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**DIRECTIVE 15H-9**

**Issue date: October 2018**

## **COMMISSIONING**

Purpose: The purpose of this Directive is to describe, in outline, the requirements of Commissioning on SUCF Projects.

### **1. Applicability**

- a. New York State Energy Conservation Code (NYSECCC) and 2016 supplement to the NYSECCC requires commissioning of building mechanical systems, service water heating systems and electrical power and lighting systems. This includes all New Construction and Additions or Alterations to existing buildings and systems.

#### **1. Commissioning Process**

- a. The Fund will provide for services of a Commissioning Authority (CxA) on SUCF Projects through its Term Commissioning Agreements, a Project specific Commissioning Agreement or the Design Consultant Agreement by extra compensation.
- b. Commissioning services will be tailored to fit the Project scope and include:
  - 1) LEED Commissioning - Projects designed to LEED Silver rating as described in Directive 1B-7.
  - 2) NYSECCC Commissioning.
  - 3) Other Commissioning – Projects not requiring LEED or NYSECCC Commissioning, where commissioning is requested by the Campus and the Fund to:
    - a. Demonstrate that systems or portions of the work can be used for the purposes for which they were intended;
    - b. Assist in compliance with regulatory requirements;
    - c. Oversee building optimization with sufficient training and documentation for proper building system performance;
    - d. Identify and oversee cost-effective operational and maintenance improvements.

- c. Procedure for providing a fee proposal:
- 1) The Fund will identify the required commissioning services in the list above and request a fee proposal.
  - 2) The CxA will review the scope of work for the Project, its time schedule for construction and other information that exists at the time of the Fund's request, as shown and described in the information provided by the Fund's Design Consultant.
  - 3) Based on the scope of work for the Project and the requirements of Directive 15H-9, the CxA will determine the extent of the systems to be commissioned.
  - 4) The CxA will provide a proposal for the Fund's review and approval using the format in Directive 1C-4 Extra Compensation Authorization. The proposal will describe the systems to be commissioned; qualifications of proposed staffing; time required by staff for their services during pre-construction, construction and occupancy; hourly rates for staff applicable for the duration of commissioning; estimated reimbursable expenses; the methodology for arriving at the total fee; and other information requested by the Fund.
  - 5) After the Fund determines that the proposal is fair and reasonable, the CxA will be authorized to proceed in accordance with the requirements of the Term Commissioning Agreement, Project specific Commissioning Agreement or the Design Consultant Agreement if services are provided by extra compensation, as applicable.
- b. Systems to be Commissioned: Base building mechanical systems, service water heating systems, and electrical power and lighting systems. The following systems, as applicable to the Project, must be commissioned:
1. Chiller, Air Conditioner, Heat exchangers, Campus chilled water, Condensers, Cooling systems.
  2. Boiler, Furnace, Heat exchangers, Steam, HTHW, MTHW, Heating systems.

3. Domestic and Service Water Heater, Domestic Water heating systems.
  4. Cooling Tower (Fan, valves).
  5. Air Handling Unit (Coils, valves, fans, humidification, dampers).
  6. Ventilation, exhaust and miscellaneous fans.
  7. Ducts and Dampers.
  8. Piping and Valves.
  9. Duct and Piping Insulation.
  10. Controls for System, Building and Central Plant.
  11. Energy Recovery (components, systems, and units).
  12. Air or water Economizers
  13. Renewable Energy systems.
  14. Thermal Storage.
  15. HVAC pumps.
  16. Refrigerant leak detection systems.
  17. Fume hood and other special exhaust systems.
  18. Systems for laboratory, medical and/or research gases, fluids and other specialized materials and methods.
  19. Electrical systems and Lighting systems including daylight/occupancy sensor and dimming controls
  20. Emergency and standby power systems, including generators and transfer switching.
  21. Air leakage – thermal envelope installation verification.
  22. Any other equipment or systems used for HVAC that affect energy use or Indoor Air Quality, or the Campus' ability to operate a building for its intended use.
  23. Any other system as requested by the design team and approved by SUCF.
- c. Commissioning as required to achieve selected LEED credits including documentation as required for and filling out of LEED templates for commissioning credits.
- d. Commissioning as required to meet the requirements of selected NYSERDA programs or any other incentive program used by the Project.

