



Dufferin-Peel Catholic District School Board

STANDARD TEXT GUIDELINE FOR

Mechanical & Electrical Subcontractors' Commissioning

for

ELEMENTARY AND SECONDARY SCHOOLS

**Prepared by the Plant Department
In Cooperation with CFMS Consulting Inc.**

Formatted by the Design Department

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1 INSTRUCTIONS TO ARCHITECTS

- 1.1.1 The intent of this Guideline should be included in the specifications for both new Elementary and Secondary schools as well as additions over 1,800 m² or 20 classrooms.
- 1.1.2 This Mechanical and Electrical Sub-Contractors' Commissioning Guideline is for **General Contractor as well as Mechanical and Electrical Sub-Contractors**, cost of which is included in the General Contract.
- 1.1.3 The Scope of Work for the **Commissioning Agent** is identified in a different section of the Web site and is for information purposes only. The Commissioning Agent is hired directly by the Board, and fees for services will be paid directly by the Board. Commissioning Agent's costs are not to be carried in the Contract.

2 GENERAL REQUIREMENTS

- 2.1.1 Specify that all Sub-Contractors conform to the General Conditions of the Contract and to the Mechanical General Conditions, Division 15000 and Electrical General Conditions, Division 16000.
- 2.1.2 Specify that the Sub-Contractors must provide labour material, and mechanical expertise to conduct the Commissioning Process as outlined in this Guideline.
- 2.1.3 Specify that the Sub-Contractors and their Equipment Manufacturers shall provide all instrumentation and equipment necessary to conduct tests as specified, and to ensure completion of the Mechanical and Electrical Sub-Contractors' commissioning responsibilities as outlined.
- 2.1.4 The Mechanical and Electrical Sub-Contractors shall advise the Mechanical and Electrical Consultants of instrumentation to be used and the dates the instruments were calibrated.

END OF INSTRUCTIONS TO ARCHITECTS AND GENERAL REQUIREMENTS

3 MECHANICAL SUBCONTRACTOR'S RESPONSIBILITIES

3.1 MECHANICAL COMMISSIONING PROCESS

- 3.1.1 The Mechanical Commissioning Process shall consist of the following:
- 3.1.1.1 Shop Drawings and Record Drawings.
 - 3.1.1.2 Installation inspection and equipment verification
 - 3.1.1.3 Plumbing and drainage system testing as per all pertinent codes
 - 3.1.1.4 Testing of piping systems
 - 3.1.1.5 Independent Sub-Contractor balancing of water systems
 - 3.1.1.6 Testing and balancing of air systems
 - 3.1.1.7 Independent Sub-Contractor balancing of air systems
 - 3.1.1.8 Testing of all major equipment components and related systems
 - 3.1.1.9 BAS Commissioning
 - 3.1.1.10 Commissioning Agent performance testing
 - 3.1.1.11 Commissioning meetings
 - 3.1.1.12 Operating and maintenance manuals
 - 3.1.1.13 Training
 - 3.1.1.14 Systems Demonstration and turnover
 - 3.1.1.15 Testing forms
 - 3.1.1.16 Warranties

3.2 SHOP DRAWINGS AND RECORD DRAWINGS

- 3.2.1 Conform to the Consultant's Specifications for requirements for Shop Drawings, Submittals and Record Drawings.

3.3 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

- 3.3.1 The Mechanical Sub-Contractor shall co-ordinate with the Mechanical Consultant who will inspect the mechanical installation.
- 3.3.2 The Mechanical Contractor shall complete the equipment verification forms, provided by the Commissioning Agent for each piece of equipment.

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- 3.3.3 The forms shall be included in the Operating and Maintenance Manual. The equipment data shall include:
- 3.3.3.1 Manufacturers name, address and telephone number
 - 3.3.3.2 Distributors name, address and telephone number-Make, model number and serial number
 - 3.3.3.3 Pumps - RPM, impeller sizes, rated flow
 - 3.3.3.4 Fans - belt type and size, sheave type and size
 - 3.3.3.5 Electrical - volts, amps, fuse size, overload size
 - 3.3.3.6 Any other special characteristics

3.4 PLUMBING AND DRAINAGE SYSTEM TESTING

- 3.4.1 The plumbing and drainage system shall be tested in accordance with the Plumbing Code under the Ontario Water Resources Act and the consultants' Specification Sections.
- 3.4.2 The Mechanical Sub-Contractor shall notify the Building Inspector when systems are available for testing. The Mechanical Sub-Contractor shall document all tests performed and shall arrange for the Building Inspector to sign for tests completed. The forms shall be forwarded to the Mechanical Consultant.

