

**CITY OF WINNIPEG**

NEWPCC INTERIM PHOSPHOROUS REMOVAL  
**Commissioning Plan – Draft**

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Revision:

**Rev. B**

KGS Group Project No:

**21-0107-015**

City Project No:

**S-1146**

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## 1.0 INTRODUCTION

The North End Sewage Treatment Plant (NEWPCC) is the largest of three sewage treatment plants servicing the City of Winnipeg. In the NEWPCC wastewater treatment process, ferric chloride is currently dosed at two points around the anaerobic digesters, being the primary and digested sludge. The purpose of the NEWPCC Interim Phosphorous Removal project is to provide an interim way to reduce phosphorus in the effluent at NEWPCC until a permanent upgrade to the current biological nutrient removal system is built.

The interim dosing system will add three new chemical dosing scenarios to the wastewater treatment process for phosphorous removal. To make new dosing scenarios possible, two new buildings will be annexed on to the existing “Railcar Shelter 1” building to the south and to the east. The new “Railcar Shelter 2” building addition to the south will provide a second railcar unloading area. The new “Ferric Chloride Chemical Storage Room” building addition to the east will house two new ferric chloride storage tanks and chemical distribution systems. Finally, a new “Sodium Hydroxide Chemical Storage Building” will be constructed west of the existing dewatering building to house two new sodium hydroxide storage tanks and chemical distribution systems.

The new ferric chloride distribution system will include one main triplex chemical metering pump skid and two chemical transfers pumps located within the new Ferric Chloride Chemical Storage Room. Additionally, two local pump skids and dosing tanks will be installed to service chemical dosing points DP 2.1 and DP 4.1/4.2/4.3. The new sodium hydroxide chemical distribution system, located in the Sodium Hydroxide Chemical Storage Building, will include one main triplex chemical metering pump skid.

Ancillary systems within each of the building or building additions will include HVAC, plumbing, emergency shower/eyewash stations, flushing water, compressed air, and natural gas systems.

New dedicated process controls and automation systems to control chemical unloading, storage and distribution will be connected back to the NEWPCC site’s main DCS/PCS control system. Building mechanical controls including the gas fired air handling equipment will be through the new PLC panel.

The following document provides a plan for the start-up, testing, operation and acceptance criteria for the commissioning of the new equipment and systems installed. It details the commissioning processes, roles and responsibilities, commissioning specifications and objectives, procedures, verification and certification requirements and documentation and acceptance criteria for the Project.

## 2.0 COMMISSIONING TEAM

### 2.1 Participants

Commissioning will require the participation of the following organizations to verify the performance of the equipment and systems:

- General Contractor, and Subcontractors.
- Original Equipment Manufacturer (OEM).
- Contract Administrator – KGS Group.
- Commissioning Agent – KGS Group.
- Owner/Client – City of Winnipeg (The City).

### 2.2 Roles and Responsibilities

The Contract Administrator is to provide comprehensive planning and leadership for the commissioning of the works. In cooperation with the Contractor and Owner, the Contract Administrator will be responsible for ensuring that all commissioning activities are carried out to allow for the delivery of a fully operational facility that is compliant and complete. The Contract Administrator will provide sufficient personnel to develop, manage and implement the commissioning works as illustrated by Table 1 below.

The Contractor shall be responsible for the commissioning work under the direction of the Contract Administrator. The Contract Administrator will monitor the commissioning activities and upon satisfactory completion of the commissioning, will review the documentation provided by the Contractor. A Commissioning handover package will be compiled and provided to the City by the Contract Administrator, which includes all commissioning documentation, including:

- Commissioning Completion Report
- Project commissioning plans and procedures
- Evidence of commissioning verification
- Deficiency reports and corrective action taken
- Training material and records
- Other commissioning documents

**TABLE 1  
ROLES AND RESPONSIBILITIES**

Item	Task Description	Organization	Responsibility	
			Department (If Applicable)	Individual (If Applicable)
1	Safely perform all pre-commissioning, commissioning and performance verification activities.	Contractor		
2	Safely operate the equipment as required to perform commissioning activities	Contractor		
3	Document equipment and control system settings.	Contractor		
4	Provide operations and maintenance manuals.	Contractor		
5	Provide as-built drawings.	Contractor		
6	Provide training to maintenance staff and operators.	Contractor		
7	Schedule and coordinate commissioning works with the construction schedule.	Contract Administrator & Contractor		
8	Prepare agenda and record minutes of commissioning meetings.	Contract Administrator		
9	Attend and witness pre-commissioning and commissioning activities	Contract Administrator & The City		
10	Track deficiencies, record corrective measures	Contract Administrator		
11	Supply commissioning record sheets, test forms, and other documentation.	Contract Administrator		
12	Review and approve commissioning handover package.	Contract Administrator		
13	Commissioning Completion Report in accordance with RFP D12.6	Contract Administrator		
14	Start-up and shut down of systems required for the commissioning work	The City		
15	Apply and remove safety lockouts as required	The City		

Item	Task Description	Organization	Responsibility	
			Department (If Applicable)	Individual (If Applicable)
16	Verify existing DCS interface to new PLC	The City		
17	Monitor alarms during performance verification.	The City		
18	Provide effluent monitoring data through existing sampling and testing points to confirm effectiveness of chemical dosing points.	The City		
19	Plan and attend two (2) half-day commissioning workshops.	Contract Administrator		
20	Carry out process sampling and testing during Performance Verification	Contractor		

## 3.0 SCHEDULE

The anticipated commissioning schedule will occur as described in the most recent revision of the project schedule located in Appendix A. This schedule will be updated as the construction progresses in the contract administration phase. Currently, commissioning is expected to begin **June 1, 2023 and finish by July 20, 2023**. Planned shut downs or interruptions to the NEWPCC site will be identified within the schedule as the project progresses into detailed design.

### 3.1 Commissioning Sequence

#### PHASE 1A: ANCILLARY SYSTEMS FUNCTIONAL TESTING

(Summer 2023)

Commissioning will commence separately within each new building and building addition. Within each area, ancillary systems such as drainage, domestic water, flushing water, compressed air, natural gas, safety systems and HVAC with all associated equipment will be commissioned prior to the process systems. This will ensure all required supporting systems for the main process systems are ready and will constitute phase 1 of the commissioning plan.

#### PHASE 1B: PROCESS FUNCTIONAL TESTING

(Summer 2023)

The sequence for commissioning the process systems will be based on key process functional groups starting with chemical unloading by railcar and truck, followed by the chemical storage tanks, chemical distribution pumps, local dosing tanks and metering pump skids. Throughout the commissioning process associated automation and control functionality will be tested. Systems that will convey chemicals will initially be commissioned using water prior to introduction of chemical.

