

## Scope of Services for Commissioning Agent

**A) Commissioning Activities:** Commissioning activities for individual projects shall include the following integrated building systems:

- 1) Building thermal envelopes and all materials and components forming a part of these systems including, but not limited to, walls, windows, doors, louvers, vents, grilles and sun screens.
- 2) Roofing systems and all materials and components forming a part of these systems including parapets and roof openings (e.g., skylights, monitors, pipe chases, ducts, penetrations),
- 3) HVAC Systems: Heating, ventilating and air conditioning systems, and all mechanical equipment forming a part of these systems including, but not limited to, all boilers, chillers, direct expansion refrigeration equipment, fuel storage and handling systems, pumps, piping, air handler systems, terminal equipment, fans, exhaust systems, ventilation systems, variable frequency drives, heat recovery systems, thermal solar systems, and automated temperature controls and energy management systems.
- 4) Plumbing Systems and all equipment forming a part of these systems including, but not limited to, potable and non-potable water systems, water pressure booster systems, service water heating systems, sanitary waste and vent systems, grey water systems, laboratory waste and acid neutralization systems, storm water systems including rain water reclamation systems, natural gas systems, and compressed air systems.
- 5) Electrical Power Systems and all equipment forming a part of these systems including, but not limited to, electrical supply and distribution systems, emergency and standby power systems including automatic transfer switching systems, lighting and lighting control systems, low voltage systems, grounding and bonding systems, audio visual systems, photovoltaic systems, wind power systems and interfaces to automated temperature/building automation control systems.
- 6) Life Safety Systems and all equipment forming a part of these systems including, but not limited to, security and surveillance systems, fire alarm systems, fire protection and suppression systems, fire pump systems, egress lighting, and egress pressurization.
- 7) Building Automation and Controls and all equipment forming a part of these systems including, but not limited to, the interface of these systems with HVAC systems, fire alarm and security systems.

**B) Project Phases:** Commissioning services for individual projects are anticipated to be provided starting from the Design Development Phase and continue through preparation of construction documents, bidding, construction, close-out and building occupancy.

- a. **Design Development and Construction Documents Phases** Within 30 days of contract signing, the Contractor shall prepare and submit to the Design Team a Design Phase Commissioning Plan which shall include:
  - i. Commissioning Task Matrix. A matrix or narrative describing major commissioning activities and the commissioning team member(s) designated to lead and assist with fulfilling those objectives;
  - ii. Commissioning Scope of Work. A detailed scope of work highlighting the systems that will be commissioned as indicated in the Work Order, and what commissioning tasks will need to occur over the design process. This section shall also cover the level of detail needed for the project's design documentation and the content of the commissioning specifications.

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- iii. Commissioning Schedule. A preliminary commissioning schedule which is cross-referenced with the Project's schedule highlighting dates when key commissioning activities need to be completed.
- b. Contractor shall perform a thorough review of all drawings and specifications. These reviews shall occur at the following mileposts: 100% complete Design Development, 60% complete Construction Documents and 90% complete Construction Documents, and shall review and comment on their completeness, coordination among design disciplines, and adherence to the Design Team. Such review shall include each of the following issues:
  - i. Review and provide input as to how to facilitate effective commissioning (including sufficient accessibility, test ports, monitoring points and related features).
  - ii. Review for adequacy of the energy efficiency and efficiency of system types and components for building shell, HVAC systems and lighting systems.
  - iii. Review envelope design and assemblies for thermal and water integrity, moisture vapor control and assembly life.
  - iv. Review HVAC, lighting, fire control, emergency power, security control system, strategies and sequences of operation for adequacy and efficiency.
  - v. Review commissioned systems layout and their impact on other systems and the facility as a whole toward facilitating operations and maintenance (including equipment accessibility and system control).
  - vi. Review the mechanical concepts/design and recommend enhancements for operational or efficiency improvements.
  - vii. Review the electrical concepts/systems and recommend enhancements for operational or efficiency improvements.
  - viii. Review the Construction Documents, including the drawings and specifications prepared for each subcontractor, to assess their completeness and coordination among the various disciplines, to assess provisions for construction sequencing, materials and equipment delivery and storage, site and building access, testing requirements, and training requirements.
- c. Contractor shall participate in design review meetings on an as-needed basis, which meetings shall be coordinated by the Design Team and be held monthly.
- d. Contractor shall, through the Design Team, organize, coordinate and conduct a controls integration meeting with the mechanical, electrical and systems control engineers who are part of the Design Team to discuss integration issues between equipment, systems and disciplines so that integration issues and responsibilities are clearly described in the construction specifications.
- e. Contractor shall develop commissioning specifications (the "Cx Specifications") for inclusion in the Construction Documents. Schedule for completion of the Cx Specifications shall be commensurate with the overall Project schedule. The Cx Specifications shall, at a minimum, define the commissioning requirements for each specification section, for a special commissioning specification division, and for each of the systems and equipment to be commissioned as

