

SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. All of the documents in this RFP form the Basis-of-Design for this project.

1.2 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning Team duties.
3. Commissioning meetings.
4. Commissioning scheduling.
5. Test equipment, instrumentation, and tools for commissioning.
6. Construction verification.
7. Functional performance testing.
8. Commissioning tests and commissioning test demonstration.
9. Commissioning Report.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submittal procedures requirements for commissioning.
2. Section 01 77 00 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.
3. Section 01 78 23 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal.

1.3 DEFINITIONS

- A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.
- B. Basis-of-Design: A detailed description of Design criteria, parameters, set-points, concepts, decisions and selections used to meet the District's Project Requirements that serves as a basis for review, approval and documentation of the Design process used for all systems.
- C. Commissioning Agent: A District appointed entity that plans and coordinates all activities that implement commissioning as outlined by District's Basis of Design.
- D. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.

- E. Commissioning Report: A document, prepared by the Commissioning Agent, that records the activities and results of the Commissioning process.
- F. Commissioning: The process of ensuring that systems are designed, installed, functionally tested and performing in conformity with the District's Requirements and that the District has received complete equipment/systems documentation and training.
- G. Construction Verification: A quality control verification process performed by the installer as building assemblies, components, equipment and systems are being installed that documents that the materials, installation procedures, interfaces with other trades, start-up, testing and operations are correct, complete, in compliance with Contract Documents and manufacturer's recommendations and are ready for Functional Performance Testing.
- H. District's Project Requirements: A narrative of the program, use and functional requirements with a description of the Project goals and criteria in general categories (e.g.: flexibility of use, ease of maintenance, future expansion, etc.) and specific categories (e.g.: specialized environments, specific sustainable features, quality of materials, etc.).
- I. Functional Performance Tests: Design-Build Entity testing of installed building assemblies, components, equipment, systems and interfaces which confirms correct performance through all operating modes and compliance with Contract Documents, manufacturer's recommendations and the District's Project Requirements.
- J. Retro-Commissioning: A systematic process for improving and optimizing a building's operations and supporting those improvements with enhanced documentation and operator training.
- K. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

1.4 District's Project Requirements.

- A. The District's Project Requirements include:
 - 1. Maximizing the generation of electricity at each site using solar photovoltaics to achieve net zero energy use to the greatest extent possible, without exceeding the annual energy consumption at each site
 - 2. Reducing the cost of electricity at each site through solar photovoltaics with battery storage to reduce peak demand
 - 3. Minimize the cost of the design and construction of solar photovoltaics at each site

1.5 ABBREVIATIONS

- A. The following abbreviations are used in this Section:
 - 1. A/E Criteria Architect / Engineer.
 - 2. BAS: Building Automation System.
 - 3. Cx: Commissioning.
 - 4. CxA: Commissioning Agent.
 - 5. DPR: District's Project Requirements.
 - 6. FPT: Functional Performance Tests.
 - 7. O&M: Operations and Maintenance.
 - 8. PI: Project Inspector.

- 9. PPO: Physical Plant Operations
- 10. P/T: Pressure / Temperature.
- 11. TAB: Testing, Adjusting, and Balancing.

1.6 COMMISSIONING TEAM DUTIES

Cx TASK	Provided By					Provided To					Planning	Design	Construc- tion	Turnover	Operation
	DISTRICT	PI	A/E	CxA	DBE	PPO	PI	A/E	CxA	DBE					
District's Project Requirements				X		X	X	X		X	PPO Nar- rative	Update	Update	Update, Include in Cx Report	
	X	X	X		X					X	Review Comments on PPO	Additional Comments on PPO	Additional Comments on PPO	Additional Comments on PPO	
Basis of Design			X			X	X			X	Basis of Design	Update	Update	Update	
	X	X		X					X		Review Comments	Additional Comments	Additional Comments	Additional Comments	
				X		X	X	X		X				Include in Cx Report	
Cx Plan				X		X	X	X		X	Cx Plan	Update	Update	Update, Include in Cx Report	Update, Include in Cx Report
	X	X			X					X	Review Comments	Additional Comments	Additional Comments	Additional Comments	Additional Comments
Construction Verification Checklists and Checklist Tracking Report					X	X				X		Edit and Develop	Update		
						X	X			X			Perform and Submit as Work is Installed	Include in O&M Man- uals	
	X			X						X			Review Comments		
Functional Performance Tests and FPT Tracking Report					X	X				X	X	Devel- op/Edit Test Forms	Update Forms, Schedule and Direct	Include in Cx Report	
					X	X				X			Perform and Submit		
	X			X						X			Review Comments		
Cx Report				X		X	X	X		X				Draft Report	Final Report
Cx Issues, Site Visit and Close-out Items Log				X		X	X	X		X	Cx Issues, Site Visit & Closeout Log	Update	Update	Update	
				X						X		Actions Taken	Actions Taken	Actions Taken	