#### PHASES 2 & 3: PROCESS EFFECTIVENESS TESTING

(Summer 2023 & Winter 2023/24)

As part of commissioning existing testing points throughout the NEWPCC site will be used to monitor the effectiveness of the chemical dosing points to the reduction of total phosphorous and wastewater treatment process. These existing testing points will be used to gather data over a set period of time and reviewed against the modeled and bench scaled testing summarized in the AECOM report. Adjustments to the chemical dosing rates and process controls will be made in two periods: One in Summer 2023, and one in Winter 2023/24, to capture both summer and winter wastewater flows.

During these two time periods, **effluent Total Phosphorous** (TP) and pH curves will be plotted based on ferric chloride and sodium hydroxide (caustic soda) dosing rates respectively. The curves will be determined empirically by setting the dosing rates and then manually testing the effluent using a Hach test kit. Because the digesters have a 2-week retention period, each major ferric and sodium hydroxide dose adjustment should be followed by up to 15 days observation of the digester performance.

Both periods will be 6-weeks long. The first four weeks will have two dosing rate adjustment and measurement periods. The last two weeks of each period will be to allow the pumps to automatically adjust chemical dosing rates based on the established curve and continue to manually monitor the process.

## 4.0 SCOPE OF WORK

### 4.1 General

Commissioning of process and ancillary systems will follow the requirements of the technical specifications listed in the reference section and make use of the commissioning forms and procedures described therein. In addition to these documents, the contractor is responsible for reviewing the full scope of drawings and specifications and meeting all of the commissioning requirements listed therein.

The following is a general list of the systems to be commissioned. Each system named below includes all electrical and mechanical components that operate together to achieve the desired purpose.

- Truck/Railcar Chemical Unloading
- Chemical Metering/Dosing System
- HVAC Systems
- Remote Monitoring/Control
- Fire Alarm
- Power Distribution
- Lighting/Emergency Lighting

Detailed commissioning requirements for each system and device are provided in the technical specifications previously listed. However, the general scope of commissioning is also discussed in the following sections.

### 4.2 Pre-Commissioning

Pre-commissioning will consist of one meeting to confirm that all construction phase inspection and testing is complete. Examples of typical inspection and testing activities completed prior to pre-commissioning are listed below:

- Equipment factory acceptance testing
- Piping hydrostatic testing
- Backfill compaction testing
- Concrete slump testing
- Megger testing

Applicable Quality Control (QC) documents, Inspection and Testing Plan (ITP) documents, and City of Winnipeg certificates will be reviewed for completion and signed-off. This includes all the static inspection and start-up checklists as well as City of Winnipeg forms nos. 100, 101, 102. If construction is incomplete, and commissioning work must proceed concurrently with on-going construction, additional pre-commissioning meetings may be required.

### 4.3 Commissioning (Phase 1A, 1B)

Commissioning services will be provided for all pumps, tanks, piping systems, electrical equipment, HVAC equipment, compressed air equipment, lighting systems, fire alarm systems, and emergency shower/eye wash stations. The full extents of the scope of equipment to be tested is listed in the technical specifications.

In addition, required system shutdowns are identified in the Construction Plan and a monitoring and analysis plan for start-up and on-going implementation of the phosphorous removal is outlined in the following sections. This specification includes recommended parameters for monitoring the digester, primary clarifier, bioreactor, and secondary clarifier performance.

The full extent of the system functions described in the technical specification 25 90 01 Sequence of Operation will be tested and verified using water to calibrate and prove all systems are ready for use.

The wastewater treatment plant will be operational during commissioning. This will require that all commissioning tasks, especially those that include the existing ferric chloride dosing system, must be coordinated with plant operations staff and the ongoing wastewater treatment plant process. Removal and reinstallation of new components installed on live systems that are found to be defective, may require a shut-down of the wastewater treatment process.

### 4.4 Process Testing and Verification (Phase 2, 3)

The specific chemical and biological aspects of the wastewater treatment plant process that will govern phases 2 and 3 of commissioning of the dosing systems will be:

- Anaerobic digestion pH and temperature must remain within acceptable parameters
- Digester microbial population equilibrium (methanogens, acidogens, etc.) must remain within acceptable parameters
- Residual iron must remain below a threshold value of ###

Furthermore, as noted above, because of the Sludge Retention Time and that the effluent will be manually tested, the results for each dosing rate tested will be available after a 14-day (2-week) delay. This will limit the number of dosing levels that can be used for the caustic.

Separate ferric and sodium hydroxide dosing protocols will be provided to guide the testing and monitoring operation. Based on these results, the following empirical curves will be generated:

- OP amount in sludge vs ferric dose vs TP in the centrate and SBR effluent
- Sludge flow rate vs. sodium hydroxide dosing vs. pH
- OP amount in mixed liquor vs. ferric dose vs TP in the final wastewater effluent

To minimize the uncertainty and risks to the plant's existing operations, rapid lab-scale batch tests are proposed to obtain the above relationships first.

At start of the chemical dosing commissioning, the flow rates, pH and soluble OP concentrations of the primary and trucked SE and WE sludges as well the mixed liquor will be measured, the soluble OP will be determined by the HACH test kits. The ferric dosing for sludge will start with half of the amount recommended in the AECOM report. The ferric dosing for mixed liquor biomass would start with 50% of the

measured optimal Ferric to (OP centration – 2.5 mg/L) ratio. The sodium hydroxide dosing should start with the safe amount from the afore-mentioned batch test. The TP and OP (and pH, VFA, Alkalinity) analyses of digestate and of final effluent will be made.

By varying the ferric doses and measuring the TP concentrations of the centrate and final effluents, the actual dependence curves will be obtained for the last two weeks' dosing application. The ferric dosing will be manually controlled by adjusting the ferric pump flow rate according to the above ferric-TP dependence chart.

Proposed commissioning plan for each of the dosing points.

Dosing Point	Comments
DP 1.4 (Ferric Chloride Trucked Sludge)	<p>First 4 weeks:</p> <ul style="list-style-type: none"> <li>• Pumps set on Manual Operation. Adjustment of the ferric chloride dosing rate. Starting dosing rate of X. Dosing rate change at interval of X hrs with incremental flow rate of X L/hr.</li> <li>• Sample and test sludge from piping for the following parameters: <ul style="list-style-type: none"> <li>○ TP</li> <li>○ pH</li> </ul> </li> <li>• Record wastewater flow rate and influent flow rate.</li> <li>• Plot on Graph</li> </ul> <p>Remaining 2 weeks:</p> <ul style="list-style-type: none"> <li>• Pumps set on automatic operation</li> <li>• Input pump speed adjustment to match empirical graph.</li> <li>• Program to adjust pump speed based on associated flow meter.</li> <li>• Monitor pumps and system</li> <li>• Sample and test wastewater from piping for the following parameters: <ul style="list-style-type: none"> <li>○ TP</li> <li>○ pH</li> </ul> </li> </ul>
DP 1.5A/B (Sodium Hydroxide Primary Sludge)	Same as DP 1.4 but with sodium hydroxide. <b>New starting point TBD</b>
DP 1.6 (Sodium Hydroxide Trucked Sludge)	Same as DP 1.6.
DP 2.1 (Ferric Chloride Post Grit Removal)	Same as DP 1.4 but with sodium hydroxide. <b>New starting point TBD</b>
DP 4.1/4.2/4.3 (Ferric Chloride Post Bio Reactor)	Same as DP 1.4 but with sodium hydroxide. <b>New starting point TBD</b>

## 5.0 TRAINING

Two (2ea) four-hour long training classes will be presented by the Contract Administrator and the Contractor at the NEWPCC boardroom for two groups of City personnel. The Contract Administrator is responsible for the coordination, quality assurance, overall packaging, and presentation of the training sessions.

