman for each trade who will actually perform or supervise the work is to be designated as the representative to the commissioning team. Responsibility for the various steps of the commissioning process will be accomplished by the commissioning team member, as described in the commissioning plan.
- C. Commissioning Agent: The entity selected by the Architect to have undivided responsibility for formulating and enabling the commissioning plan, and for coordinating and directing each step of the commissioning process, and for recommending acceptance or non-acceptance of each item of equipment and system requiring commissioning.
- D. Design Intent: The basic design intent, basis of design, and the expected performance requirements indicated in the Contract Documents. The final design intent document includes updates to reflect approved as-built conditions and will become part of the Operating and Maintenance Data.

1.6 PERFORMANCE REQUIREMENTS

- A. General: Work of this Section includes creation of a commissioning plan, start-up testing and adjusting of HVAC, plumbing, lighting and power delivery systems, life safety systems and building controls to confirm performance with the basic design intent, basis of design, and with the expected performance requirements indicated in the Contract Documents. The process of assuring that such performance is achieved is referred to as "Commissioning."

- B. Commissioning requires cooperation and direct involvement by Contractor and other entities involved in furnishing and installing systems requiring commissioning throughout the construction process to achieve systems complying with the design intent and with the expected performance requirements indicated in the Contract Documents. Successful commissioning requires that installation of all building systems not only comply with Contract requirements but also that systems and equipment are fully operational early enough to provide full operational check-out and perform necessary adjustments prior to Substantial Completion. In addition to fulfilling scheduling and planning requirements, Contractor is further required to provide appropriate commissioning plan, documentation and operational verification data for all equipment and systems requiring commissioning as part of the Project Record Documents, as specified in Section 01 78 23 – Operation and Maintenance Data. Coordinate with requirements of this Section with those of Section 01 90 13.
- C. 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. Contractor shall arrange for a qualified commissioning agent with undivided responsibility for establishing the commissioning plan and commissioning testing and adjusting process. The commissioning process shall not be delegated to individual subcontractors.
- D. Owner's quality assurance testing and inspection program is independent of the Commissioning program. Contractor is required to coordinate and perform all testing and adjusting as specified in the Contract Documents in addition to the implementation of the commissioning plan and other general Commissioning requirements outlined in this Section.

1.7 SUBMITTALS

- A. Submit the following in accordance with requirements of Division 01 Section – Submittal procedures:
 - 1. Summary of operation and maintenance criteria for each item of equipment and system from information given in the Contract Documents.
 - 2. Verification and performance functional testing results reported in initial equipment matrix and Equipment or System Start-Up/Request for Inspection Form.
 - 3. Initial equipment and system test results showing compliance with basic design intent and with the expected performance requirements indicated in the Contract Documents.
 - 4. Final equipment and system test results showing compliance with basic design intent and with the expected performance requirements indicated in the Contract Documents.
 - 5. Competed Commissioning Report, with equipment matrix and Equipment or System Start-Up/Request for Inspection Form.

1.8 QUALITY ASSURANCE

- A. Engage a Commissioning agent with a minimum of three years satisfactory experience in formulating coordinated commissioning plans, establishing testing procedures for the verification system performance, and preparation of commissioning reports for facilities similar to size and scope of those required for this Project. Submit a list of commissioning work experience for the past three years, including the general scope of commissioning performed at each project; and the name, address and telephone number of the physical plant manager at each location.