## **2. Responsibilities of Commissioning Participants**

- a. Designer of systems to be commissioned must prepare a written description of each system's Owners Project Requirements (OPR), basis of design (BOD), and sequence of operations. Development of OPR and BOD shall include a review by the CxA. These items shall be submitted with the Design Manual Phase submission.

- 1) The Owners Project Requirements (OPR) document shall detail the basics of the system(s) and assemblies that are to be commissioned. It shall include but not be limited to: Service Water heating criteria, lighting systems design, space temperature and humidity criteria, thermal zoning criteria, level of occupant control over HVAC systems, ventilation and IAQ criteria, performance related to energy efficiency, envelope requirements, and commissioning criteria. The OPR shall identify functional expectations, performance criteria, sustainable objectives, cost considerations, maintenance expectations and measurable indicators/standards that can be used to verify compliance.
  - 2) The Basis of Design (BOD) document shall layout the decisions made to meet building program requirements. The BOD details systems, conditions, methods and components chosen to meet the OPR. The BOD must include the following; occupancy, space climate requirements, applicable codes and standards, primary load and design assumptions, LEED elements, lighting levels and controls, energy performance, ventilation strategies and methods, control systems complete with sequence of operations, fire and life safety criteria, emergency power control and function, and additional information that will aid in the commissioning process or future building operation.
  - 3) In addition to submitting the OPR and BOD to SUCF for review during the design process, the OPR and the BOD must be included in the Commissioning Reports and System Manual.
- b. CxA shall manage the commissioning services, lead, plan, schedule and coordinate the process of verifying and documenting that the facility and its systems are planned, designed, installed, tested, operated, and maintained to meet the OPR. The CxA will review the BOD for compliance with the OPR and provide a written report of its review to the Fund.

### **3. Qualifications of the CxA**

- a. LEED CxA Requirements
  - 1) CxA must have done two design through occupancy commissioning Projects with a similar scope of work.
  - 2) Unless otherwise approved by the Fund, the CxA will be independent from the Consultant and subconsultants on the design team.

- b. NYSECCC CxA Requirements
  - 1) NY Registered Design Professional, or
  - 2) Approved agency – An established and recognized commissioning firm approved by the SUCF.

#### **4. LEED Commissioning (Prerequisite Fundamental Commissioning / Verification and Enhanced Commissioning Credit)**

The CxA must:

- a. Review and approve the designer's system descriptions, etc. from 2.a.
- b. Review design documents, at or before the Design Manual submission for their impact on the commissioning process and the final performance of the commissioned systems. This review shall ensure that adequate devices are included in the design to properly document the performance of the commissioned systems and equipment. The review shall confirm that the BOD is reflected in the design documents and meets the OPR.
- c. Develop/review and approve the following written products:
  - 1) Develop Commissioning specifications.
  - 2) Develop Design phase Commissioning plan.
  - 3) Develop Construction phase Commissioning plan.
  - 4) Review Contractor Submittals of commissioned Systems/equipment.
  - 5) Develop/review and approve installation Verification checklists, and pre-functional checklists.
  - 6) Develop/review Functional performance testing procedures and checklists.
  - 7) Review/approve Testing, adjusting, and balancing (TAB) plan.
  - 8) Review/approve equipment/system training requirements during design.
  - 9) Review/approve Operations and Maintenance Manual as submitted by the Contractor.
  - 10) Develop Commissioning Operations Manual
  - 11) Develop Systems Manual requirements and include in bid documents
  - 12) Develop Systems Manual
  - 13) Develop Commissioning Report.
  - 14) Develop an ongoing Commissioning Plan.
  - 15) Review building envelope for compliance with OPR and BOD.

