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COMMISSIONING PLAN

Summary
January 19, 2015

1.0 SUMMARY

1.1 COMMISSIONING

Commissioning is the Quality Assurance process of moving the facility from the static completion to the optimal 'dynamic' operating state by verifying through testing that the systems are performing as per the design intent and meet the Owner's operational needs.

The Commissioning Plan provides the details for the implementation of the commissioning process by providing the following information:

- An outline of the commissioning process and the objectives of the commissioning.
- Identification of the members of the commissioning team and their roles and responsibilities in the commissioning process.
- Required documents from the commissioning process for future references in operating and maintaining the facility.
- A schedule of the commissioning activities for testing, verification, and training of Operations and Maintenance (O&M) staff.

COMMISSIONING PLAN

Objectives
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2.0 OBJECTIVES

The objectives of the commissioning plan are as follows:

- Support quality management through monitoring and checking of the installation.
- Verify system performance through testing and commissioning of the completed installation.
- Move the completed facility from the 'static completion' state to the optimal 'dynamic' operating state.
- System debugging and optimization.

COMMISSIONING PLAN

Phases of Commissioning
January 19, 2015

3.0 PHASES OF COMMISSIONING

The phases of the commissioning consist of:

- Design Phase
- Construction Phase
- Post-Construction Phase

Each phase is outlined in more detail below.

3.1 DESIGN PHASE

- Commissioning requirements are developed and incorporated into the contract documents.
- The Commissioning Plan is developed.
- The design intent is established by the Departmental Representative and the basis of the design is developed into contract documents.

3.2 CONSTRUCTION PHASE

- Contractor submittals are reviewed.
- Commissioning meetings are held with the commissioning team to review the commissioning plan and schedule.
- Equipment start-up and testing dates are established and incorporated into the construction schedule.
- The installation progress is reviewed and verified against a pre-functional checklist.
- The start-up procedures are reviewed and equipment start-up is witnessed by the pertinent members of the commissioning team.
- Contractor and third party test reports are reviewed for the equipment being commissioned.
- Functional testing and verification procedures are developed, reviewed, and implemented.

COMMISSIONING PLAN

Phases of Commissioning
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- The requirements of the O&M manuals are reviewed and the O&M manuals are completed.
- The as-built drawings are reviewed and completed.
- The requirements for the O&M staff training are reviewed and training is completed.
- The system and equipment warranties are reviewed.
- The final commissioning report is completed.

3.3 POST-CONSTRUCTION PHASE

The systems are reviewed with the O&M staff prior to the end of the warranty period.

COMMISSIONING PLAN

Roles and Responsibilities
January 19, 2015

4.0 ROLES AND RESPONSIBILITIES

4.1 THE DEPARTMENTAL REPRESENTATIVE

With the assistance of the project design team, the Departmental Representative will:

- Provide operating personnel to attend training and instruction regarding specific components, equipment, and systems.
- Observe on-site installation, start-up, and testing of equipment and systems.
- Review the contractor's submittals, such as shop drawings, to ensure compliance with the specifications requirements.
- Prepare equipment test data forms for some equipment, to be used by contractor as a template for other commissioned equipment.
- Review contractor's installation program to ensure that the installation sequences have been coordinated with the project schedule.
- Monitor, check, and inspect the installation throughout the construction stages to ensure the equipment installation is as designed and the installation method, workmanship, and procedures follow the reviewed submission and method statement.
- Issue deficiency reports as required on equipment installations. Ensure deficiencies are corrected and certify installation of systems.
- Review contractor's commissioning schedule to ensure the proposed tests, sequence of tests, and methods conform to the contract requirements.
- Review O&M manuals, balancing and test reports, and as-built markups for accuracy.
- Witness equipment start-up and tests; note any deficiencies and provide progress reports as required.
- Confirm completion of contractor's commissioning.

4.2 THE CONTRACTOR

With the assistance of the subcontractors, the contractor will:

- Manage and ensure entire installation complies with requirements of the Contract Documents.