1.9 PRE-COMMISSIONING MEETING

- A. Within 60 days from the effective date of Owner's Notice to Proceed, Contractor shall schedule, plan, and conduct a pre-commissioning meeting with all entities involved in the Commissioning process. At a minimum this should include the Commissioning Agent, major sub-contractors, specialty manufacturers/suppliers, the Architect, mechanical and electrical consultants, and the Owner's test and balance firm.
 - 1. Contractor shall create a meeting agenda, preside over the meeting, and review all aspects of the Commissioning specification and procedures. Discuss all commissioning plan and documentation, verification and functional performance test procedures, and review all operation verification forms. Contractor shall prepare an outline noting responsibilities of the various entities involved in the Commissioning process for review at this meeting.
 - 2. Review requirements and discuss responsibility for the scope of each entities work for Commissioning process and for preparation of documentation to be included in the Commissioning Report for inclusion in the Operation and Maintenance Data Manuals. Contractor should be prepared to distribute copies of the pertinent Specification sections to the various entities involved in the Commissioning process.
 - 3. Progress schedule incorporating Commissioning Milestones
- B. The Commissioning Agent shall create and discuss the following documents and procedures at the pre-commissioning meeting:
 - 1. Commissioning plan, target dates for startup testing, and adjusting with the Construction Schedule as specified in Division 01 Section – Construction Progress Documentation.
 - 2. Verification and functional performance testing protocols for each item of equipment and each system to verify conformity with the basis of design intent and expected performance requirements indicated in the Contract Documents.
 - 3. Progress report tracking the progress of Commissioning testing and adjusting submitted monthly and included as an agenda item on all monthly project progress meetings as specified in Division 01 Section – Project Management and Coordination.
 - 4. Operation and Maintenance Data, including appropriate commissioning documentation and operational verification data, for all equipment, systems, and devices requiring commissioning, and equipment and closeout matrixes.

1.10 PREINSTALLATION MEETINGS

- A. Contractor shall conduct preinstallation meetings as specified in Division 01 Section – Project Management and Coordination. These meeting shall be conducted before any of the work to be reviewed is installed.

1.11 EQUIPMENT DOCUMENTATION REQUIREMENTS

- A. Equipment List/ Matrix, General:
 - 1. Prior to the pre-commissioning meeting, Contractor shall submit a complete listing of all operating equipment, devices, and systems requiring commissioning, testing and adjusting to the Commissioning Agent and Architect. Coordinate response to this requirement with its preparation of the Work Progress Schedule, Submittal Schedule, Schedule of Values, and list of all equipment.
 - 2. Minimize duplicating efforts in favor of a single, organized approach to all documentation required for project equipment, systems, and devices.

3. Format the equipment matrix 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. Submit Matrix in two (2) phases, initial and final. An electronic database program may be used instead of a spreadsheet, if approved by the Owner.
4. The matrix shall identify all operable devices and equipment to be provided; such are to be arranged and 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. Submit an Initial Equipment Matrix prior to the Pre-commissioning meeting. Include the following data, as a minimum, for each device, and shall allow for additional columns for subsequent data requirements as indicated in 1.9 A. 6. below.
 - a. Brief equipment identification text
 - b. Equipment or device I.D. number
 - c. Associated building system, if any
 - d. Governing specification section
 - e. Appropriate submittal reference number(s) and projected time of original submission of device or system
 - f. Installation location, by room number or column coordinates, as indicated in contract documents.
6. Submit a Final Equipment Matrix for each device or system is to be provided as attachment to the Contractor's submission of the "EQUIPMENT or SYSTEM START-UP/Request for Inspection Form" for requesting inspection of particular devices or systems. This matrix shall include all data noted above, 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.

1.12 EQUIPMENT OR SYSTEM START-UP/REQUEST FOR INSPECTION FORM

- A. Provided a one page "Equipment or System Start-Up/Request for Inspection" form for use in requesting an acceptance inspection of any system or system component. Form includes:
 1. Written certification by Contractor that he has verified that the installation and the operation of the system or component is in accordance with specifications, drawings and details.
 2. Written certification by the manufacturer's representative that he has verified that the installation and the operation of the system or component is in accordance with their published recommendations (if certification is required by the Contract Documents).
 3. An area for remarks and acceptance sign-off by Owner representative.