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identified in the Work Order, and shall be coordinated for format and content with the project manual developed by the Design Team.

- i. The Cx Specifications shall include, but shall not be limited to, requirements for commissioning submittals, startup and checkout test plans, functional test development support, pre-functional checklists and functional test execution, training plan development and execution, operations and maintenance manuals, as-built drawings and coordination among subtrades.
  - ii. The Cx Specification shall specifically include specifications for the start-up protocols, including an identification of any and all equipment or instrumentation needed for measurements during pre-functional testing and functional performance testing, so that these requirements and any specialized equipment or instrumentation will be clearly delineated and provided for in the Construction Documents. These procedures shall also be included in the Design Team's pertinent bid specifications for relevant subcontractors.
- f. Building upon the responsibilities defined in the Design Phase Commissioning Plan and the Cx Specifications, prior to the Project being put out to bid, Contractor shall develop the Construction Phase Commissioning Plan (the "Cx Plan"), including all documentation identifying and describing all required functional performance tests and defining clear procedures for the commissioning process. The Cx Plan shall be provided to the Design Team and the Design Team for review, approval and incorporation into the Construction Documents. At a minimum, the Cx Plan shall include the following:
  - i. Commissioning Task Matrix. A matrix or narrative describing major commissioning activities and the commissioning team member(s) designated to lead and assist with fulfilling those objectives
  - ii. Commissioning Scope of Work. Detailed description of all systems scheduled for commissioning, including the nature of the testing to be performed for each piece of equipment, for each sub-system and for each system.
  - iii. Deliverables: Clearly define the deliverables to be produced from the commissioning process and the deadlines for such deliverables, and identify parties responsible for producing them. Deliverables shall include, but not be limited to, schedules, test plans, test reports, training plans and final report. Identify required format for deliverables and include sample documents as appropriate.
  - iv. Schedule: Prepare a schedule of commissioning activities. The commissioning schedule shall be coordinated with the overall Project schedule as established by the OPM.
  - v. Checkout, Startup & Pre-functional Testing: Define the processes and procedures to be used for the installation review, startup and prefunctional testing process and required integration between these activities for each piece of equipment, sub-system and system.
  - vi. Functional Performance Testing: Describe the functional performance testing process, including prerequisites and any special equipment or instrumentation needed to obtain necessary measurements during performance testing. Include requirements for deferred seasonal functional performance testing as appropriate.
  - vii. Test Guidelines: Include requirements for review, approval and documentation practices and test acceptance criteria.