4.5

COMMISSIONING PLAN

Roles and Responsibilities
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- Set up and chair commissioning meetings.
- Submit shop drawings complete with Contractor's Stamp of Review.
- Submit working detail (interference or installation) drawings, as required.
- Complete testing and commissioning forms for all equipment being commissioned.
- Submit an installation method statement. This generally includes:
 - Method of equipment delivery to the installation location on-site.
 - Prerequisite preparation for delivery, such as completion of the factory testing and the completion of site work to accept this equipment.
 - Installation method and sequences of installing the equipment and the associated connections to the equipment.
- Submit an installation schedule. This schedule shall include:
 - Time schedule of each activity, with lead and lag time allowed and indicated.
 - Shop drawings and working detail drawing submissions.
 - Major equipment delivery and factory testing dates.
 - Coordinated installation activities and sequences in compliance with the General Contractor's project schedule and other trades' installation schedules.
 - Schedule of testing and commissioning of the systems and major equipment.
- Submit a commissioning schedule. This schedule shall include:
 - Time schedule for system and equipment commissioning which are in compliance with the timing and sequences of installation schedule stated above. In this schedule allow for additional time for testing and commissioning, such that re-tests of the equipment can be performed in a timely manner, if required, without impacting the overall project schedule or causing delay to the Project completion.
 - Dates for completion of required factory tests prior to equipment delivery to the site.
- Prepare and submit testing and commissioning method statements for review by the Departmental Representative.

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Roles and Responsibilities
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- Complete and submit testing and commissioning record or report forms for review by the Departmental Representative.
- Complete the equipment test data forms (data sheets) provided by the Departmental Representative. Create or provide equipment data forms for commissioned equipment when forms are not available from the Departmental Representative.
- Attend progress and commissioning meetings.
- Promptly rectify or replace reported deficiencies and defects.
- Where required by codes and/or specifications, retain manufacturers and/or independent third parties to provide service for testing and certification of the systems and training of O&M personnel.
- Provide and schedule training and instruction on commissioned systems for the O&M personnel.
- Perform testing and commissioning of equipment and systems to the satisfaction of the Departmental Representative. Testing and commissioning will be witnessed by the Departmental Representative as required. Contractor or his agents shall also record procedure and findings in reviewed test and record forms. Submit test and record forms with the signature of the tester for review by the Departmental Representative.
- Pay for and be responsible for all inspections required by codes, specifications, and Authorities Having Jurisdiction. Obtain and submit all Certificate of Approval for such inspections and verifications.
- Submit for review as-built drawing markups, including those for location of control devices and wiring, and submit O&M manuals for all equipment as per the specification requirements.
- Provide O&M manuals for review by the Departmental Representative with all the testing and commissioning results and reports incorporated.
- Obtain, issue, and assign warranties to the Departmental Representative for all equipment and systems installed under Contract.
- Provide all testing equipment necessary for testing and commissioning equipment. Provide recently validated calibration certificates for all equipment to be used in verification prior to testing and commissioning commencement.
- Optimize operation according to the Departmental Representative's needs.

COMMISSIONING PLAN

Roles and Responsibilities

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- Complete all commissioning procedures and activities and performance verification procedures which were delayed or not concluded during the commissioning period.
- Complete system checks, once during the first month of system operation, once during the third month of system operation, and once between the fourth and tenth months of system operation.
- Complete rectification of all deficiencies revealed by these checks. Equipment manufacturers involved in commissioning shall participate in systems checks.
- Revise all 'as-built' and O&M documents to reflect all changes, modifications, revisions, and adjustments upon completion of commissioning.

COMMISSIONING PLAN

Meetings and Schedules
January 19, 2015

5.0 MEETINGS AND SCHEDULES

5.1 MEETINGS

5.1.1 Site Meetings

The Contractor will schedule and chair site meetings during the construction. The Contractor is responsible for coordinating their subtrades and ensuring all required personnel attend the site meetings. The Contractor is to provide the Departmental Representative with information regarding substitutions, change orders, and any supplemental instructions that may affect the commissioning of equipment, systems, or the commissioning schedule. The Contractor will prepare meeting minutes for distribution to all attendees, and all attendees will review the minutes and provide comments and revisions to be incorporated as required.