1.13 INSPECTION PLAN AND FORMATTED CHECKLIST

- A. As a second attachment to the "Equipment or System Startup/Request for Inspection" form noted above, the Contractor shall provide a written plan and a formatted checklist for Owner and Architect's use.
 - 1. The plan shall identify the parties to attend, the anticipated duration, the steps to be taken, devices activated, measurements taken, and similar activities appropriate to demonstrate system performance.
 - 2. The checklist shall identify in columnar format each device, the location, the test method, the sequence reference, the device code reported, and other data as appropriate.
 - 3. The Contractor shall provide a draft version of each of these (plan and check-list) at the Pre-Installation Conference for the system. Based on discussions at the Pre-Installation Conference and subsequent as-built conditions, the Contractor shall amend and revise both documents as appropriate prior to requesting system inspection from the Owner.
 - 4. The final versions of both these documents shall be provided by the Contractor as attachments to their "Equipment or System Start-Up/Request for Inspection Form".

1.14 CONTRACTOR'S VERIFICATION INSPECTION

- A. The Contractor shall review the installation and contract requirements for each system and shall provide written confirmation, in addition to the "Equipment or System Start-Up/Request for Inspection" form, verifying the following items:
 - 1. 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.
 - 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. Each component device has been installed in accordance with both the governing specifications and codes as well as the manufacturer's written recommendations.

1.15 COMMISSIONING AND CLOSEOUT DATA

- A. The Contractor shall incorporate all commissioning and closeout documentation and verification data into the Operation and Maintenance Data Manual for transmittal to the Owner at the conclusion of the project as specified in Division 01 Section – Operation and Maintenance Data. 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.
- B. Included in this manual shall be (but not limited to) the following:
 - 1. Equipment List Matrix
 - 2. Closeout Documentation Matrix
 - 3. Paint/Finish Schedule. This schedule shall include all paints, flooring, finishes, etc. used on the project.

- a. Provide manufacturer, model #, color formula, location on project, purchase source and any other information helpful to the Institutions' maintenance personnel.
4. Spare Parts, Attic Stock and Keys Checklist
 5. Building Envelope
 6. Elevator Checklist
 7. Indoor Air Quality Methods and Procedures
 8. Energy Supply Systems
 9. Sewer Video Log
 10. Compliance with Codes and Standards
 11. Witness Testing, Including Flushing, Cleaning, Pressure Testing, and Leakage Testing
 12. Air-handling and Distribution and Ventilation Systems
 13. Heating Systems
 14. Cooling Systems
 15. Hydronic Systems
 16. Piping System Test Reports
 17. Life Safety Systems, including Smoke Detection, Fire Alarm and Public Address Systems, Fire Sprinkler Systems and Standpipes (including pumps and fire main flow tests), Stairwell Pressurization, and Smoke Purge
 18. Communications Systems
 19. Emergency Power/Generator/UPS
 20. Water Softener Systems.
 21. Controls
 22. Building Automation Systems
 23. Electrical Test Reports
 24. Equipment Test Reports
 25. HVAC Calibration Reports
- a. Including duct testing reports
26. Operation Procedures
 27. Emergency Procedures
 28. Demonstration / Training Reports
 29. Create forms for project specific equipment. The Contractor shall review each form for approval with the Owner before using the form.
 30. Organize manual, provide dividers, table of contents, reproduce, bind, and distribute copies as specified in Section 01 78 23 – Operation and Maintenance Data.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.1 PRE-INSTALLATION CONFERENCE

- A. As a minimum, Contractor shall schedule a pre-installation conference for the work of each major building system. The pre-installation conference shall be scheduled, in writing, a minimum of ten (10) days in advance, and shall be scheduled so that the Owner, Architect, and MEP Engineers can attend. This conference shall be convened following approval of system submittals and prior to commencement of system installation work.

- B. Contractor shall arrange for all entities (subcontractors, suppliers, and manufacturers involved in the system) to be present or adequately represented.
- C. The Contractor shall bring the following to this conference, as a minimum, for review and discussion:
 - 1. The portion of the Initial Equipment Matrix applicable to the system under discussion.
 - 2. The draft of the Inspection Plan and Formatted Checklist.
 - 3. The Current Work Schedule data pertaining to the beginning, start-up, inspection, and turn-over phases anticipated for the particular system.
 - 4. Copy of all approved submittals for the system.
- D. The purpose of this Conference is for the Contractor and all applicable subcontractors and/or 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, develop a game plan for start-up, inspection and acceptance, based on the Contractor's draft plan and checklist, so that all entities are aware of what is expected and/or acceptable.