The Contract Administrator will provide a description of the new systems with instruction on the design philosophy, criteria, and intent. The Contractor will instruct City personnel how to operate the new control systems safely, and reliably. The Contractor will also discuss proper preventative maintenance practices along with diagnosis and trouble-shooting information.

The Contract Administrator and Contractor (in coordination with associated subtrades and vendors) will provide training material in advance of training sessions for review and approval by the City. Final review and approval of all training manuals and materials is required by the City of Winnipeg prior to the training sessions. It is assumed that feedback will be provided in a timely manner and that scheduling of the training sessions in conjunction with commissioning work will not be delayed.

Technical memoranda prepared by the Contractor will be provided following the commissioning/training workshops. The City will be responsible for providing appropriate personnel to participate in the training for the operation and maintenance of the facility.

Although the Contract Administrator is responsible for the overall training package, the individual equipment instructors will be responsible for the content and quality of their respective sections. The Contractor and any required certified factory-trained manufacturers' personnel will provide specific instruction on the start-up, operation and shut-down of their equipment with emphasis on the components, control features, servicing and maintenance. Specifically, training for the operation and maintenance of the Automation System including the PLC and the HMI is required. It is expected that the Contractor will provide instruction on the operation of the PLC and HMI system.

### 5.1 Training Session Objectives

The objectives of the training will be to provide City personnel with the following information:

- A description of the purpose and design of the new chemical storage and dosing systems.
- An overview of the function requirements of the system
- A detailed description of the extent of all structural, electrical, and mechanical work performed.
- A review of the system layout, the equipment, controls and emergency shut off.
- Equipment and system start-up, operation, monitoring, servicing (including trouble-shooting diagnosis), maintenance and shut-down procedures.
- System operating sequences, including step-by-step directions for starting, operating and shutting down applicable switches and control settings.
- Examples for operation of new truck/rail unloading controls

- Examples for operation of new chemical dosing system controls
- Examples for operation of new building HVAC controls
- Recommended preventative maintenance practices along with diagnosis and trouble-shooting information.
- A review of O&M Manual documentation

Additionally, commissioning workshops will be held to train plant staff on the operation and maintenance of the new upgraded facilities and equipment.

The training provided will be in accordance with Appendix 23 of RFP 429-2021 (see Appendix D).

## 6.0 O&M MANUAL

Upon completion of the project, the Contractor shall provide a complete set of information (the “Operation and Maintenance Information” or “O&M Information”) to furnish City staff with all the information required to operate and maintain the Project.

A draft of the O&M manual will be provided to the City prior to commissioning in accordance with Appendix 17 of the RFP. Final review and approval of all operation and maintenance (O&M) manuals and materials will be required by the City prior to the training sessions. Recommended Preventative Maintenance procedures will be provided by the OEM and Contractor in document format prior to Substantial Completion.

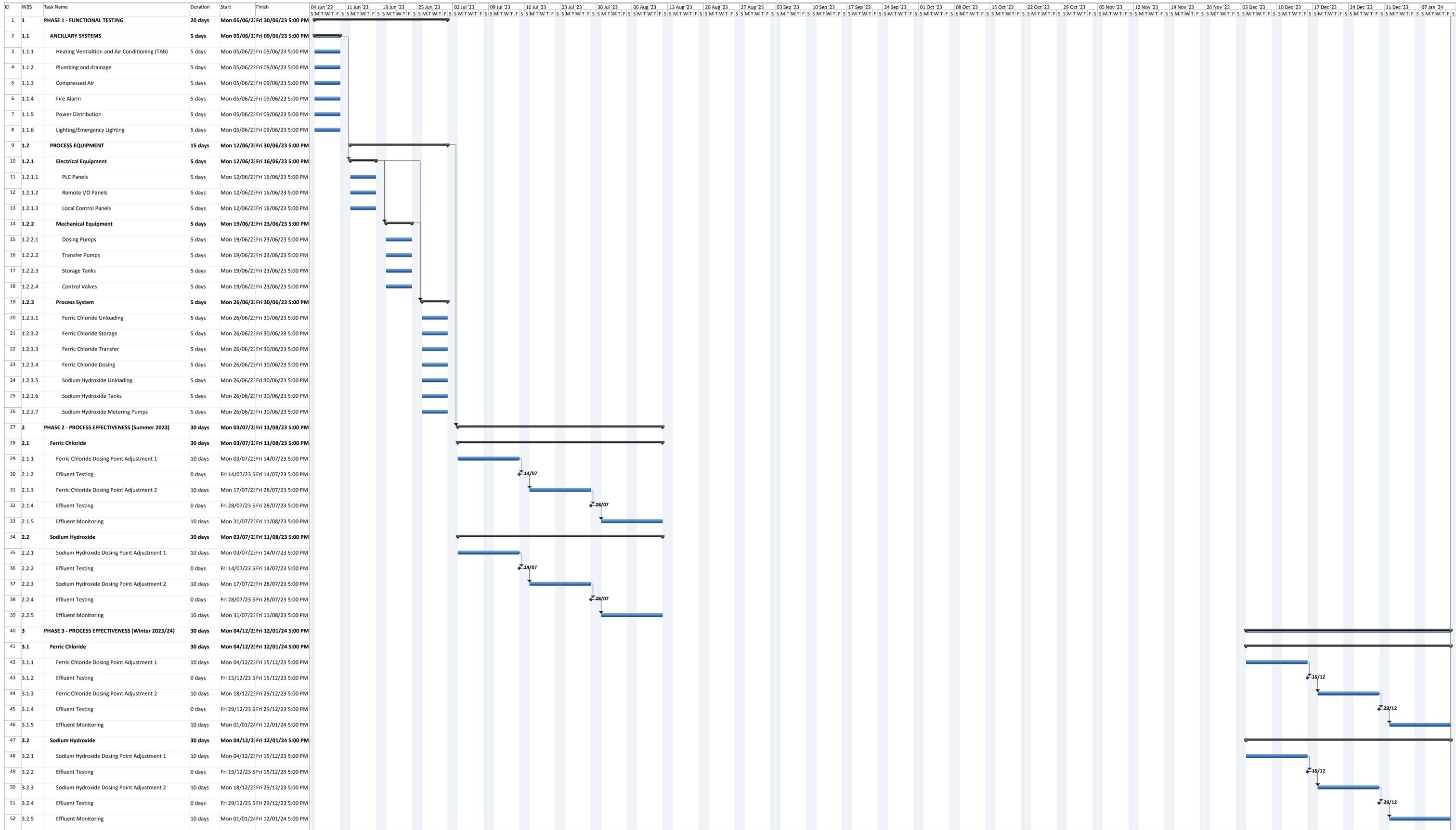
The O&M documentation will be provided in two sections, one containing information furnished by the Contract Administrator, and one containing information provided by the Contractor and will include the following:

- Consultant:
  - Preliminary Design Report
  - Record drawings
  - Final Asset Registry
  - Final Construction Report; and
- Contractor:
  - “As-Built” contract documents
  - Operating Manuals
  - Maintenance Manuals
  - Shop Drawings
  - Product Information (PI) sheets
  - Supplemental training materials like presentations, training videos and/or equipment models
  - Video recording of training sessions

The O&M document package will be provided in electronic and hard copy format and will be in accordance with section Appendix 22 of RFP 429-2021 (see Appendix E).

# **APPENDIX A**

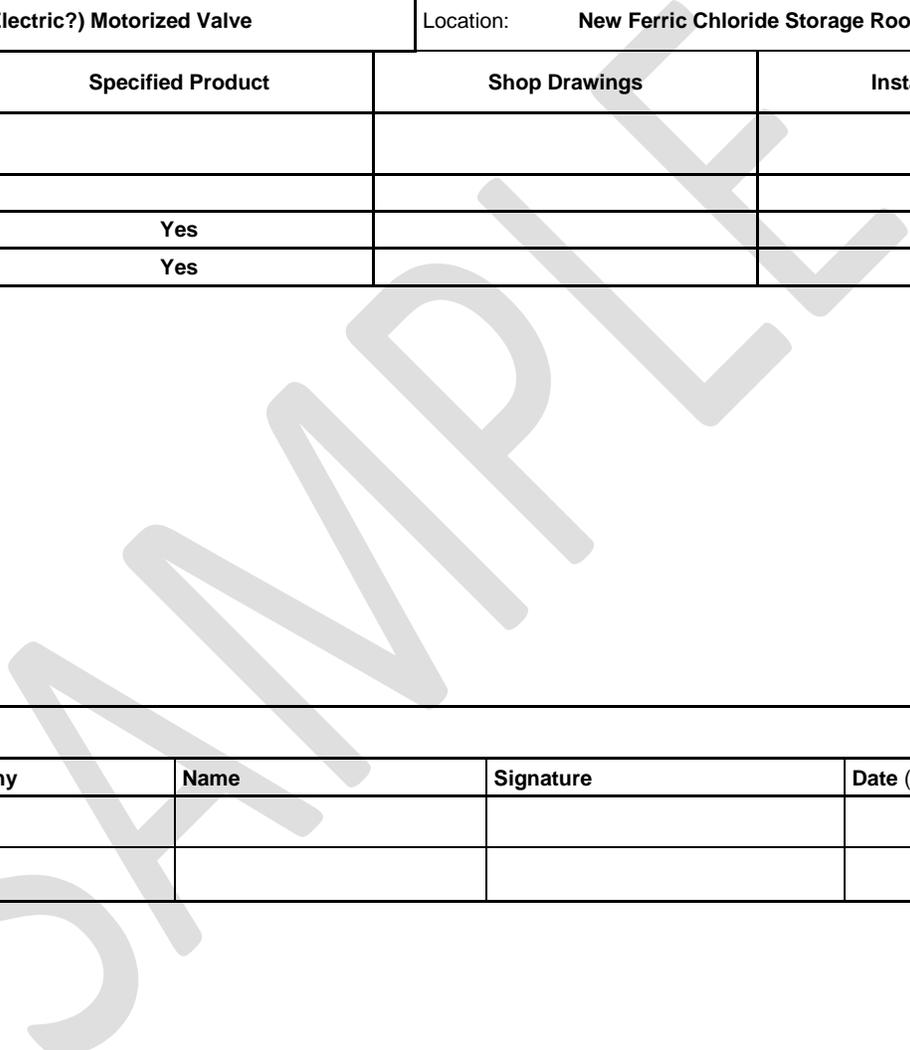
Commissioning Schedule



# **APPENDIX B**

Pre-Commissioning and Commissioning Forms

 Winnipeg	<b>PRE-COMMISSIONING FORM EQUIPMENT START-UP TEST</b>		Page 1 of 1
			System Title: New Ferric Chloride Transfer
<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Removal</b>	
	Area: <b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Start-Up: Control Valves</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>XV-F8706</b>	PID: <b>P5.037</b>	Manufacturer:	Model No.:
	Equipment Type: <b>(Electric?) Motorized Valve</b>		Location: <b>New Ferric Chloride Storage Room</b>	
	<b>Control Valve Details:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Power/Air Requirement			
	Pipe Size			
	Open Actuation	<b>Yes</b>		
	Close Actuation	<b>Yes</b>		
	Comments:			

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

 Winnipeg	<b>PRE-COMMISSIONING FORM EQUIPMENT START-UP TEST</b>		Page 1 of 1
			System Title: New Ferric Chloride Transfer
<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus replacement</b>	
	Area: <b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Start-Up: Pumps</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>P-0780</b>	PID: <b>P5.039</b>	Manufacturer: <b>Pulsafeeder</b>	Model No.: <b>E25NFVF-X</b>
	Equipment Type: <b>Ferric Chloride Transfer Pump</b>		Location: <b>New Ferric Chloride Chemical Storage Room</b>	
	<b>Pump Details:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Pump Flow Rate (L/hr.)	1500		
	Pump Pressure (psi)	58		
	Pump Head (m)			
	Pump Speed (rpm)	1750		
	Dosing Rate (L/hr.)			
	Power (kW)	1.5		
	Voltage (V/Ph/Hz)	208/3/60		
	Installed Dosing Set Point:			
Comments:				

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				



**PRE-COMMISSIONING FORM  
EQUIPMENT START-UP TEST**

Page 1 of 1

System Title: New Ferric Chloride Transfer

<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Replacement</b>
	Area : <b>Chemical Receiving and Storage Area</b>	Bid Opportunity:

<b>Start-Up: Tanks</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>TK-F0730</b>	PID: <b>P5.034</b>	Manufacturer:	Model No.:
	Equipment Type: <b>Ferric Chloride Chemical Storage Tank</b>		Location: <b>New Ferric Chloride Chemical Storage Room</b>	
	<b>Tank Details:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Min. Working Volume (L)	140,000		
	Nominal Volume (L)	160,000		
	Max. Working Volume (L)			
	Comments:			