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- viii. Training & Turnover: Identify training requirements, and responsibilities for development of the training plan and participation by the Commissioning Team members in the training process. The training program shall assure that the Owner's building operation personnel receive adequate training for the proper operation of the new facility systems. Define required O&M, as-built and commissioning deliverables and the deliverables turnover procedures, with references to the construction specifications as appropriate, to ensure that the school district receives all necessary documentation from the
- ix. Define a procedure for the turn-over of all required tools, lubricants, spare parts and miscellaneous start-up consumables required to be provided by the CM including requirements for documentation and acceptance.
- x. Other commissioning-related correspondence, checklists, test forms, and documentation.
- xi. Upon OPM's receipt of 100% complete Construction Documents, Contractor shall provide to the Design Team three (3) electronic copies (DOC and PDF formats) on compact disk or flash drive of the Commissioning Plan, specifications and graphic materials.

#### **g. Bidding Phase**

- i. Contractor shall attend and participate in the pre-bid meeting(s) defining, to those in attendance, what is involved in the commissioning process, reviewing the sequence and schedule of the commissioning phase, and explaining its importance to the Project.
- ii. Contractor shall assist the Design Team and the CM in responding to requests from prospective bidders for information or clarification relating to commissioning.

#### **h. Construction Phase**

- i. Contractor shall coordinate the commissioning work with the CM and the Design Team and assess whether the commissioning activities are properly accounted for in the master Project schedule.
- ii. When equipment to be commissioned is about to be installed and during the installation of such equipment, Contractor shall track the progress and quality of the work being performed. To that end, Contractor shall visit the site at such intervals as are appropriate to the stage of construction; and whenever a significant amount of work in a specific discipline is being installed or constructed, Contractor shall bring to the site visits the specific members of Contractor's core team with expertise in such disciplines. Contractor shall advise the CM & the Design Team on any issues related to these matters. Contractor, however, shall not be required to make exhaustive or continuous on-site inspection to check the quality or quantity of the work.
- iii. In addition to attending construction meetings, Contractor shall, through the CM, plan and conduct periodic commissioning team meetings, which shall include, at a minimum, the CM/GC, sub-contractors responsible for the installation of systems to be commissioned, the Design Team, and the facility's operations personnel. These meetings should occur regularly during most of the Construction Phase and more frequently during the three months prior to the commencement of the Acceptance Phase. Contractor shall prepare commissioning meeting minutes and distribute them to the MSBA, the OPM and all attendees.
- iv. Contractor shall prepare Pre-Functional Checklists and Functional Test Procedures for commissioned equipment and systems and in the process shall:

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- i. Review CM and subcontractor submittals applicable to systems being commissioned concurrently with review by the Design Team to obtain equipment and system information and verify compliance with commissioning needs and requirements; advise the CM and Design Team of any deficiencies noted that may impact the commissioning execution or intended system performance; review the Design Team's submittal documentation and comments, and assist in resolving any discrepancies.
  - ii. Request and review additional manufacturers' or CM's information as required to develop the test procedures, including operations and maintenance materials, contractor start-up plans and component test procedures. Contractor shall request and review all Requests for Information (RFI), change directives and construction contract Change Orders (CO) for any changes that would affect the systems to be commissioned.
  - iii. Before startup, gather and review the approved control sequences of operation and interlocks, and work with the CM appropriate subcontractors and appropriate members of the design team until sufficient clarity has been obtained, in writing, to be able to write detailed functional performance test procedures.
  - iv. The functional performance test procedures shall be developed from industry performance testing standards and supplemented by information contained in approved shop drawings and submittals and shall include requirements for operating each system and its components through each of the written sequences of operation and other significant modes and sequences, including startup, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment.
  - v. Submit completed pre-functional checklists and functional performance test procedures and distribute to the CM Design Team, and equipment vendors for review as required and to assure understanding prior to execution.
1. Contractor shall review and comment on the CM's systems start-up plans and checkout plans, equipment and component test procedures, and shall coordinate these plans and procedures with the Design Team and through the Design Team, shall facilitate CM/GC compliance with the requirements of the Cx Plan and Construction Documents.
  2. Contractor shall review the testing, adjusting and balancing (TAB) execution plan before TAB is executed, and shall monitor functional testing of the control system, and, through the Design Team, recommend and coordinate such retesting of the control system as may be necessary until, in the opinion of the Contractor, it's ready for use for TAB. In connection with the TAB, Contractor shall review air and water systems balancing by spot testing, by reviewing completed reports, and by selected site observation.
  3. Contractor shall review and comment on the Training Plan developed by the CM. Review the plan for compliance with training requirements of the facility's operations staff and obtain documentation from the Owner attesting to the adequacy and acceptance of the Training Plan.