5.1.2 Commissioning Meetings

The Contractor will schedule and chair commissioning meetings during the construction. The Contractor is responsible for coordinating their subtrades and ensuring that all relevant commissioning personnel attend the commissioning meetings. These meetings shall address commissioning related responsibilities as well as the preparation for all specified testing, documentation, O&M manuals, training, and post-construction requirements. These meetings may be held in tandem with the site meetings if the project schedule and progress allows.

5.1.3 Scheduling

The Contractor is responsible for the preparation of a Commissioning schedule and project schedule. These schedules must be produced with respect to the other and provide a complete implementation schedule for the Contract documents, from the start of demolition to the completion of commissioning. The schedules will be reviewed by the Departmental Representative and the Contractor will be provided with revision comments as required. These comments must be incorporated into the schedules and the schedules resubmitted until an agreement on the final schedule is established between the Departmental Representative and the Contractor.

COMMISSIONING PLAN

Progress Reporting and Issues Log
January 19, 2015

6.0 PROGRESS REPORTING AND ISSUES LOG

The Departmental Representative will produce regular commissioning progress reports. These reports will include:

- Any newly identified deficiencies in the current installation that need to be addressed.
- A list of outstanding deficiencies from previous reports.

COMMISSIONING PLAN

Systems to be Commissioned
January 19, 2015

7.0 SYSTEMS TO BE COMMISSIONED

The following is a list of systems to be commissioned. The commissioning requirements include, but are not limited to, the following. Refer to specifications sections 01 91 13, 01 91 31, 01 91 33, 01 91 41, and 01 91 51 for additional commissioning requirements.

7.1 TEMPORARY FUEL-OIL SYSTEM

- Equipment for the temporary fuel-oil installation, including DT-1, ST-T, FMS-T, P-T
- All piping and sensors associated with the fuel-oil installation.
- Power, wiring, and conduit to and from FMS-T and P-T

7.2 PERMANENT FUEL-OIL SYSTEM

- Equipment for the permanent fuel-oil installation, including FMS-1, ST-1, P-1, P-2
- All piping and sensors associated with the fuel-oil installation.
- Power, wiring, and conduit to and from FMS-1, P-1, and P-2
- Connections from FMS-1 to the existing BAS system, and the operator graphic for the existing BAS system.

COMMISSIONING PLAN

Performance Testing
January 19, 2015

8.0 PERFORMANCE TESTING

Commissioning of the systems shall commence once the equipment has been completely installed, started up, tested by the contractor and manufacturer, and test reports have been submitted for review by the Departmental Representative.

8.1 TEMPORARY FUEL-OIL SYSTEM

The temporary fuel-oil system is to be tested to ensure that the controls sequence for FMS-T is operating as designed, and the fuel-oil loop between ST-T, DT-1, and the existing emergency generators is properly installed and operational.

- Test data forms for the equipment to be commissioned are to be developed and completed by the contractor, and submitted to the Departmental Representative for review and approval.
- Any manufacturer supplied start-up and performance verification forms are to be completed in tandem with the forms developed by the contractor.
- All equipment is to be started up as per the manufacturers' recommendations.
- Pre-operational cleaning is to be completed for the fuel-oil system and reports provided to the Departmental Representative for review.
- All shop drawings, test reports, manuals, as-builts, etc. are to be submitted by the contractor for review by the Departmental Representative.
- The Departmental Representative will need to register ST-T with Environment Canada prior to it being filled with fuel. The contractor is to provide and support the Departmental Representative in acquiring the required registration information.
- All protective devices are to be properly set, tested, and calibrated. Report to be submitted to the Departmental Representative for review prior to energizing the equipment.

8.2 PERMANENT FUEL-OIL SYSTEM

The temporary fuel-oil system is to be tested to ensure that the controls sequence for FMS-1 is operating as designed, and the fuel-oil loop between ST-1, DT-1, and the existing emergency generators is properly installed and operational.