- 16) Provide other reports when requested by the Fund.
- d. Using the Installation Verification and Pre-functional Checklists the CxA shall, with the assistance of the Contractor, verify and document the installation of systems, equipment, and components. The CxA shall be the responsible party to obtain Contractor signatures and to fill out installation checklists and pre-functional tests. The CxA shall also be responsible to maintain an up to date commissioning report at the site. Any differences between original construction documents and final installation must be documented in the report. Documentation shall also be provided for other building systems or components that may be compromising the efficiency of the systems or features being commissioned.
  - e. The CxA shall also be responsible party to oversee functional testing performed by the Contractor and to fill out the functional performance checklists and procedures for insertion in the commissioning report.
  - f. Commissioning shall be performed on 100% of all main/central equipment and systems. Sampling strategies are allowed during Functional testing only on terminal equipment. (i.e. fan coils or non-laboratory VAV boxes.) Sampling shall incorporate 20% of terminal equipment or 10 units minimum. If functional issues are discovered additional units shall be added until 20% of the terminal units pass functional testing and are functioning according to the BOD.
  - g. Provide timely reporting and distribution of the findings, as required to minimize the volume of submissions submitted for the Fund's information and review. Provide frequent updates to the status of activities and facilitate Fund review of progress and status reports such as through electronic or online access to forms, with changes flagged by date.
  - h. Witness all or part of the:
    - 1) HVAC piping tests and flushing procedures
    - 2) HVAC duct tests and cleaning procedures
    - 3) Sufficient functional testing of the control system to approve its use for TAB, before TAB is executed.
    - 4) Building envelope mock up and testing
  - i. Visit and inspect the construction site, participate in Project design review meetings and telephone conference calls with the Fund, its Contractors and Consultants, and the Campus, as required to effectively provide commissioning services.

- j. Early in the construction process meet with the Contractor and Construction Manager (CM) to incorporate Commissioning activities into the construction schedule.
- k. Conduct construction commissioning Kickoff meeting with all commissioning team members in attendance to review the process and requirements for all commissioning activities through Campus occupancy.
- l. Conduct regular commissioning meetings with Commissioning team throughout construction. Unless otherwise agreed to by the Fund, conduct meetings once a month beginning eight weeks after the Fund issues a Notice to Proceed to the Contractor progressing to once a week when the Project moves into the functional testing phase. Provide written meeting minutes and distribute to attendees at least two days prior to the next scheduled meeting.
- m. Oversee and approve the training of the Campus' personnel.
- n. Maintain a master log of commissioning deficiencies and their resolutions, and maintain a separate testing log.
- o. Return to the site 10 months after building occupancy to review building operation and original commissioning, and return as appropriate for seasonally-deferred testing.

**5. NYSECCC Commissioning:** The CxA must:

- a. Develop/review and approve the following written products:
  - 1) Develop Commissioning specifications.
  - 2) Develop Design phase Commissioning plan.
  - 3) Develop Construction phase Commissioning plan.
  - 4) Develop/review Functional performance testing procedures and checklists.
  - 5) Review/approve Testing, adjusting, and balancing (TAB) plan
  - 6) Develop preliminary Commissioning Report
  - 7) Develop Operations and Maintenance Manual
  - 8) Develop Final Commissioning Report
- b. The CxA shall also be responsible to maintain an up to date commissioning report at the site.