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### I Acceptance Phase

- i. Contractor shall plan, organize, schedule and coordinate all commissioning and other work activities including pre-functional testing and functional performance testing during this phase of the Project, shall coordinate such activities with the OPM and the CM/GC, and shall lead all commissioning team meetings.
- ii) Contractor shall review pre-functional checklist execution by site observation and spot checks, shall review all completed pre-functional checklists, shall review the deficiency and resolution log, balancing reports, approved shop drawings, open RFI's and manufacturers' start-up sheets and comment on the readiness for functional performance testing.
- iii) Contractor shall review the calibration status of sensors and actuators reported during pre-functional check by the installing contractors and shall spot check the same during functional testing.
- iv) Working with the CM, equipment vendors and appropriate subcontractors, Contractor shall execute, coordinate, witness and assess the functional performance tests for each sub-system and system as established by the Cx Plan, and shall coordinate retesting as necessary until satisfactory performance is achieved. Services shall include:
  - (1) Coordination, witnessing and assessing performance tests of building envelope components.
  - (2) Execution of tests on HVAC equipment during both the heating and cooling season. Tests shall be conducted with the systems utilizing permanent electrical power and, to the extent possible, under full load conditions, though, some overriding of control values to simulate conditions may be allowed, if used judiciously.
  - (3) Execution of tests using conventional methods, control system trend logs or stand-alone data loggers, to provide a high level of confidence in proper system function.
  - (4) Analyze functional performance trend logs and monitoring data to assess performance.
  - (5) Maintain a master deficiency and resolution log, which shall become part of the Issues Log, and a separate testing record, provide periodic, written progress reports to the OPM, the Design Team and the MSBA which include test results with recommended actions, coordinate resolution of any deficiencies with the CM/GC and appropriate subcontractors, and witness and document repeat testing, as necessary to indicate whether all deficiencies are corrected.
  - (6) Witness all tests of commissioned equipment and systems which the Owner may contract for or which may be performed by manufacturer's personnel over whom the Contractor may not have direct control, review and comment on the accuracy of the test reports and the conformance of the test results with the Contract Documents, and document and include the test data and reports of such tests in the commissioning record and in the operations and maintenance manuals.
- v) Contractor shall coordinate and participate in the training of the facility's operations and maintenance staff in accordance with the requirements of the training plan, which shall include participation of appropriate systems and equipment vendors and contractors. Contractor shall provide documentation to the Design Team that this has been satisfactorily completed.
- vi) Contractor shall review completed as-built drawings and records, including operation and maintenance manuals prepared by equipment manufacturers, fabricators or installers.
- vii) The Contractor, with the assistance of the Design Team and GC shall develop a Systems Manual that provides the information needed to understand, operate, and maintain the building's systems and assemblies. Systems Manual shall be developed in accordance with ASHRAE 202-2013.
- viii) Contractor shall participate in meetings and other Project activities relating to system start-up and after Substantial Completion shall participate in the review of the building operations.