Cx TASK	Provided By					Provided To					Planning	Design	Construction	Turnover	Operation
	DISTRICT	PI	A/E	CxA	DBE	PPO	PI	A/E	CxA	DBE					
PPO Training					X	X	X	X	X			O&M Data, Training Plan and Training			
	X		X							X		Evaluate O&M Data & Training			

1.7 INFORMATIONAL SUBMITTALS

- A. Comply with requirements in Section 01 33 00 "Submittal Procedures" for submittal procedures general requirements for commissioning.
- B. Lists:
 - 1. Construction Verification List.
 - a. Select appropriate lists from Appendix A.
 - 2. Function Performance Tests List.
 - a. Select appropriate lists from Appendix C.
- C. Forms:
 - 1. Construct Verification Tracking Report.
 - a. See Appendix B.
 - 2. Functional Performance Test Tracking Report.
 - a. See Appendix D.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Provide equipment required to perform startup, checkout and testing. Provide equipment that has been calibrated per the manufacturer’s recommendations within the past year.

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

- A. Assist District's Commissioning agent in development of a complete commissioning plan detailing the following information at a minimum:
1. Contact information for key members of commissioning team.
 2. Description of procedures to be utilized for each commissioning task.
 3. List of commissioning systems and associated equipment.
 4. Functional Performance Test sampling approach to be utilized for repeat equipment items.
 5. List of responsibilities for each party involved in the commissioning process.
 6. Commissioning milestones and schedule.
- B. Commissioning Meetings:
1. Attend commissioning meetings with involved subcontractors and other personnel requested by CxA. Each party is responsible for providing a review of Project progress, commissioning issues and scheduling for future commissioning tasks.
- C. Communication:
1. Relay communications resulting from or in relation to commissioning activities directly to the responsible party whenever possible, with copies to Construction Manager and Project Inspector.
- D. Responsibilities:
1. All parties are to follow the Commissioning Plan and are responsible for commissioning activities as outlined in Article "Commissioning Team Duties."
- E. Scheduling:
1. Provide CxA and involved subcontractors with a copy of the Project Schedule and regular monthly updates. CxA will provide Design-Build Entity with a detailed schedule of commissioning tasks for incorporation into project schedule.
- F. Construction Verification:
1. The purpose of the Construction Verification List is to have a formal means of providing individual workers the key criteria for a successful installation and to easily track construction progress.
 2. Notify CxA five days prior to construction verification so that CxA may witness, as deemed necessary, each assembly, component, equipment, system start up and testing.
 3. If CxA identifies more than a 10 percent discrepancy rate, revalidate all items covered by that checklist and resubmit new checklists.
- G. Functional Performance Testing:
1. Assist CxA in establishing a schedule for Functional Performance Testing.
 2. Ensure all subcontractors involved with specific assemblies, components, equipment, systems and interfaces have qualified installers and technicians present at the same time working together to perform testing and demonstrate correct performance through all

operating and failure modes and compliance with Contract Documents, manufacturer's recommendations and the District's Project Requirements.

3. Ensure completion and coordination of the Work prior to testing. Preplan testing procedures, and ensure necessary staff and resources are on hand for expediting testing. Failure to complete or coordinate work, preplan, or have staff and resources available to carry out testing will result in retesting.
4. CxA will establish sampling protocol and, at the time of testing, select sample test locations for identical pieces of equipment. Receive CxA approval where simulation of conditions or altering of set points or values is required to achieve an opening or failure mode for testing.
5. Correct minor deficiencies during testing. Deficiencies that cannot be corrected during testing will be documented and subject to retest. Retesting will continue until no deficiencies remain.
6. The cost of retesting is the responsibility of the Design-Build Entity and subject to deductive change order. Deficiencies and retesting are the responsibility of the Design-Build Entity and are not subject to time extensions or delay claims. Review preliminary construction checklists and preliminary test procedures and data forms.

3.2 OPERATION AND MAINTENANCE DATA

- A. Provide as specified in Section 01 78 23 "Operation and Maintenance Data."

3.3 DEMONSTRATION AND TRAINING

- A. Provide as specified in Section 01 79 00 "Demonstration and Training."

3.4 COMMISSIONING REPORT

- A. CxA will provide Design-Build Entity, A/E, and District a Commissioning Report for the Project upon substantial completion. This report will include contact information for key members of the commissioning team; description of commissioned systems, commissioning activities, sampling protocol and results. The report to also include the District's Project Requirements, Basis-of-Design, Construction Verification Checklist Tracking Report, and Functional Performance Test Tracking Report.

END OF SECTION 01 91 13

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APPENDIX A – CONSTRUCTION VERIFICATION LIST

Choose from the following Construction verification checklists and provide additional items as needed to reflect the verification Requirements of assemblies, components, equipment and systems to be commissioned on this Project and used on the Construction Verification Tracking Report.

