

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 25 05 01 - EMCS: General Requirements.

### **1.2 DEFINITIONS**

- .1 Acronyms and Definitions: Refer to Section 25 05 01 - EMCS: General Requirements.
- .2 AEL: Ratio between total test period less any system downtime accumulated within that period and test period.
- .3 Downtime: Results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
  - .1 Outage of main power supply in excess of back-up power sources, provided that:
    - .1 Automatic initiation of back-up was accomplished.
    - .2 Automatic shut-down and re-start of components was as specified.
  - .2 Failure of communications link, provided that:
    - .1 Controller automatically and correctly operated in stand-alone mode.
    - .2 Failure was not due to failure of any specified EMCS equipment.
  - .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
    - .1 System recorded said fault.
    - .2 Equipment defaulted to fail-safe mode.
    - .3 AEL of total of all input sensors and output devices is at least 99% during test period.

### **1.3 DESIGN REQUIREMENTS**

- .1 Confirm with Departmental Representative that Design Criteria and Design Intentions are still applicable.
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- .2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intent.

#### **1.4 SUBMITTALS**

- .1 Submit documents and samples required.
- .2 Final Report: Submit report to Departmental Representative.
  - .1 Include measurements, final settings and certified test results.
  - .2 Bear signature of commissioning technician and supervisor.
  - .3 Report format to be approved by the Departmental Representative before commissioning is started.
  - .4 Revise "As-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative and to Consultant in accordance with Architectural Specifications.
  - .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

#### **1.5 CLOSEOUT SUBMITTALS**

- .1 Provide documentation, O&M Manuals, and training of O&M personnel for review by the Engineer before interim acceptance.

#### **1.6 COMMISSIONING**

- .1 Complete commissioning under the supervision of the Departmental Representative and the PWGSC Commissioning Manager.
  - .2 Inform the Departmental Representative in writing, at least 14 days before the start of commissioning or before each test. In order to obtain approval submit the following information:
    - .1 Location and section of the system to be tested.
    - .2 Test procedures and anticipated results.
    - .3 Name of the persons who will perform the tests.
  - .3 Correct deficiencies, re-test in until satisfactory performance is obtained.
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- .4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .5 Load system with project software.
- .6 Perform the tests in accordance with the requirements.

## **1.7 COMPLETION OF COMMISSIONING**

- .1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Departmental Representative.

## **1.8 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION**

- .1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT**

- .1 Provide sufficient instrumentation to verify and commission the installed system.
- .2 Instrumentation Accuracy Tolerances: Higher order of magnitude than equipment or system being tested.
- .3 An independent laboratory must certify testing materials compliance no more than two months before the tests.
- .4 Locations to be approved, readily accessible and readable.
- .5 Application: To conform to normal industry standards.

## **PART 3 - EXECUTION**

### **3.1 PROCEDURES**

- .1 Test each system independently and then in unison with other related systems.
  - .2 Follow the Departmental Representative's start-up procedures for each system.
  - .3 Follow the Departmental Representative's start-up procedures for integrated systems.
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- .4 Debug system software.
- .5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
- .6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

### **3.2 FIELD QUALITY CONTROL**

- .1 Pre-Installation Testing.
    - .1 General: Consists of field tests of equipment just prior to installation.
    - .2 Testing may be on site or at Contractor's premises as approved by Departmental Representative.
    - .3 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's, including MCU's, LCU's, and TCU's.
    - .4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
    - .5 Additional instruments to include:
      - .1 DP transmitters.
      - .2 SP transmitters in supply duct - VAV.
      - .3 DP switches used for dirty filter indication.
    - .6 Beyond the testing material, the Contractor must also provide the following: inclined tube manometer, digital micromanometer, milliammeter and a pressure gauge with a range of 0 Pa to 500 Pa, which can maintain a constant pressure at any value and with an output to the milliammeter.
    - .7 After initial calibration, verify the zero value and the range by 10% increments (by increasing and decreasing values).
    - .8 The Departmental Representative must write "Approved for Installation" on instruments having an accuracy of 0.5% or less in both directions.
    - .9 Transmitters above 5% error will be rejected.
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- .10 DP switches to open and close within 2% of setpoint.
  - .2 Completion Testing.
    - .1 General: Test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
    - .2 Include following activities:
      - .1 Test and calibrate field hardware including stand-alone capability of each controller.
      - .2 Test all analog-digital converters.
      - .3 Test and calibrate each AI using calibrated digital instruments.
      - .4 Test each DI to ensure proper settings and switching contacts.
      - .5 Test each DO to ensure proper operation and lag time.
      - .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
      - .7 Test operating software.
      - .8 Test application software and provide samples of logs and commands.
      - .9 Verify each CDL including energy optimization programs.
      - .10 Debug software.
      - .11 Blow out static pressure stations with high air pressure at 700 kPa.
      - .12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Departmental Representative. This document will be used in final start-up testing.
    - .3 Final start-up Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Departmental Representative and PWGSC Commissioning Manager and provide:
      - .1 Two technicians capable of calibrating the equipment and modifying the software on the field.
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- .2 A detailed daily program, indicating the elements to be tested and the available personnel.
  - .3 Acceptance by the Departmental Representative in writing, for every execution and application program.
  - .4 Commissioning to commence during final start-up testing.
  - .5 O&M personnel to assist in commissioning procedures as part of training.
  - .6 Commissioning to be supervised by Departmental Representative.
  - .7 Start-up of the security systems before any of the concerned areas are occupied.
  - .8 Operate systems as long as necessary to commission entire project.
  - .9 Monitor progress and keep detailed records of activities and results.
  - .4 Final Operational Testing: To demonstrate that EMCS functions in accordance with contract requirements.
    - .1 Prior to beginning, demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.
      - .1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
    - .2 Test to last at least 30 consecutive 24 hour days.
    - .3 Tests to include:
      - .1 Demonstration of correct operation of monitored and controlled points.
      - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
    - .4 System will be accepted when:
      - .1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
      - .2 Requirements of Contract have been met.
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- .5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
- .6 Correct defects when they occur and before resuming tests.
- .5 The Commissioning Manager must verify the results.

### **3.3 ADJUSTING**

- .1 Final adjusting: Upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

**END OF SECTION**

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