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- ix) Contractor shall assess and report to the Design Team and CM whether all equipment and systems are working in conformance with the requirements of the Construction Documents, and shall make recommendations for modification or adjustment as necessary.
- x) Contractor shall review all equipment warranties and advise the MSBA, OPM, and Design Team of compliance with the Construction Documents.
- xi) Contractor shall review all testing, adjusting and balancing with respect to each piece of equipment to be commissioned, for each system and combination of systems, and for the facility as a whole; shall assess the adequacy, accuracy and completeness of all final testing, adjusting, and balancing reports; and shall advise the OPM and MSBA of any necessary corrections.
- xii) Contractor shall observe all environmental performance testing, and testing of environmental monitoring systems or tests by manufacturers' personnel over whom Contractor may not have direct control, shall review and comment on the accuracy of the test reports and the conformance of the test results with the Contract Documents, and all permits and other applicable requirements, and shall document and include the results of these tests in the Final Commissioning Report.
- xiii) Contractor shall monitor the continuing adjustment, optimization, and modification of all systems to assess whether they meet operating and performance requirements specified in the Contract Documents, and shall advise the OPM and the MSBA on a regular basis on the status of this process.
- xiv) Contractor shall coordinate with the OPM to review and recommend appropriate action with respect to the operator training program required by the CM/GC.
- xv) Contractor shall comment on documentation provided by the CM/GC regarding the provision of all required tools, lubricants, spare parts and miscellaneous start-up consumables required to be provided by the CM/GC.
- xvi) Contractor may be requested by the MSBA to provide on-going support to the OPM, the MSBA and the Owner during the first full year of operation on an as-needed basis as a reimbursable service.
- xvii) Contractor shall accompany the OPM and Design Team on a walk-through site visit upon completion of punch list by the CM/GC, review the deficiency and resolution log and report to the OPM on the installation completeness and functionality of all commissioned systems; and shall advise the OPM of any necessary corrections.
- xviii) Contractor shall provide the MSBA, OPM, and Design Team with prompt written notice if Contractor becomes aware of any fault or defect or noncompliance with the Construction Documents as they may affect the systems to be commissioned.

#### **8) Project Closeout**

- i) Contractor shall provide a Final Commissioning Report. The report shall include an executive summary, list of participants and the role of each participant, brief building and systems descriptions, an overview of the scope of commissioning and testing, and a general description of testing and verification methods.
- ii) For each piece of commissioned equipment, the report shall address the adequacy of the equipment, documentation and training, in satisfying the requirements of the Contract Documents in each of the following areas:
  - (1) Equipment/system specifications and design intent
  - (2) Equipment/system installation
  - (3) System functional performance and efficiency
  - (4) Description of the verification method used (manual testing, trend logs, data loggers, or other as appropriate) and observations and conclusions from the testing

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- (5) Non-compliance issues referenced to the specific functional test, inspection,
- (6) trend log, and other records where the deficiency is documented
- (7) Equipment/system operations and maintenance
- (8) Record documentation
- (9) Operator and maintenance training.
- iii) ii. All outstanding non-compliance items shall be specifically listed in the report, and recommendations for improvement to equipment or operations, future actions, commissioning process changes, and other appropriate matters shall also be listed.
- iv) iii. Appendices shall contain all acquired sequence documentation, Issues Log, meeting minutes, progress reports, deficiency lists, site visit reports, findings, unresolved issues, communications, and all other relevant information.
- v) iv. Pre-functional checklists and functional performance tests and monitoring data and analyses shall be provided in a separate labeled binder.

#### **9) Post Occupancy**

- i) Contractor shall, through the OPM, plan, organize, schedule and coordinate required seasonal or deferred testing and deficiency corrections.
- ii) Contractor shall provide the final testing documentation for the commissioning record and operations and maintenance manuals.
- iii) Ten months after Substantial Completion of the Project and after one complete heating and cooling season, Contractor shall return to the Project site and review with the building operations and maintenance staff including the status of outstanding issues related to the original and seasonal commissioning, shall interview facility staff and identify problems and any concerns they may have with the operation and maintenance of the facility as originally intended, shall make suggestions for improvements and for recording any proposed changes in the operations and maintenance manuals, shall identify to the facility staff those issues whose correction may be covered by equipment and system warranties or by the original construction contract, and shall assist the facility staff in developing reports and documents and requests for services to remedy outstanding problems. Once deficiencies have been corrected, Contractor may be requested to provide oversight on any final testing required, and document the results in the Commissioning Record as a reimbursable service.