- CV-22 05 14 – Backflow Preventers
- CV-22 05 14 – Trap Primer Values
- CV-22 07 00 – Plumbing Insulation
- CV-22 11 00 – Water Distribution
- CV-22 13 00 – Sanitary Sewage
- CV-22 14 00 – Storm Drainage
- CV-22 30 00 – Expansion Tanks
- CV-22 30 00 – In-line Centrifugal Pumps
- CV-22 30 00 – Water Heaters (Electric)
- CV-22 30 00 – Water Heaters (Gas)
- CV-22 42 00 – Plumbing Fixtures
- CV-22 60 00 – Air Compressors
- CV-23 05 14 – Variable Frequency Drives
- CV-23 05 15 – Air Separators
- CV-23 05 15 – Expansion Tanks
- CV-23 05 15 – Suction Diffusers
- CV-23 07 00 – HVAC Ductwork Insulation
- CV-23 07 00 – HVAC Piping Insulation
- CV-23 09 14 - Air Compressors
- CV-23 09 14 - Control Wiring and Devices
- CV-23 11 00 - Gas Piping
- CV-23 21 13 - Hydronic Piping
- CV-23 21 13 - Pumps
- CV-23 23 00 - Refrigerant Piping / VRF, VRV
- CV-23 25 00 - HVAC Water Treatment
- CV-23 31 00 - Ductwork and Casings
- CV-23 34 00 - Ceiling Exhaust Fans
- CV-23 34 00 - Centrifugal Fans
- CV-23 34 00 - Destratification Fans
- CV-23 34 00 - Vaneaxial Fans
- CV-23 36 00 - Air Terminal Units
- CV-23 37 13 - Diffusers, Grilles and Registers
- CV-23 41 00 - Filter Racks
- CV-23 52 00 - Cast Iron or Modular Cast Iron Boiler
- CV-23 52 00 - Fire Box, Fire Tube, Flexible Water Tube or Vertical Tubeless Boilers
- CV-23 54 00 - Gas Fired Furnaces
- CV-23 55 00 - Direct Fired MUA Units
- CV-23 55 00 - Gas Fired Unit Heaters
- CV-23 55 00 - Indirect Fired MUA Units
- CV-23 62 13 - Air Cooled Chillers
- CV-23 64 15 - Water Cooled Chillers
- CV-23 73 12 - Refrigerant Coils
- CV-23 82 00 - Fan Coil Units
- CV-23 82 00 - Reheat Coils
- CV-23 82 00 - Unit Heaters
- CV-23 82 00 - Unit Ventilators
- CV-26 05 13 - Medium Voltage Cables
- CV-26 05 26 - Grounding and Bonding
- CV-26 05 33 - Conduit, Raceway & Boxes for Electrical Systems
- CV-26 05 36 - Cable Trays

CV-26 18 23 - Medium Voltage Surge Arrestor
CV-26 22 00 - Low Voltage Transformer
CV-26 24 13 - Switchboard
CV-26 24 16 - Panelboards
CV-26 27 13 - Electrical Meter
CV-26 27 28 - Non-Fusible Disconnect Switches
CV-26 28 16 - Enclosed Switches and Circuit Breakers
CV-26 29 00 - Magnetic Motor Starters
CV-26 29 00 - Manual Motor Starters
CV-26 29 00 - Motor Control Centers
CV-26 36 00 - Automatic Transfer Switches
CV-26 43 13 - Transient Voltage Suppression
CV-26 51 13 - Interior Light Fixtures, Lamps & Ballasts
CV-26 51 15 - Lighting Control Panels
CV-26 56 29 - Site Lighting
CV-27 00 00 - Communications Cabling
CV-28 31 00 - Fire Alarm Control Panels
CV-28 31 00 - Fire Alarm Wiring & Devices

APPENDIX C – FUNCTIONAL PERFORMANCE TEST LIST

Choose from the following Functional Performance Test list and provide additional items needed to reflect the Testing Requirements of assemblies, components, equipment and systems to be commissioned on this Project and used on Functional Performance Test Tracking Report.

- FPT-22 30 00 - Domestic Booster Pumps
- FPT-22 30 00 - Inline Centrifugal Pumps
- FPT-22 30 00 - Water Heaters
- FPT-23 05 14 - Variable Frequency Drives
- FPT-23 09 23 - EMS Communication/Calibration
- FPT-23 21 13 - Pumps
- FPT-23 34 00 - HVAC Fans
- FPT-23 36 00 - Air Terminal Units
- FPT-23 52 00 - Boiler
- FPT-23 54 00 - Gas Fired Furnaces
- FPT-23 55 00 - Direct Fired MUA Units
- FPT-23 55 00 - Gas Fired Unit Heaters
- FPT-23 62 13 - Air-Cooled Chillers
- FPT-23 64 15 - Water Cooled Chillers
- FPT-23 73 13 - Air Handling Units/VRF, VRV
- FPT-23 82 00 - Cabinet Heaters
- FPT-23 82 00 - Fan Coil Units
- FPT-23 82 00 - Re-Heat Coils
- FPT-23 82 00 - Unit Heaters
- FPT-26 51 15 - Lighting Controls