3.5 THE MECHANICAL SUB-CONTRACTOR'S TESTING OF PIPING SYSTEMS

- 3.5.1 Testing of all piping systems shall be in accordance with all applicable plumbing codes and the Consultants' Specifications.
- 3.5.2 All tests for the systems shall be performed in the presence of the Mechanical Consultant or Commissioning Agent. Complete the testing forms and forward to the Mechanical Consultant.

3.6 THE MECHANICAL SUB-CONTRACTOR'S TESTING OF AIR SYSTEMS

- 3.6.1 Conform to the Consultants' Specification on *Testing, Adjusting and Balancing*.
- 3.6.2 All tests shall be performed in the presence of the Mechanical Consultant or the Commissioning Agent. Complete the testing forms and forward to the Mechanical Consultant.

3.7 TESTING OF EQUIPMENT AND SYSTEMS

- 3.7.1 The Mechanical Sub-Contractor shall hire the services of the manufacturer's technicians to test the equipment and associated systems. The technician shall record the results of the tests on the testing forms.

- 3.7.2 The tests shall be witnessed by the Mechanical Consultant or the Commissioning Agent. When the tests have been completed satisfactorily, the technician and witnessing authority shall sign the forms.
- 3.7.3 A copy of the forms shall be forwarded to the Mechanical Consultant. The original shall be inserted into the Operating and Maintenance Manuals.
- 3.7.4 Should equipment or systems fail a test, the test shall be repeated after repairs or adjustments have been made. The additional tests shall be witnessed.
- 3.7.5 Tests that have not been witnessed shall not be accepted and shall be repeated within a time period defined by the Mechanical Consultant.
- 3.7.6 The equipment and systems to be tested shall include:
 - 3.7.6.1 Chillers and Pumps
 - 3.7.6.2 Heat Pumps
 - 3.7.6.3 Cooling Towers/Boilers and Pumps
 - 3.7.6.4 Packaged Air Handling Units
 - 3.7.6.5 Life Safety and Fire Protection Systems
 - 3.7.6.6 Oil Handling Systems
 - 3.7.6.7 Humidification Systems
 - 3.7.6.8 Water Treatment Systems
 - 3.7.6.9 Building Automation Systems (BAS)
 - 3.7.6.10 Noise and Vibration Control
 - 3.7.6.11 Speciality Equipment

3.8 COMMISSIONING MEETINGS AND REPORTING

- 3.8.1 The Mechanical Contractor shall include the schedule for all tests and equipment start-up tests in the construction schedule.
- 3.8.2 The commissioning meetings shall occur as part the regular Construction Site Meetings. The testing schedules, and results of all tests, shall be reviewed by the Commissioning Agent.
- 3.8.3 All testing forms and reports associated with the mechanical systems shall be directed to the Consultant with copies to the Architect, Commissioning Agent and the Board.
- 3.8.4 The forms and reports to be issued shall include:
 - 3.8.4.1 Shop drawings, issued and reviewed
 - 3.8.4.2 Equipment verification forms
 - 3.8.4.3 Testing forms

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- 3.8.4.4 Reports resulting from tests
- 3.8.4.5 Testing schedule
- 3.8.4.6 Minutes of commissioning meetings

3.9 OPERATING AND MAINTENANCE MANUAL

- 3.9.1 Conform to the Consultants' Specifications for requirements for the O & M Manuals.