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

	<b>PRE-COMMISSIONING FORM EQUIPMENT STATIC INSPECTION</b>		Page 1 of 1
			System Title: New Ferric Chloride Transfer
<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Replacement</b>	
	Area : <b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Static Testing: Pumps</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>P-0780</b>	PID: <b>P5.039</b>	Location: <b>New Ferric Chloride Storage Room</b>	
	Equipment Type: <b>Ferric Chloride Transfer Pump</b>			
	<b>Pump Specifications:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Manufacturer	<b>Pulsafeeder</b>		
	Model	<b>E25NFVF-X</b>		
	Serial No.			
	Checklist:	<input type="checkbox"/> No Physical Damage <input type="checkbox"/> Pump is in acceptable orientation <input type="checkbox"/> Motor & pump aligned <input type="checkbox"/> Pump has adequate service space <input type="checkbox"/> Pressure gauges installed <input type="checkbox"/> Correct direction of flow <input type="checkbox"/> Valves & Strainers installed <input type="checkbox"/> Bearings lubricated <input type="checkbox"/> Correct identification tag <input type="checkbox"/> Tag is clearly visible <input type="checkbox"/> Proper support/mounting <input type="checkbox"/> Piping identification installed <input type="checkbox"/> Operation type (parallel/single) <input type="checkbox"/> Impeller & Motor rotation correct <input type="checkbox"/> ECMS Verified operation <input type="checkbox"/> No fluid leakage <input type="checkbox"/> Net positive suction head checked <input type="checkbox"/> Air flow for Motor cooling		
	Comments:			

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				

	<b>PRE-COMMISSIONING FORM EQUIPMENT STATIC INSPECTION</b>		Page 1 of 1
			System Title: New Ferric Chloride Transfer
<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Replacement</b>	
	Area: <b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Static Testing: Tanks</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>TK-0730</b>	PID: <b>P5.034</b>	Location: <b>New Ferric Chloride Chemical Storage Room</b>	
	Equipment Type: <b>Ferric Chloride Chemical Storage Tank</b>			
	<b>Tank Specifications:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Manufacturer			
	Model			
	Serial No.			
	Checklist:	<input type="checkbox"/> No Physical Damage <input type="checkbox"/> Tank has adequate service space <input type="checkbox"/> Correct identification tag <input type="checkbox"/> Tag is clearly visible <input type="checkbox"/> Proper support/mounting <input type="checkbox"/> Piping identification installed <input type="checkbox"/> No fluid leakage <input type="checkbox"/> Flanged connections bolted <input type="checkbox"/> Instrumentation connected <input type="checkbox"/> Threaded connections made <input type="checkbox"/> Tank properly anchored <input type="checkbox"/> Other:		
	Comments:			

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				

<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Removal</b>
	Area : <b>Chemical Receiving and Storage</b>	Bid Opportunity:

<b>Static Inspection: Control Valve</b>	<b>Nameplate Information</b>			
	Equipment Tag:	<b>XV-F8706</b>	PID:	<b>P5.037</b>
	Equipment Type: <b>(Electric?) Motorized Valve</b>			Location: <b>New Ferric Chloride Storage Room</b>
	<b>Pump Specifications:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Manufacturer			
	Model			
	Serial No.			
Checklist:	<input type="checkbox"/> No Physical Damage <input type="checkbox"/> Valve has adequate service space <input type="checkbox"/> Correct identification tag <input type="checkbox"/> Tag is clearly visible <input type="checkbox"/> Actuator connection made <input type="checkbox"/> Controls connected			
	<input type="checkbox"/> Piping gasket flange bolted <input type="checkbox"/> Air connection made* <input type="checkbox"/> Power connection made* <input type="checkbox"/> Control connection made <input type="checkbox"/> Actuator Open function <input type="checkbox"/> Actuator Closed function			
	<input type="checkbox"/> Remote operation function <input type="checkbox"/> Other: *if applicable			
Comments:				

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				



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**Form 100**  
**CERTIFICATE OF EQUIPMENT DELIVERY**

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We certify that the equipment listed below has been delivered into the care and custody of the Installation Contractor. The equipment has been found to be in satisfactory condition. There is no visible evidence of exterior damage or defects.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

\_\_\_\_\_  
(Authorized Representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Contract Administrator)

\_\_\_\_\_  
Date



**Form 101**  
**CERTIFICATE OF READINESS TO INSTALL**

---

We have familiarized the installing contractor of the specific requirements related to the equipment listed below and am satisfied that the installing contractor understands the required installation procedures.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

We certify that we have received satisfactory installation instructions from the equipment manufacturer/vendor.

---

(Authorized Representative of Install Contractor)

---

Date



---

**Form 102**  
**CERTIFICATE OF SATISFACTORY INSTALLATION**

---

We have completed our checks and inspection of the installation of our equipment as listed below and confirm that it is satisfactory and that any defects have been remedied except any as noted below.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

**Outstanding Defects:**

\_\_\_\_\_  
(Authorized Representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Contractor Administrator)

\_\_\_\_\_  
Date

	<b>COMMISSIONING FORM</b>		Page	1 of 1
	<b>SYSTEM FUNCTIONAL TEST</b>		System Title:	New Ferric Chloride Transfer
<b>Project</b>	Facility:	<b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Replacement</b>	
	Area :	<b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Functional Testing</b>	<b>System Title:</b> New Ferric Chloride Transfer				
	<b>Commissioning Process Overview</b>		Commission the new chemical transfer system with water at 10-20 °C from the new chemical storage tanks TK-F0730/40 to new ferric chloride chemical storage tanks TK-G0750 and TK-Y0790		
	<b>Transfer Path 1</b>		TK-F0730 to TK-G0750		
	<b>Valves:</b>				
	XV-F8706	<input checked="" type="checkbox"/> Open	<input checked="" type="checkbox"/> Closed	XV-G87090	<input checked="" type="checkbox"/> Open <input type="checkbox"/> Closed
	XV-F8707	<input checked="" type="checkbox"/> Open	<input checked="" type="checkbox"/> Closed	XV-G87095	<input checked="" type="checkbox"/> Open <input type="checkbox"/> Closed
	XV-F8710	<input type="checkbox"/> Open	<input checked="" type="checkbox"/> Closed	XV-Y87150	<input type="checkbox"/> Open <input checked="" type="checkbox"/> Closed
	XV-F8711	<input type="checkbox"/> Open	<input checked="" type="checkbox"/> Closed	XV-Y87155	<input type="checkbox"/> Open <input checked="" type="checkbox"/> Closed
	<b>Functional Testing</b>				
	<b>Equipment Tag (s):</b>		Tank TK-0730		
	<b>Low Level Alarm</b>	<b>Communicated to SCADA:</b>		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
	<b>High Level Switch</b>	<b>Communicated to SCADA:</b>		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
	<b>Comments:</b>				
	<b>Equipment Tag (s):</b>		Pump P-F0780		
	<b>Equipment Function:</b>	Check dosing pump settings and flowrate during test should be 1500L/min		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
<b>Equipment Tag (s):</b>		Flowmeter F07804-FE			
<b>Equipment Function:</b>	Flow element flow check should read 1500L/min during test		<input type="checkbox"/> Pass <input type="checkbox"/> Fail		
<b>Comments:</b>					
<b>Equipment Tag (s):</b>		Pump P-F0781			
<b>Equipment Function:</b>	Check dosing pump settings and flowrate during test should be 1500L/min		<input type="checkbox"/> Pass <input type="checkbox"/> Fail		
<b>Equipment Tag (s):</b>		Flowmeter F0814-FE			
<b>Equipment Function:</b>	Flow element flow check should read 1500L/min during test		<input type="checkbox"/> Pass <input type="checkbox"/> Fail		



