# Systems Commissioning

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Commissioning Manager’s Signature ________________________________

Commissioning Manager’s Name ________________________________
I. General

Commissioning process shall be in accordance with LEED’s requirements (latest revision) for Fundamental Building Systems Commissioning where applicable.

Conduct tests in presence of Owner/Owner’s Representative.

Further to all documented inspections, verifications and measurements of Electrical and Mechanical systems a report shall be submitted to the Engineer for verification.

Submit (3) Electronic copy and (3) Hard copies in a binder of all completed and verified test reports and results to Dalhousie University Facilities Management.

Prior to Interim Acceptance, the Commissioning Manager (CM) will have completed all tests including the System Functional Performance Tests.

Prior to the Facility Takeover date, the CM shall assemble the completed testing forms, system performance testing forms, BACS and fire alarm system printouts, and include them in the interim commissioning report.

Equipment will not be accepted until all test results are satisfactory; warranty shall only commence thereafter.

During the warranty period, the CM shall be available upon request to coordinate remediation of systems failure or low performance identified by the University.

II. Commissioning

- The Commissioning Team will be under the direction from the Lead Architectural Consultant to ensure all systems meet the requirement of the Consulting Team’s design.
- The Commissioning Team will consist of at least 1 representative of the following groups:
  - Architectural Consultant (Team lead)/Commissioning Manager
  - Mechanical Consultant,
  - Electrical Consultant,
  - Energy Consultant,
  - General Contractor/Construction Manager,
  - Mechanical Contractor,
  - Electrical Contractor,
  - BAS Contractor,
  - Balancing Agent
  - Project Manager (Owner’s representative).
- The commissioning process will begin once all systems have been installed and ready to be started by the manufacturer’s representatives.
- All equipment and system start-ups will be supervised and approved by the commissioning team.
- Once all systems and equipment have been started and approved, the Balancing Agent will balance all systems under the supervision and direction of the Commissioning Team.
• The Commissioning Team will evaluate all system and equipment performance data to determine system compliance. Any systems determined to be compliant by the Commissioning Team will be approved by both the Commissioning Team Manager and the Project Manager. Systems determined non-compliant will be reported to the applicable consultant and contractor to rework until such system is determined compliant based on further performance testing and evaluation.

• The commissioning process is not complete until all systems are determined compliant with the commissioning and design requirements and have been approved by the Commissioning Team Manager and the Project Manager.

III. Mechanical Systems

A. Testing, Adjusting and Balancing
• All HVAC air and water systems must be balanced as per the Consultants design criteria and the Associated Air Balance Council (AABC) standards.
• Balancing will not commence until all systems are operational and approved by the Consulting Team.
• The Balancing Agent will report directly to the General Contractor or Construction Manager/Project Leader.
• All balancing data and results must be verified and authorized by both the consulting team and owner to be deemed acceptable. The Balancing Agent may be asked to perform sample tests in the presence of the Consulting Team and Owner to verify accuracy of data.
• The Balancing Agent’s contract will not be considered complete until all systems are commissioned and approved by the Consulting Team and the Owner.
• All balancing reports must be accompanied by AutoCAD drawings complete with all actual measured readings entered on the drawings for all associated equipment.

B. Piping
• Maintain test pressure without loss for 2 hours unless otherwise specified.
• Hydraulically test hydronic piping systems at 1-1/2 times system operating pressure or minimum 862 kPa, whichever is greater.
• Test drainage, waste and vent piping to the National Building Code, the Canadian Plumbing Code, and the authorities having jurisdiction.
• Test domestic hot, cold, and recirculation water piping at 1-1/2 times system operating pressure or minimum 862 kPa, whichever is greater.
• Test fire protection/sprinkler systems in accordance with NFPA 13, NFPA 20, and the authorities having jurisdiction and as specified elsewhere.
• Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.
• Prior to start up ensure all closed loop piping systems are thoroughly flushed and cleaned to remove any signs of debris in the systems.
IV. Electrical Systems

A. Load Balancing
1. Measure phase current to panel boards with normal loads (including lighting) operating at time of acceptance. Adjust branch circuits to obtain best balance of current between phases and record changes.
2. Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
3. Submit, at completion of work, report listing phase and neutral currents on all panel boards, dry core transformers and motor control centers, while operating under normal load. State hour and date on which measurements were taken and, all phase to phase and phase to neutral voltages at time of test.

B. Electrical Coordination Study
1. The Engineer must ensure that the settings determined from the Coordination Study are correctly applied to all installed protective devices
2. Thermal scan of all panel boards, CDP, MCC and switchboards to be conducted by contractor prior to warranty expiration. Report to be reviewed by Electrical Engineer. Any subsequent rectification work requested by the Engineer will be contractor’s responsibility.
3. Refer to Table 1 for further commissioning requirements.

V. TRAINING
The CM’s/Consultant’s duties shall include but not limited to the following:
   a. To develop list of critical systems for which training is essential.
   b. To coordinate, organize, and schedule all specified training.
   c. Allow for classroom training immediately followed by hands-on training where required.
   d. Provide all training materials from each sub-contractor/manufacturer for review and approval of the Commissioning Team prior to the training session.
   e. To ensure that the contractor prepares an agenda for each training session.
   f. To provide full documentation of each training session, including attendance sheets, are to be included in the Commissioning Report.

The CM/Consultant shall arrange for all classroom and training session aids for all training sessions in collaboration with the Dalhousie University.

Each training session shall cover, as minimum, the following:
   a. Classroom presentation followed by on-site demonstrations
   b. Description of the equipment / system components
   c. Demonstration of the equipment / system operation
d. Operating procedures

e. Maintenance by Building Operator

f. Maintenance provided by the manufacturer

g. Normal and special tools required for equipment servicing

h. Spare part stocked by the manufacturer and delivery schedule and location of other parts

i. Acceptable tolerances for equipment adjustment

j. Scope of the equipment warranty

k. A review of the operation and maintenance data

l. Start-up and shut-down procedures

m. Emergency procedures

Where equipment is part of a system, the training session shall identify how the equipment interacts with the system as a whole.

End of Section
### Dalhousie University Commissioning Guidelines - Electrical

#### Table 1.

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>TEST</th>
<th>Transformer</th>
<th>Switchgear</th>
<th>Oil Samples &amp; Testing</th>
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<tr>
<td>25kV 4.16kV Switch</td>
<td>DC Insulation (Step Voltage)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>25kV 4.16kV Switch Xfmr Feed (Fused)</td>
<td>DC Insulation (Step Voltage)</td>
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<tr>
<td>25kV 4.16kV Oil Filled Transformer</td>
<td>Transformer Tests (Capacitance and Dissipation)</td>
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<td>X</td>
<td>X X</td>
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<tr>
<td>25kV 4.16kV Dry Type Transformer</td>
<td>Transformer Tests (Capacitance and Dissipation)</td>
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<tr>
<td>25kV 4.16kV 1200A Main Incoming Circuit Breaker</td>
<td>Transformer Tests (Capacitance and Dissipation)</td>
<td>X X</td>
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<td>X X</td>
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<tr>
<td>25kV 4.16kV Feeder Circuit Breaker</td>
<td>Transformer Tests (Capacitance and Dissipation)</td>
<td>X X</td>
<td>X</td>
<td>X X</td>
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<tr>
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<td>Switch Contact Resistance</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>600V Or 208V Main Breaker (Drawout Type)</td>
<td>Transformer Tests (Capacitance and Dissipation)</td>
<td>X X</td>
<td>X</td>
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Tests to be carried as part of the commissioning procedures.