3.10 OPERATOR TRAINING

- 3.10.1 Conform to the Consultants' Specification for requirements on *Instruction to Operating Staff*.
- 3.10.2 The training shall be conducted in a classroom and at the equipment or system location at each site.
- 3.10.3 Training will begin when the Operating and Maintenance Manuals have been delivered to the Board and approved by the Mechanical Consultant.
- 3.10.4 Each training session shall be structured to cover:
 - 3.10.4.1 The Operating and Maintenance Manual
 - 3.10.4.2 Operating procedures
 - 3.10.4.3 Maintenance procedures
 - 3.10.4.4 Trouble-shooting procedures
 - 3.10.4.5 Spare parts as required
- 3.10.5 Submit a course outline to the Mechanical Consultant before training commences. Provide course documentation for up to eight people.
- 3.10.6 The training sessions shall be scheduled and co-ordinated by the Commissioning Agent. The Commissioning Agent shall video tape the sessions.
- 3.10.7 Training shall be provided for the following systems:

<u>Systems/Equipment</u>	<u>Minimum Training Hours</u>
Chillers	4
Cooling Towers	2
Boilers	2
Packaged Air Handling Units	2
Life Safety & Fire Protection Systems	2
Water Treatment Systems	2
The Mechanical System	8
Heat Pumps	2

- 3.10.8 The minimum training for the BAS shall be 24 hours. The training shall include:
 - 3.10.8.1 A walk-through of the installation for all Custodians to review the installation and equipment
 - 3.10.8.2 Operation of the central computer
 - 3.10.8.3 Operation of portable terminals
 - 3.10.8.4 Control sequences
 - 3.10.8.5 Report set-up and generation
 - 3.10.8.6 Managing the system
 - 3.10.8.7 Maintenance requirements
- 3.10.9 The training requirement for the Mechanical System shall include a walk-through of the building by the Mechanical Sub-Contractor. During the walk through the Mechanical Sub-Contractor shall:
 - 3.10.9.1 Identify equipment
 - 3.10.9.2 Identify starters associated with equipment
 - 3.10.9.3 Identify valves and balancing dampers
 - 3.10.9.4 Identify access doors
 - 3.10.9.5 Review general maintenance of equipment
 - 3.10.9.6 Review drain points in pipe work systems
 - 3.10.9.7 Identify maintenance items
- 3.10.10 When each training session has been completed, the Commissioning Agent shall sign the associated form to verify completion.

3.11 COMMISSIONING AGENT

- 3.11.1 A Commissioning Agent (CA) shall be hired by the Board.
- 3.11.2 The CA responsibilities shall include:
 - 3.11.2.1 Preparing the Commissioning Plan
 - 3.11.2.2 Co-ordinating with the Mechanical Sub-Contractor to schedule tests
 - 3.11.2.3 Preparing and issuing to the Mechanical Sub-Contractor a Test Form Manual
 - 3.11.2.4 Witnessing selected tests
 - 3.11.2.5 Receiving all test forms
 - 3.11.2.6 Conducting performance test

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- 3.11.2.7 Co-ordinating the Mechanical Sub-Contractors training
- 3.11.2.8 Chair commissioning meetings
- 3.11.3 The Mechanical Sub-Contractor shall conform to these requirements and shall co-operate with the CA.
- 3.11.4 The Mechanical Sub-Contractor shall provide assistance to the CA and have appropriate and experienced personnel available during the performance testing procedure. Each Mechanical System shall be tested in the operational mode.
- 3.11.5 Performance testing shall begin when all systems have been completed, tested by the Mechanical Sub-Contractor and the Mechanical Consultant has completed their final review.

3.12 MECHANICAL SYSTEM DEMONSTRATION AND TURNOVER

- 3.12.1 The system demonstration and turnover to the Board shall occur when:
 - 3.12.1.1 The installation is complete
 - 3.12.1.2 The acceptance test conducted by the Mechanical Consultant has been completed successfully
 - 3.12.1.3 The Commissioning Agent system performance testing has been completed successfully
 - 3.12.1.4 Training has been completed
 - 3.12.1.5 Shop-drawings have been updated
 - 3.12.1.6 As-built drawings have been completed
 - 3.12.1.7 Operating and Maintenance Manuals have been presented and accepted by the Mechanical Consultant and the Board's Representative.
- 3.12.2 The systems demonstration shall be conducted by the Mechanical Sub-Contractor and Equipment Manufacturers. The demonstration shall cover an illustration of equipment operation.