**COMMISSIONING FORM  
SYSTEM FUNCTIONAL TEST**

Page 2 of 2  
System New Ferric Chloride  
Title: Transfer

<b>Comments:</b>				
<b>Equipment Tag (s):</b> Tank TK-G0750				
<b>Low Level Alarm</b>	<b>Communicated to SCADA:</b>		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
<b>High Level Alarm</b>	<b>Communicated to SCADA:</b>		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
<b>Level Switch High LSH-G07503</b>	<b>Stop P-0780</b>	<b>Stop P-0781</b>	<b>Close XV-G87090</b>	<b>Close XV-G8795</b>
	<input type="checkbox"/> Pass <input type="checkbox"/> Fail			
<b>Tank Leak Alarm LS-G07904</b>	<b>Communicated to SCADA:</b>		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
<b>Tank Leak Alarm LS-G07905</b>	<b>Communicated to SCADA:</b>		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
<b>Comments:</b>				
<b>Equipment Tag(s):</b> Ultrasonic Transmitter LIT-G07502				
<b>Fault Alarm</b>	<b>Communicated to SCADA:</b>		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
<b>Comments:</b>				
<b>Equipment Tag(s):</b> Sump Pit Level Switch LSH-F8707				
<b>High Level Alarm</b>	<b>Communicated to SCADA:</b>		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
<b>Comments:</b>				

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Performed By</b>				
<b>Checked By</b>				

 Winnipeg	<b>PRE-COMMISSIONING FORM EQUIPMENT START-UP TEST</b>		Page 1 of 1
			System Title: New Ferric Chloride Transfer
<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Removal</b>	
	Area: <b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Start-Up: Control Valves</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>XV-F8706</b>	PID: <b>P5.037</b>	Manufacturer:	Model No.:
	Equipment Type: <b>(Electric?) Motorized Valve</b>		Location: <b>New Ferric Chloride Storage Room</b>	
	<b>Control Valve Details:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Power/Air Requirement			
	Pipe Size			
	Open Actuation	<b>Yes</b>		
	Close Actuation	<b>Yes</b>		
	Comments:			

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				



**PRE-COMMISSIONING FORM  
EQUIPMENT START-UP TEST**

Page 1 of 1

System Title: New Ferric Chloride Transfer

<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus replacement</b>
	Area : <b>Chemical Receiving and Storage</b>	Bid Opportunity:

<b>Start-Up: Pumps</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>P-0780</b>	PID: <b>P5.039</b>	Manufacturer: <b>Pulsafeeder</b>	Model No.: <b>E25NFVF-X</b>
	Equipment Type: <b>Ferric Chloride Transfer Pump</b>		Location: <b>New Ferric Chloride Chemical Storage Room</b>	
	<b>Pump Details:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Pump Flow Rate (L/hr.)	1500		
	Pump Pressure (psi)	58		
	Pump Head (m)			
	Pump Speed (rpm)	1750		
	Dosing Rate (L/hr.)			
	Power (kW)	1.5		
Voltage (V/Ph/Hz)	208/3/60			
Installed Dosing Set Point:				
Comments:				

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				



**PRE-COMMISSIONING FORM  
EQUIPMENT START-UP TEST**

Page 1 of 1

System Title: New Ferric Chloride Transfer

<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Replacement</b>
	Area : <b>Chemical Receiving and Storage Area</b>	Bid Opportunity:

<b>Start-Up: Tanks</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>TK-F0730</b>	PID: <b>P5.034</b>	Manufacturer:	Model No.:
	Equipment Type: <b>Ferric Chloride Chemical Storage Tank</b>		Location: <b>New Ferric Chloride Chemical Storage Room</b>	
	<b>Tank Details:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Min. Working Volume (L)	140,000		
	Nominal Volume (L)	160,000		
	Max. Working Volume (L)			
	Comments:			

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Performed By</b>				
<b>Checked By</b>				

	<b>PRE-COMMISSIONING FORM EQUIPMENT STATIC INSPECTION</b>		Page 1 of 1
			System Title: New Ferric Chloride Transfer
<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Replacement</b>	
	Area: <b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Static Testing: Pumps</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>P-0780</b>	PID: <b>P5.039</b>	Location: <b>New Ferric Chloride Storage Room</b>	
	Equipment Type: <b>Ferric Chloride Transfer Pump</b>			
	<b>Pump Specifications:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Manufacturer	<b>Pulsafeeder</b>		
	Model	<b>E25NFVF-X</b>		
	Serial No.			
	Checklist:	<input type="checkbox"/> No Physical Damage <input type="checkbox"/> Pump is in acceptable orientation <input type="checkbox"/> Motor & pump aligned <input type="checkbox"/> Pump has adequate service space <input type="checkbox"/> Pressure gauges installed <input type="checkbox"/> Correct direction of flow <input type="checkbox"/> Valves & Strainers installed <input type="checkbox"/> Bearings lubricated <input type="checkbox"/> Correct identification tag <input type="checkbox"/> Tag is clearly visible <input type="checkbox"/> Proper support/mounting <input type="checkbox"/> Piping identification installed <input type="checkbox"/> Operation type (parallel/single) <input type="checkbox"/> Impeller & Motor rotation correct <input type="checkbox"/> ECMS Verified operation <input type="checkbox"/> No fluid leakage <input type="checkbox"/> Net positive suction head checked <input type="checkbox"/> Air flow for Motor cooling		
	Comments:			

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				

	<b>PRE-COMMISSIONING FORM EQUIPMENT STATIC INSPECTION</b>		Page 1 of 1
			System Title: New Ferric Chloride Transfer
<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Replacement</b>	
	Area : <b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Static Testing: Tanks</b>	<b>Nameplate Information</b>			
	Equipment Tag: <b>TK-0730</b>	PID: <b>P5.034</b>	Location: <b>New Ferric Chloride Chemical Storage Room</b>	
	Equipment Type: <b>Ferric Chloride Chemical Storage Tank</b>			
	<b>Tank Specifications:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>
	Manufacturer			
	Model			
	Serial No.			
	Checklist:	<input type="checkbox"/> No Physical Damage <input type="checkbox"/> Tank has adequate service space <input type="checkbox"/> Correct identification tag <input type="checkbox"/> Tag is clearly visible <input type="checkbox"/> Proper support/mounting <input type="checkbox"/> Piping identification installed <input type="checkbox"/> No fluid leakage <input type="checkbox"/> Flanged connections bolted <input type="checkbox"/> Instrumentation connected <input type="checkbox"/> Threaded connections made <input type="checkbox"/> Tank properly anchored <input type="checkbox"/> Other:		
	Comments:			