COMMISSIONING PLAN

Performance Testing
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- Test data forms for the equipment to be commissioned are to be developed and completed by the contractor, and submitted to the Departmental Representative for review and approval.
- Any manufacturer supplied start-up and performance verification forms are to be completed in tandem with the forms developed by the contractor.
- All equipment is to be started up as per the manufacturers' recommendations.
- Pre-operational cleaning is to be completed for the fuel-oil system and reports provided to the Departmental Representative for review.
- All shop drawings, test reports, manuals, as-builts, etc. are to be submitted by the contractor for review by the Departmental Representative.
- The Departmental Representative will need to register ST-1 with Environment Canada prior to it being filled with fuel. The contractor is to provide and support the Departmental Representative in acquiring the required registration information.
- All protective devices are to be properly set, tested, and calibrated. Report to be submitted to the Departmental Representative for review prior to energizing the equipment.

COMMISSIONING PLAN

List of Testing
January 19, 2015

9.0 LIST OF TESTING

The following is a sample of the tests to be completed by the contractor. Refer to the specifications and contract documents to develop a complete list of the tests required.

- Pressure testing of piping
 - Piping for temporary fuel-oil installation
 - Piping for permanent fuel-oil installation
- Flushing and cleaning of all pipes
- Voltage, phasing, and load measurements.

COMMISSIONING PLAN

List of Equipment data forms (data sheets)
January 19, 2015

10.0 LIST OF EQUIPMENT DATA FORMS (DATA SHEETS)

The following is a list of equipment data forms provided by the Departmental Representative and to be completed by the Contractor. Any data forms required for commissioning equipment or systems that are not listed below will need to be produced by the Contractor and submitted to the Departmental Representative for review and approval. The data sheets listed below are included in Appendix A of this commissioning plan.

- Pumps
- Fuel supply tank
- Fuel day tank
- Fill box
- Fuel management system

COMMISSIONING PLAN

Documentation
January 19, 2015

11.0 DOCUMENTATION

The following is a sample list of documentation to be provided by the Contractor. Refer to the specification and contract documents for a complete list of documentation submittals.

- Shop drawings
- Test forms and reports
- Manufacturer start-up reports
- As-built markups
- O&M manuals
- Warranties

COMMISSIONING PLAN

Training
January 19, 2015

12.0 TRAINING

The commissioning schedule produced by the Contractor shall establish dates for when the systems will be available for training. Training is to commence once the systems have been commissioned. Arrangement will be made to have all required parties on-site during the training.

The key to training is to ensure that experts in the field train the appropriate personnel. Working with the O&M personnel, the Contractor will coordinate the operator training and will bring the operators and instructors together to ensure that system operations are demonstrated to the satisfaction of the Owner.

In some cases the training sessions will be recorded for future reference and training of new O&M staff.

The O&M manuals and as-built drawings will be used for training purposes. The contractor is to provide a training agenda outlining the topics to be covered during the training session. Provide handouts of manufacturer O&M recommendations on the topics to be covered during the training session(s).

COMMISSIONING PLAN

Acceptance
January 19, 2015

13.0 ACCEPTANCE

At the substantial completion stage, the Departmental Representative will report on the commissioning status and make recommendations with respect to the level of completion. When all aspects of commissioning have been completed to the satisfaction of the Departmental Representative, a recommendation will be made with respect to acceptance.

Appendix – Data Sheets

COMMISSIONING PLAN

Pumps
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PUMPS

PROJECT: _____	
Equipment Name/Tag: _____	Location: _____
System/Area Served: _____	Related Equipment: _____

ITEM	√	COMMENTS
PRE-START-UP INSPECTION		
Commissioning lock-out procedures reviewed		
Operation and maintenance information		
Piping and valving		
Mounting/support system and vibration isolation		
Freedom of rotation		
Lubrication		
Electrical wiring		
Overload protection (sized correctly)		
Disconnect switch (tested)		
Control system - point to point checks complete		
START-UP		
Fuel-oil available		
Direction of rotation		
Electrical interlocks - stop/start		
Vibration & noise level acceptable		
Motor Amps - Rated :__ Actual : _____		
Motor Volts - Rated :__ Actual : _____		