3.13 TESTING FORMS

- 3.13.1 The Mechanical Sub-Contractor and Equipment Manufacturers shall fill out the forms issued by the Commissioning at such time as he is ready to perform his commissioning procedures.

3.14 WARRANTIES

- 3.14.1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by the Board.

4 ELECTRICAL SUB-CONTRACTOR'S RESPONSIBILITIES

4.1 ELECTRICAL COMMISSIONING PROCESS

4.1.1 The Electrical Commissioning Process shall consist of the following:

- 4.1.1.1 Shop Drawings and Record Drawings
- 4.1.1.2 Installation inspection and equipment verification
- 4.1.1.3 Independent testing Sub-Contractor
- 4.1.1.4 Testing of equipment and systems
- 4.1.1.5 Commissioning meetings
- 4.1.1.6 Operating and maintenance manuals
- 4.1.1.7 Operating training
- 4.1.1.8 Commissioning Agent testing
- 4.1.1.9 Systems Demonstration and turnover
- 4.1.1.10 Testing forms
- 4.1.1.11 Warranties

4.2 SHOP DRAWINGS AND RECORD DRAWINGS

4.2.1 Conform to the Electrical Consultants' Specification for requirements of shop drawings and record drawings.

4.3 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

4.3.1 The Electrical Sub-Contractor shall co-ordinate with the Electrical Consultant who will inspect the electrical installation.

4.3.2 The Electrical Sub-Contractor shall complete the equipment verification forms for each piece of equipment. The forms shall be included in the operating and maintenance manual. The equipment data shall include:

- 4.3.2.1 Manufacturers name, address and telephone number
- 4.3.2.2 Distributors name, address and telephone number
- 4.3.2.3 Make, model number and serial number
- 4.3.2.4 Voltage and current ratings

4.4 TESTING OF EQUIPMENT AND SYSTEMS

- 4.4.1 The Electrical Sub-Contractor shall be responsible for all tests detailed in the Electrical Consultant's Specification and those tests required by a manufacturer as part of their installation requirements.
- 4.4.2 The Electrical Sub-Contractor shall schedule all tests that are to be witnessed by the Electrical Consultant or the Commissioning Agent. The Electrical Sub-Contractor shall complete and sign the testing forms.
- 4.4.3 The Electrical Sub-Contractor shall conduct tests on the following equipment as a minimum. Refer to the individual specification sections for test procedures.
- 4.4.3.1 Co-ordination study
 - 4.4.3.2 Switchboard
 - 4.4.3.3 Motor control centre
 - 4.4.3.4 Power and lighting panels
 - 4.4.3.5 Fire alarm
 - 4.4.3.6 Security
 - 4.4.3.7 Public address
 - 4.4.3.8 Cables
- 4.4.4 When all testing has been completed and all mechanical and electrical systems are operational the Electrical Sub-Contractor shall conduct system load balance measurements, infra-red test and harmonics tests.

4.5 COMMISSIONING MEETINGS AND REPORTING

- 4.5.1 The Electrical Sub-Contractor shall include the schedule for all tests in the construction schedule.
- 4.5.2 The Commissioning Meetings shall occur as part of the regular Construction Meetings. The testing schedules and the results of all tests shall be reviewed.
- 4.5.3 All testing forms and reports associated with the electrical systems shall be directed to the Electrical Consultant with copies to the Architect, Commissioning Agent and the Board.
- 4.5.4 The forms and reports to be issued shall include:
- 4.5.4.1 Shop drawings, issued and accepted
 - 4.5.4.2 Equipment verification forms
 - 4.5.4.3 Testing forms
 - 4.5.4.4 Reports resulting from tests

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- 4.5.4.5 Testing schedule
- 4.5.4.6 Minutes of commissioning meetings
- 4.5.4.7 Manufacturers Certificates

4.6 OPERATING AND MAINTENANCE MANUAL

- 4.6.1 Conform to the Electrical Consultant's Specification for the requirements of the O & M manuals.

