

COMMISSIONING OF MECHANICAL SYSTEMS

1. GENERAL

1.1 General

- .1 This Section describes the commissioning of the mechanical system.
- .2 The commissioning of the mechanical system shall be in accordance with the Code of Practice for Commissioning Mechanical Systems in Buildings and as described in this Section.
- .3 The commissioning process shall be applied to all products, equipment and systems provided under this Division.
- .4 Work specified in this Section shall be performed by the Commissioning Agent, who shall be a qualified individual(s) hired by the Contractor.

1.2 Scope

- .1 Demonstration of equipment and systems operations.
- .2 Document all commissioning on commissioning sheets.
- .3 Instruction seminars for the City's personnel.

1.3 Quality Assurance

- .1 Work specified shall be performed by a qualified individual(s) or Commissioning Agency specialising in this type of Work.

2. COMMISSIONING PROCESS

2.1 Duties of the Commissioning Agent

- .1 The Commissioning Agent shall plan, organise and implement the commissioning process and shall within one month of the award of the contract submit the name and address of the Contract Administrator.
- .2 The Commissioning Agent shall provide a complete description of the systems operation, performance and flow data to the Contract Administrator for review.
- .3 The Commissioning Agent shall prepare the commissioning plan and provide demonstration and instructions to the City's staff over a period of time to enable the staff to become familiar with the systems.

2.2 Commissioning Schedule

- .1 Within one (1) month of commencing with the project Work the Commissioning Agent shall review design intent and intended commissioning procedures with the Contract Administrator. One (1) month prior to the date of scheduled Substantial Performance, submit a detailed plan identifying the orderly progression of the pre-start commissioning check and

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subsequent commissioning performance check of each sub-system, leading up to the ultimate commissioning of entire systems.

- .2 Submit a schedule for the commissioning phase of the Work. This schedule shall show:
 - .1 Completion dates for each trade in each major section of the building.
 - .2 Timing of the various phases of the commissioning, testing, balancing and demonstration process.
 - .3 Submission dates for the various documents required prior to verification of commissioning by the Contract Administrator.
 - .4 Prepare a commissioning statement in which each of the four (4) phases that the process is perceived to be worked through. In sequence, the phases are expected to be:
 - Phase 1 - System Readiness.
 - Phase 2 - System Start-up, Testing, Balancing, Etc.
 - Phase 3 - Verification of System Commissioning.
 - Phase 4 - Demonstration and Instruction.
- .3 With the commissioning schedule noted above, submit a copy of all commissioning worksheets to be used during the commissioning process.
- .4 Each phase is applicable to each major and separate system making up the work in Division 23 including controls and Division 26 interface as applicable.

2.3 Commissioning Phases

- .1 **Phase 1** - Before starting any of the separate systems, provide written verification stating that the specific system is ready for start-up and the following conditions have been met:
 - .1 Copies of all test and certificates have been submitted to the Contract Administrator.
 - .2 All safety controls installed and fully operational (dry run test).
 - .3 Flushing, chemical cleaning (as required), charging, fluid operating (as required), are complete.
 - .4 Equipment lubrication and pre-start checks are complete.
 - .5 Air system cleaning complete.
 - .6 All DX systems checked for pressure and leakage.
 - .7 Filter systems installed and sealed in place (except for air system charcoal filters).
 - .8 Adjusting vibration isolation completed.

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- .9 Alignment of drives (direct and belt) completed.
 - .10 Control functional checks, including all alarms performed.
 - .11 Start-up verification checks by manufacturers representatives completed.
 - .12 All deficiencies to be recorded, reviewed by the commissioning team and, subsequently corrected before proceeding to the next phase, Phase 2.
- .2 **Phase 2** - System Commissioning shall include but not necessarily be limited to:
- .1 Activation of all systems.
 - .2 Testing and adjustment of all systems.
 - .3 As in the case of the System Readiness Phase, all deficiencies are to be recorded, reviewed by the Commissioning team and, subsequently, corrected. The process at the point of the deficiency shall be repeated before proceeding forward.
 - .4 Phase 2 is concluded when the installation is in full working order and acceptable for use. The work will include the following:
 - .1 Position all balance dampers in ductwork.
 - .2 Position all balance valves in piping systems (where appropriate).
 - .3 Make provisions for testing air pressures and flow rates.
 - .4 Set up air diffusers, registers and grilles.
 - .5 Set up all automatic temperature control devices.
 - .6 Plug all air pressure and flow measuring holes.
 - .7 Adjust vibration isolators as necessary.
 - .8 Verification by the air balance contractor that all fire dampers have been checked.
 - .9 Air and water balance complete.
 - .5 Fine Tuning:
 - .1 Setting up automatic controls for accurate response and precise sequencing.
 - .2 Correction of problems revealed by Balancing Agency and change of fan speed and pitch as necessary.
 - .6 Testing:
 - .1 The Contract Administrator shall perform a detailed check of the following:
 - .1 All items and functions to be later demonstrated to the City's Representatives.