Pre-start checks by: _____	_____	Date: _____
Start-up checks by: _____	_____	Date: _____
print name	signature	

COMMISSIONING PLAN

Fuel Supply Tank
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FUEL SUPPLY TANK

PROJECT: _____	
Equipment Name/Tag: _____	Location: _____
System/Area Served: _____	Related Equipment: _____

ITEM	√	COMMENTS
PRE-START-UP INSPECTION		
Operation and maintenance information		
Piping and valving		
Mounting/support system		
Fuel-Oil Containment precautions		
Overfill protection valve installed correctly		
All tank connections are liquid- and vapour-tight		
Emergency vent		
Foot valves installed correctly		
Wiring from control devices is correct classification for installation location.		
Control system - point to point checks complete		
START-UP		
Fuel-oil available		
Fuel level sensor working correctly		
Liquid level switch working correctly		
Overfill protection valve working correctly		
Leak detector is working correctly		

Pre-start checks by: _____	_____	Date: _____
Start-up checks by: _____	_____	Date: _____
<small>print name</small>	<small>signature</small>	

COMMISSIONING PLAN

Fuel Day Tank
January 19, 2015

FUEL DAY TANK

PROJECT: _____	
Equipment Name/Tag: _____	Location: _____
System/Area Served: _____	Related Equipment: _____

ITEM	√	COMMENTS
PRE-START-UP INSPECTION		
Operation and maintenance information		
Piping and valving		
Mounting/support system		
Fuel-Oil Containment precautions		
All tank connections are liquid- and vapour-tight		
Tank vent		
Wiring from control devices is correct classification for installation location.		
Control system - point to point checks complete		
START-UP		
Fuel-oil available		
Fuel level sensor working correctly		
Liquid level switch working correctly		
Leak detector is working correctly		

Pre-start checks by: _____	_____	Date: _____
Start-up checks by: _____	_____	Date: _____
<small>print name</small>	<small>signature</small>	

COMMISSIONING PLAN

Fill Box

January 19, 2015

FILL BOX

PROJECT: _____	
Equipment Name/Tag: _____	Location: _____
System/Area Served: _____	Related Equipment: _____

ITEM	√	COMMENTS
PRE-START-UP INSPECTION		
Operation and maintenance information		
Piping and valving		
Mounting/support system		
Fuel-Oil Containment precautions		
All piping connections are liquid- and vapour-tight		
Accessible from filling platform		
Overfill alarm is installed correctly		
Wiring from control devices is correct classification for installation location.		
Control system - point to point checks complete		
START-UP		
Overfill alarm working correctly		
Alarm silence working correctly		
Drain valve and spill basin working correctly		
Quick-connect for fuel hose working correctly		

Pre-start checks by: _____	_____	Date: _____
Start-up checks by: _____	_____	Date: _____
print name	signature	

COMMISSIONING PLAN

Fuel Management System
January 19, 2015

FUEL MANAGEMENT SYSTEM

PROJECT: _____	
Equipment Name/Tag: _____	Location: _____
System/Area Served: _____	Related Equipment: _____

ITEM	√	COMMENTS
PRE-START-UP INSPECTION		
Operation and maintenance information		
Disconnect switch (tested)		
Mounting/support system		
Hand-off-auto selector switches		
Push-to-test pushbutton for alarm beacon		
Alarms connected to BAS		
Correct labelling for all pilot lights		
Wiring from control devices is correct classification for installation location.		
Control system - point to point checks complete		
START-UP		
Connection to fire alarm panel is working correctly		
Connections to day tank are working correctly		
Connection to fill box is working correctly		
Connections to supply tank are working correctly		
Connections to BAS are working correctly		
Connection to alarm beacon is working correctly		
BAS graphic properly illustrates control system status		

Pre-start checks by: _____	_____	Date: _____
Start-up checks by: _____	_____	Date: _____
print name	signature	