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				

<b>Project</b>	Facility:	NEWPCC	Project Name:	Interim Phosphorus Removal
	Area :	Chemical Receiving and Storage	Bid Opportunity:	

<b>Static Inspection: Control Valve</b>	<b>Nameplate Information</b>					
	Equipment Tag:	XV-F8706	PID:	P5.037		
	Equipment Type:	(Electric?) Motorized Valve		Location: New Ferric Chloride Storage Room		
	<b>Pump Specifications:</b>	<b>Specified Product</b>	<b>Shop Drawings</b>	<b>Installed</b>		
	Manufacturer					
	Model					
	Serial No.					
Checklist:	<table style="width:100%; border: none;"> <tr> <td style="width:33%; border: none;"> <input type="checkbox"/> No Physical Damage  <input type="checkbox"/> Valve has adequate service space  <input type="checkbox"/> Correct identification tag  <input type="checkbox"/> Tag is clearly visible  <input type="checkbox"/> Actuator connection made  <input type="checkbox"/> Controls connected </td> <td style="width:33%; border: none;"> <input type="checkbox"/> Piping gasket flange bolted  <input type="checkbox"/> Air connection made*  <input type="checkbox"/> Power connection made*  <input type="checkbox"/> Control connection made  <input type="checkbox"/> Actuator Open function  <input type="checkbox"/> Actuator Closed function </td> <td style="width:33%; border: none;"> <input type="checkbox"/> Remote operation function  <input type="checkbox"/> Other:    *if applicable </td> </tr> </table>			<input type="checkbox"/> No Physical Damage <input type="checkbox"/> Valve has adequate service space <input type="checkbox"/> Correct identification tag <input type="checkbox"/> Tag is clearly visible <input type="checkbox"/> Actuator connection made <input type="checkbox"/> Controls connected	<input type="checkbox"/> Piping gasket flange bolted <input type="checkbox"/> Air connection made* <input type="checkbox"/> Power connection made* <input type="checkbox"/> Control connection made <input type="checkbox"/> Actuator Open function <input type="checkbox"/> Actuator Closed function	<input type="checkbox"/> Remote operation function <input type="checkbox"/> Other:  *if applicable
<input type="checkbox"/> No Physical Damage <input type="checkbox"/> Valve has adequate service space <input type="checkbox"/> Correct identification tag <input type="checkbox"/> Tag is clearly visible <input type="checkbox"/> Actuator connection made <input type="checkbox"/> Controls connected	<input type="checkbox"/> Piping gasket flange bolted <input type="checkbox"/> Air connection made* <input type="checkbox"/> Power connection made* <input type="checkbox"/> Control connection made <input type="checkbox"/> Actuator Open function <input type="checkbox"/> Actuator Closed function	<input type="checkbox"/> Remote operation function <input type="checkbox"/> Other:  *if applicable				
Comments:						

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				



# PRE-COMMISSIONING AUTOMATION CHECKLIST

Project	
Facility:	Project Name:
Area :	Bid Opportunity:

Inspection Checklist					
No.	Item to be Inspected			Comments	Pass (P/F)
1.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
	Tested By				
	Witnessed By				
2.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
	Tested By				
	Witnessed By				
3.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
	Tested By				
	Witnessed By				
4.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
	Tested By				
	Witnessed By				
5.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
	Tested By				
	Witnessed By				



**PRE-COMMISSIONING AUTOMATION CHECKLIST**

Inspection Checklist					
No.	Item to be Inspected			Comments	Pass (P/F)
6.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
7.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
8.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
9.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
10.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
11.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
12.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					

Inspection Checklist					
No.	Item to be Inspected			Comments	Pass (P/F)



# PRE-COMMISSIONING AUTOMATION CHECKLIST

13.				
	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Tested By</b>				
<b>Witnessed By</b>				

Additional Tasks		
No.	Item to be Inspected	Pass (P/F)
1.		

Comments:



---

**Form 100**  
**CERTIFICATE OF EQUIPMENT DELIVERY**

---

We certify that the equipment listed below has been delivered into the care and custody of the Installation Contractor. The equipment has been found to be in satisfactory condition. There is no visible evidence of exterior damage or defects.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

---

(Authorized Representative of Install Contractor)

---

Date

---

(Authorized Representative of Contract Administrator)

---

Date



Water and Waste Department • Service des eaux et des déchets

---

**Form 101**  
**CERTIFICATE OF READINESS TO INSTALL**

---

We have familiarized the installing contractor of the specific requirements related to the equipment listed below and am satisfied that the installing contractor understands the required installation procedures.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

We certify that we have received satisfactory installation instructions from the equipment manufacturer/vendor.

---

(Authorized Representative of Install Contractor)

---

Date



---

**Form 102**  
**CERTIFICATE OF SATISFACTORY INSTALLATION**

---

We have completed our checks and inspection of the installation of our equipment as listed below and confirm that it is satisfactory and that any defects have been remedied except any as noted below.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

**Outstanding Defects:**

\_\_\_\_\_  
(Authorized Representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Contractor Administrator)

\_\_\_\_\_  
Date





# PRE-COMMISSIONING ELECTRICAL CHECKLIST

Inspection Checklist					
No.	Item to be Inspected			Comments	Pass (P/F)
1.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
2.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
3.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
4.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
5.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
6.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					



## PRE-COMMISSIONING ELECTRICAL CHECKLIST

Page 3 of 3

### Additional Tasks

No.	Item to be Inspected	Comments	Pass (P/F)
1.			

Comments:



# COMMISSIONING AUTOMATION CHECKLIST

Project	
Facility:	Project Name:
Area :	Bid Opportunity:

Inspection Checklist					
No.	Item to be Inspected			Comments	Pass (P/F)
1.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
2.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
3.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
4.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
5.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
6.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					



# COMMISSIONING AUTOMATION CHECKLIST

Inspection Checklist					
No.	Item to be Inspected			Comments	Pass (P/F)
7.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
8.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
9.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
10.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
11.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
12.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					



# COMMISSIONING AUTOMATION CHECKLIST

Inspection Checklist					
No.	Item to be Inspected			Comments	Pass (P/F)
13.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
14.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
15.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					

Additional Tasks		
No.	Item to be Inspected	Pass (P/F)
1.		