- c. The CxA shall also be responsible party to oversee functional testing performed by the Contractor and to fill out the functional performance checklists and procedures for insertion in the commissioning report.
- d. Commissioning shall be performed on 100% of all main/central equipment and systems. Sampling strategies are allowed during Functional testing only on terminal equipment. (i.e. fan coils or non-laboratory VAV boxes.) Sampling shall incorporate 20% of terminal equipment or 10 units minimum. If functional issues are discovered additional units shall be added until 20% of the terminal units pass functional testing and are functioning according to the BOD.
- e. Provide timely reporting and distribution of the findings, as required to minimize the volume of submissions submitted for the Fund's information and review. Provide frequent updates to the status of activities and facilitate the Fund's review of progress and status reports such as through electronic or online access to forms, with changes flagged by date.
- f. Visit and inspect the construction site, participate in Project design review meetings and telephone conference calls with SUCF, its Contractors and Consultants, and the Campus, as required to effectively provide commissioning services.
- g. Early in the construction process meet with the Contractor and Construction Manager (CM) to incorporate Commissioning activities into the construction schedule.
- h. Conduct construction commissioning Kickoff meeting with all commissioning team members in attendance to review the process and requirements for all commissioning activities through Campus occupancy.
- i. Conduct regular commissioning meetings with Commissioning team throughout construction. Unless otherwise agreed to by the Fund, conduct meetings once a month beginning eight weeks after the Fund issues a Notice to Proceed to the Contractor progressing to once a week when the Project moves into the functional testing phase. Provide written meeting minutes and distribute to attendees at least two days prior to the next scheduled meeting.
- j. Provide Preliminary Commissioning report for review certified by registered design professional or approved agency to the Fund and Campus prior to final inspection. Final inspection of building shall not occur until Fund acknowledges receipt of this report.



- k. Provide the following documentation within 90 days of certificate of occupancy.
  - 1) Construction documents drawings and specifications
  - 2) Commissioning Operating and Maintenance manual
  - 3) Air and Water System Balancing Manuals
  - 4) Final Commissioning Report

## 6. Deliverables

- a. Commissioning Plans: Commissioning should be done in two separate but related parts. Commissioning Plan–Design phase and Commission Plan–Construction phase. Each plan must include, but is not limited to:
  - 1) Overview of tasks to be executed and responsibility for each.
  - 2) List of all systems and features to be commissioned and performance expectations for each.
  - 3) Simulation of various operational conditions and scenarios that could be anticipated to occur in each space.
  - 4) List of all reference documents, i.e. specifications, drawings, and submittals.
  - 5) List of participants and their responsibilities.
  - 6) A plan for management, communication, and documentation.
  - 7) Outline of the scope of the commissioning process.
  - 8) Description of checklists and tests to be performed for pre-start and start-up.
  - 9) A list of functional performance tests.
  - 10) Description of the verification process used to document the process.
  - 11) Description of the content of the training to be provided to the facility personnel.
  - 12) An activity schedule.
  - 13) Method to document changes and incorporating changes in as-built record
  - 14) A list of code related commissioning documentation required prior to acceptance of construction.
  
- b. Commissioning Specification: Must be included in the Construction Documents and must include:
  - 1) Scope and details of the process.
  - 2) Qualifications required by the Commissioning Agent.
  - 3) Roles and responsibilities of all parties involved in commissioning process.

- 4) Systems, equipment and components to be commissioned.
  - 5) Pre-functional checklist and start-up requirements.
  - 6) Functional performance testing requirements, including test conditions and acceptance criteria.
  - 7) Procedures for resolving deficiencies.
  - 8) Reporting and documentation requirements.
  - 9) Training requirements.
  - 10) Operations and maintenance manuals requirements.
  - 11) Proposed schedule of activities.
  - 12) Definition of the minimum requirements for the Contractor's coordination and management plan (the need for a single person employed by Contractor to coordinate work of subcontractors, staff qualifications, etc.).
- c. Commissioning plan and commissioning specifications must be written around using a single prime Contractor. Terms such as; Mechanical Contractor, Plumbing Contractor, Electrical Contractor and Controls Contractor, etc. shall not be used. Coordinate and cooperate with the Fund's Design Consultant to incorporate the commissioning specifications in their submissions of deliverables to the Fund.
- d. Operations and Maintenance Manual(s) (O&M) must be complete and fully cover all systems commissioned. At a minimum the O&M manual(s) must include, for all equipment:
- 1) System narrative of how each system is intended to operate.
  - 2) Vendor location and contact information.
  - 3) Name and address of one service agency.
  - 4) Project specific Submittal information.
  - 5) Operations and maintenance instructions for specific model (Only information for equipment actually installed shall be included).
  - 6) Installation and startup instructions.
  - 7) Schedule for inspecting and recalibrating all lighting controls.
  - 8) Parts list and special tool list.
  - 9) Performance data (pump, fan curves).
  - 10) Warranty information
  - 11) As-built data for control systems to document actual control schemes and sequences used. Include sequence of operations, wiring diagrams, and schematics. Documents shall have all field determined set-points permanently recorded at control devices and in system programming instructions.
- e. Systems Manual(s) must be Project specific and must contain at a minimum:

- 1) Executive Summary
  - 2) A narrative of the BOD and OPR (modified to reflect the as-constructed installations) which should include a brief description of the systems.
  - 3) Construction Record Drawings and specifications.
  - 4) Final Commissioning plan and the Final Commissioning report.
  - 5) Operations and Maintenance Manual
  - 6) A detailed description of energy saving features and options as well as a description of their special maintenance requirements.
  - 7) Recommendations and methodology for accounting of building energy usage.
  - 8) Recommendations for frequency of sensor and actuator recalibration.
  - 9) Recommendations for frequency of recommissioning of specific systems (i.e. CO<sub>2</sub> controlled outdoor air system).
  - 10) List and description of user adjustable set points and schedules with recommendations for adjustments.
  - 11) List of system diagnostic tools (i.e. trend logs) to be used by operators in optimizing building energy efficiency.
- f. Preliminary & Final Commissioning Report must be Project specific and completed after all commissioning except seasonally deferred testing. Report must include:
- 1) Executive Summary
  - 2) List of all commissioning participants and their roles.
  - 3) Brief building description
  - 4) Overview of commissioning scope, testing and verification methods
  - 5) List of commissioned systems
  - 6) Description of adequacy of training, installation, functional performance, efficiency, equipment documentation, and O & M manuals.
  - 7) List of outstanding commissioning issues and statement as to why item is outstanding. (i.e. installation deficiency, seasonally deferred testing, etc.) Each outstanding commissioning item shall be referenced to where deficiency is documented in the commissioning plan and shall lay out the path/schedule as to when commissioning will take place.
  - 8) Appendices with Commissioning plans, Installation checklists, pre-functional tests, functional tests, individual commissioning reports or reviews, sequence documentation, logs, meeting minutes, progress reports, deficiency logs, site visit reports, photos, findings,

unresolved issues, communications and other relevant Project information.

- 9) A list of as-built components, equipment, systems, controls, and sequences of operation that is different than required in the original construction documents.
- 10) CxA shall issue an addendum to the commissioning report (if necessary) to complete the commissioning report for seasonally deferred testing or deficiency resolution to commissioned systems.

g. Training documentation as detailed in part 7 below.

## 7. Training

- a. Prior to Contractor training the CxA shall meet with Fund and Campus personnel to be trained to review all commissioning deliverables.
- b. The CxA must document that training (both instructional and demonstration) of operations and maintenance personnel was conducted for all commissioned systems. The commissioning agent shall oversee and approve the content and adequacy of the training for commissioned systems.
- c. The Owner will identify the personnel to be trained.
- d. Training must be performed within six (6) months of the date commissioning is completed.
- e. The Operations and Maintenance Manual and the Systems Manual must be available and used for the training.
- f. The instructional portion of the training must cover, at a minimum:
  - 1) General description of systems, theory of operation, control modes, and sequences of operation.
  - 2) Use of the Operations and Maintenance as well as System Manuals.
  - 3) Review of control diagrams and drawings.
  - 4) Use of building controls system, including startup, shutdown, seasonal changeover, alarms, troubleshooting, set-up and data logging/trending.
  - 5) Service and operations of each system.
  - 6) Specific training on building systems which effect energy consumption, indoor air quality and occupant comfort.

- g. The demonstration portion of the training must include hands-on operation of systems and/or equipment for which instructional training will be given. Start-up, shut-down procedures, operation under all sequence of operations and emergency conditions.

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