4.7 OPERATOR TRAINING

- 4.7.1 Conform to the Electrical Consultant's Specification for requirements on instructions to operating staff for each system and equipment.
- 4.7.2 The training shall be provided by qualified technicians or electricians and shall be conducted in a classroom and at the equipment or system. The training sessions shall be scheduled, co-ordinated and videotaped by the Commissioning Agent.
- 4.7.3 Each training session shall be structured to cover:
 - 4.7.3.1 The operating and maintenance manual
 - 4.7.3.2 Operating procedures
 - 4.7.3.3 Maintenance procedures
 - 4.7.3.4 Trouble-shooting procedures
 - 4.7.3.5 Spare parts
- 4.7.4 Submit a course outline to the Consultant before training commences. Provide course documentation for up to eight people.
- 4.7.5 The training session shall be scheduled and co-ordinated by the Commissioning Agent. The Commissioning Agent shall video tape the sessions.
- 4.7.6 Training shall be provided for the following systems:

<u>System</u>	<u>Minimum Training Hours</u>
Fire Alarm System	2
Security System	1
Public Address System (if applicable)	1
Electrical System	8
Stage Lighting/Dimming System	1

- 4.7.7 The Electrical Sub-Contractor shall conduct a walk-through of the installation with the Board's Representative, Building Operator and/or Custodian, as well as the Commissioning Agent. During the walk-through, the Electrical Sub-Contractor shall:
- 4.7.7.1 Identify equipment
 - 4.7.7.2 Identify electrical panels
 - 4.7.7.3 Identify starters and disconnects
 - 4.7.7.4 Review the electrical power distribution
 - 4.7.7.5 Review the light power distribution
 - 4.7.7.6 Review the switch gear
 - 4.7.7.7 Review the general maintenance procedures

4.8 COMMISSIONING AGENT

- 4.8.1 A Commissioning Agent (CA) shall be hired by the Board.
- 4.8.2 The CA responsibilities shall include:
- 4.8.2.1 Preparing the Commissioning Plan
 - 4.8.2.2 Co-ordinating with the Electrical Sub-Contractor to schedule tests
 - 4.8.2.3 Preparing a Test Form Manual
 - 4.8.2.4 Witnessing selected tests
 - 4.8.2.5 Receiving all test forms
 - 4.8.2.6 Co-ordinating the Electrical Sub Contractor's training
 - 4.8.2.7 Chair the commissioning meetings
- 4.8.3 The Electrical Sub-Contractor shall conform to the requirements of, and co-operate with the CA.
- 4.8.4 The Electrical Sub-Contractor shall provide assistance to the CA and have appropriate and experienced personnel available during the performance testing procedure. Each electrical system shall be tested in the operational mode.

4.9 THE ELECTRICAL SYSTEM DEMONSTRATION AND TURNOVER

- 4.9.1 The System Demonstration and turnover to the Board shall occur when:
- 4.9.1.1 The installation is complete
 - 4.9.1.2 The Acceptance Test conducted by the Electrical Consultant has been completed successfully

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- 4.9.1.3 Training has been completed
- 4.9.1.4 Equipment Operating and Maintenance Manuals have been presented accepted by the Electrical Consultant and the Board's Representative
- 4.9.1.5 System operating manuals have been presented and accepted by the Electrical Consultant and the Board's Representative
- 4.9.1.6 Shop drawings have been updated
- 4.9.1.7 As-Built drawings have been completed
- 4.9.2 The Commissioning Process has been completed successfully and system operation accepted by the Electrical Consultant and Commissioning Agent.
- 4.9.3 The systems demonstration shall be conducted by the Electrical Sub-Contractor and Equipment Manufacturers. The demonstration shall cover a physical illustration of equipment installation and operation.

4.10 TESTING FORMS

- 4.10.1 The Electrical Sub-Contractor and Equipment Manufacturers shall fill out the forms issued by the C. A. at such time as he is ready to begin the Commissioning Process. The forms must be approved by the Electrical Consultant and the Board's Representative before they are used.

4.11 WARRANTIES

- 4.11.1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by the Board.
- 4.11.2 The Electrical Sub-Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.
- 4.11.3 Refer to the Consultants' Specification for the requirements during the warranty period.

4.12 COMMISSIONING PROCESS ALLOCATION

- 4.12.1 The Commissioning Process shall be allocated a value equal to 5% of the Contract. The Electrical Sub-Contractor may draw from this allocation as each of the Commissioning Process is completed.