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- .2 Systems operation in the fire mode (pressurisation and smoke removal) in the presence of the authorities having jurisdiction. Obtain a written statement/certificate of approval from the authorised manual jurisdiction.
- .3 **Phase 3 - Verification of Commissioning.**
 - .1 Verification of commissioning by the Contract Administrator shall not commence until the commissioning process, Phase 2, has been totally completed. Submit test procedure completion test certificates at the time of requesting the commencement of the verification procedure. The verification process will include the demonstration of the following:
 - .1 Location of and opening and closing of all access panels.
 - .2 Operation of all automatic control dampers and automatic temperature/volume adjustment controls.
 - .3 Operability of fire dampers.
 - .4 Operation of all equipment and systems, under each mode of operation, including:
 - .5 BMS control features;
 - .6 Automatic controls;
 - .7 Chillers and heat pumps Boilers;
 - .8 Pumps;
 - .2 At the completion of Phase 3, the Contractor shall submit the following to the Contract Administrator:
 - .1 A letter certifying that all Work specified under this Contract is complete, clean and operational in accordance with the Specification and Drawings.
 - .2 A copy of Phase 2 Verification Certificates provided by the specialist trades for submission to the Contract Administrator.
 - .3 Record Drawings as specified.
 - .4 A letter from the testing and balancing agency certifying that all necessary data for inclusion in operating and maintenance manuals has been received.
 - .5 A statement confirming completion of BMS acceptance test, Section 23 09 33.
 - .3 Upon receipt of all documents and a satisfactory outcome of the verification procedure, the Contract Administrator will provide a Certificate of Verification for Phase 3.
 - .4 Substantial Performance may, thereupon, be declared.
- .4 **Phase 4 - Demonstration and Acceptance** shall not commence until the commissioning process Phase 3 has been successfully completed - verification certificate issued and

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Substantial Performance declared. The demonstration process is a statement of satisfaction from the Contract Administrator and City upon completion. Total Performance will not be accomplished without this achievement.

3. EXECUTION

The following systems are to be commissioned:

3.1 HVAC Systems

- .1 Chillers and Heat Pumps - check out by manufacturer's representative, capacity test electrical and piping connections, chilled and condenser water flows.
- .2 Pumps - alignment, rotation, motor current draw, piping connections, flow and pressure test.
- .3 Piping System - pressure tests, insulation, identification, water balance, hangers, expansion.
- .4 Duct System - pressure tests, insulation, identification, air balance identification.
- .5 Variable Frequency Drives - installation, controls, speed modulation, connection to BMS.
- .6 Control Valves - installation, controls, capacity modulation, connection to BMS, identification.
- .7 Control Dampers - installation, operation, identification, capacity modulation, connection to BMS.
- .8 Controls - See Section 23 09 33 - commissioning of controls by Controls Contractor under the supervision of the Commissioning Agent.

3.2 General

- .1 Contractor shall arrange for presentation and demonstration of mechanical equipment and systems by appropriate specialists and shall ensure that required Manufacturer's Representatives are in attendance.

3.3 Demonstrations

- .1 Provide three (3) working days for demonstration of equipment to the City.
- .2 Demonstrate specific starting and general maintenance requirements for each major piece of equipment. Ensure all labelling and identification is completed.
- .3 Demonstrate the following systems, in the form of instruction seminars and Contractor guided tour of the facility.
 - .1 Hydronic Cooling Systems;
 - .2 Control Systems;
 - .3 Chemical Treatment Systems;

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- .4 Demonstrate the following pieces of equipment:
 - .1 Chillers;
 - .2 Heat Pump;
 - .3 Pumps;
 - .4 Heat Exchangers/Water Heaters.
- .5 Prepare a schedule identifying the proposed sequence of demonstration. Sequence of demonstration shall correspond to full system starting. Submit for review by Contract Administrator one month prior to demonstration.
- .6 Answer all questions raised by the City at demonstrations; if unable to satisfactorily answer questions immediately, provide written response within three (3) days.

END OF SECTION