3.2 INITIAL START-UP

- A. Start-up of Independent Devices:
 - 1. The Contractor shall not energize or activate, or allow to be so activated, any operable device until it has verified to its own satisfaction that all Contract requirements for such device have been met, other than those pertaining to operational checkout.
 - 2. The Contractor may energize and/or start-up independent devices for operational check-out and testing only after the Contractor and manufacturers' representative and or engineering technician (if required by the contract documents) has inspected and accepted the installation. The installation shall not vary from provisions of the applicable specifications and the manufacturer's written recommendations for start-up.
- 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 has verified that all wiring and support components for equipment are complete and have been tested in accordance with the technical specifications and the manufacturer's written recommendations.
 - b. The Contractor has verified 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.
 - c. The Contractor has verified 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.
 - d. The Contractor has provided the Owner and the Architect/Engineer with a written five (5) day notice of intent to start-up the system for operational check-out. The "Equipment or System Start-Up/Request for Inspection Form" without attachments, shall be used for this notification.
 - 2. The Contractor shall execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturer's instructions and specification requirements.

3. 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 Architect. 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.

3.3 CONTRACTOR'S OPERATIONAL TESTING

- A. The Contractor shall operate, or cause to be operated, each system, device, or equipment item, both intermittently and continuously, for a duration as indicated in the specification section(s) for such item and/or in accordance with the manufacturer's written recommendations.
- B. 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 such is applicable, as well as manual operation.
- C. 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. Operational verification of all component devices and of total system, including automatic controls where applicable. This would include, as a minimum, verification that all 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.

3.4 SYSTEM INSPECTION

- A. Following compliance with all provisions noted above and following submission of Operating & Maintenance Manuals for the particular system to be inspected, the Contractor shall submit an "Equipment or System Start-Up/Request for Inspection Form" along with the Contractor's "Inspection Plan & Formatted Check-List", the Contractor's written confirmation noted in 1.13 A of this Section, and the Final "Equipment Matrix".
- B. The Contractor shall request scheduling of an inspection with the Owner and A/E a minimum of five (5) days in advance

3.5 DEMONSTRATION AND OWNER TRAINING

- A. Training shall consist of classroom type sessions followed by on-site demonstrations of system operation. See specific specification sections for requirements. If a systems/equipment requires both demonstration and training, they may be combined if the Contractor is prepared and the Owner approves. See Section 01 79 00 – Demonstration and Training for specific requirements.
- B. The Contractor shall provide up to 8 hours of video recording of training, with audio. The Owner will select those portions of the training to be recorded. The production of the video shall provide a professional-grade product. Include the maintenance, adjustments, and emergency procedures portion of the Operation and Maintenance Data
- C. 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 manufacturers' representative for that specific piece of equipment.
- D. Utilize 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. This instruction and data review should be held in a classroom environment.
- E. Demonstrate in the field: start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of the system(s) and each component device.
- F. Demonstrate point-by-point check-out at each stage of sequence of operation. Promptly correct any deficiencies noted during the demonstration/inspection.
- G. Cooperate with Owner's agents for verification testing and final adjustments and balancing as may be indicated in technical specifications or as directed by Owner.
- H. 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 Systems and Controls.
 - 2. Building Automation Systems
 - 3. Plumbing Systems.
 - 4. Electrical Lighting and Power Distribution.
 - 5. Fire Alarm and Smoke Detection Systems.
 - 6. Fire Sprinkler Systems and Standpipes (including pumps).
 - 7. Elevator.
 - 8. Communications Systems.
 - 9. Emergency Power/Generator/UPS.
 - 10. Water Softener Systems.
 - 11. Emergency Procedures

END OF SECTION 01 75 00