Comments:





# COMMISSIONING ELECTRICAL CHECKLIST

Inspection Checklist					
No.	Item to be Inspected			Comments	Pass (P/F)
1.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
2.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
3.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
4.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
5.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					
6.					
	Company	Name	Signature	Date (yyyy/mm/dd)	
Tested By					
Witnessed By					

Comments:

	<b>INSPECTION FORM AUTOMATION – CONTROL CONDUCTORS</b>		Page 1 of 1
			ID:
<b>Project</b>	Facility:	Project Name:	
	Area :	Bid Opportunity:	

<b>Cable/Conduit Data</b>	Source:		Dest.:	
	Installation: <input type="checkbox"/> Cable <input type="checkbox"/> Cable Tray <input type="checkbox"/> Direct Buried <input type="checkbox"/> Conduit <input type="checkbox"/> Other: <input type="checkbox"/> Strapped <input type="checkbox"/> EMT <input type="checkbox"/> Alum. <input type="checkbox"/> Rigid Steel <input type="checkbox"/> PVC			
	No. of Conductors:	Size: AWG	Type:	Rated Voltage: V

<b>Visual Inspection</b>	Cable Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		Enclosure Entry Acceptable: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Wire tags installed: <input type="checkbox"/> Yes <input type="checkbox"/> No		Conduit / Cable Supported Appropriately: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Comments:			

<b>Insulation Resistance Test</b>	Test Voltage: V		Ambient Temperature: °C		All conductors not under test grounded for each reading: <input type="checkbox"/> Yes <input type="checkbox"/> No				
	#	ID	MΩ	#	ID	MΩ	#	ID	MΩ
	1			19			37		
	2			20			38		
	3			21			39		
	4			22			40		
	5			23			41		
	6			24			42		
	7			25			43		
	8			26			44		
	9			27			45		
	10			28			46		
	11			29			47		
	12			30			48		
	13			31			49		
	14			32			50		
	15			33			51		
	16			34			52		
	17			35			53		
	18			36			54		
1. Utilize 1000VDC Test Voltage for 600V rated cables, 500VDC for cables rated <= 300V. 2. Utilize a single form for each cable / conduit. 3. Disconnect both ends of wiring prior to tests. 4. Test each conductor to ground. All conductors not under test must be grounded during each test. 5. Each reading must not be less than 22 MΩ or significantly less than comparable conductors.									
Comments:									
Test Summary: <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Failed									

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				





**INSPECTION FORM  
AUTOMATION – TWISTED SHIELDED PAIRS**

ID:

Continuity Test	Pr	ID	Cond. 1 (+) to Cond. 2 (-) (mΩ)	Cond. 1 (+) to Shield (mΩ)	Pr	ID	Cond. 1 (+) to Cond. 2 (-) (mΩ)	Cond. 1 (+) to Shield (mΩ)
	1				13			
	2				14			
	3				15			
	4				16			
	5				17			
	6				18			
	7				19			
	8				20			
	9				21			
	10				22			
	11				23			
	12				24			
1. Record resistance from one end for each connection shown, which shall be made at the other end of the cable.								
Comments:								
Test Summary: <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Failed								

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

<b>Project</b>	Facility:	Project Name:
	Area :	Bid Opportunity:

<b>Cable Data</b>	Source:		Dest. / Load:	
	Manufacturer:		Type:	Conductor: <input type="checkbox"/> Copper <input type="checkbox"/> Aluminum
	No. of Conductors:	Size: <input type="checkbox"/> AWG <input type="checkbox"/> MCM	Length: m	<input type="checkbox"/> Measured <input type="checkbox"/> Previous Data <input type="checkbox"/> Jacket Markings <input type="checkbox"/> TDR
	Rated Voltage: V	Operating Voltage: V	Date Installed:	
	Installation: <input type="checkbox"/> Cable Tray <input type="checkbox"/> EMT <input type="checkbox"/> Alum. Conduit <input type="checkbox"/> Direct Buried	<input type="checkbox"/> Strapped <input type="checkbox"/> Steel Conduit <input type="checkbox"/> PVC Conduit <input type="checkbox"/> Underground Duct	Other:	

<b>Visual Inspection</b>	Physical Damage on Exposed Ends: <input type="checkbox"/> Yes <input type="checkbox"/> No	Cable Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Visual Signs of Overheating: <input type="checkbox"/> Yes <input type="checkbox"/> No	Cable Supported Appropriately: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Bend Radius Acceptable: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

<b>Insulation Resistance Test</b>	Test Preparation: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Source Isolated	Source: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Load Isolated	Cable Dest. / Load: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Load Isolated	Note: Approval of City's Representative is required, prior to leaving cables connected during the test.	
	Cable Temperature: °C		Temperature Correction Factor for 20°C:	Ground all conductors not under test for each reading.	
	<b>Test Voltage</b>	<b>Insulation Resistance (MΩ)</b>			<b>Test Summary</b> <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
		A-GND	B-GND	C-GND	
	V	Reading			
	Corrected to 20°C				
Utilize 1000VDC Test Voltage for 600V rated cables, 500VDC for cables rated <= 300V.					
Comments:					

<b>Connection Resistance</b>	<i>Note: Torque check required for all cables. Connection Resistance Test required for cables 4/0 AWG or larger.</i>					
	<b>Termination</b>	<b>Connection Resistance (μΩ) - As Left</b>				<b>Torque Check</b>
		A	B	C	N	
	Source					<input type="checkbox"/> OK
	Dest. / Load					<input type="checkbox"/> OK
Comments:						

<b>Final Analysis</b>	Cable Returned to Service: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				

	<b>INSPECTION FORM EMERGENCY LIGHTING</b>		Page 1 of 1
			ID:
<b>Project</b>	Facility:	Project Name:	
	Area :	Bid Opportunity:	

<b>Battery Unit Data</b>	Location:		Fed From:		Circuit #:
	Manufacturer:		Model:		Serial No:
	Input Voltage:      V AC	Input Current:      A	Output Voltage:      V DC	Wattage:      W	
	Qty of Internal Lamps:	Internal Lamp Wattage:      W	Type of Internal Lamps:		

<b>Remote Fixtures</b>	Quantity:		Manufacturer:		Model:
	Input Voltage:      V DC	Input Current:      A	Qty of Lamps per Fixture:		
	Lamp Wattage:      W	Type of Lamps:	Wire Size:      AWG		

<b>Visual Inspection / Cleaning</b>	Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No		Lamps Properly Aimed: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Visual signs of Moisture: <input type="checkbox"/> Yes <input type="checkbox"/> No		Connections: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Cleanliness (As Found): <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor		Ground Connection: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Comments:			

<b>Battery Testing</b>	Equipment Temperature:      °C		<b>Test Summary</b>  <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive <input type="checkbox"/> Further Investigation Required. <input type="checkbox"/> Test Failed
	<b>Test Results</b>		
	Stated Design Time (From Drawings):      Min	Time Until Lamps Turn Off:      Min	
	Comments:		

<b>Final Analysis</b>	Returned to Service: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				

Note: The person performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.



**INSPECTION FORM  
GROUNDING/BONDING CONNECTION RESISTANCE**

Area:

<b>Project</b>	Facility:	Project Name:
	Area :	Bid Opportunity:

Resistance Checks (Ductor Test)	Point A	Point B	Resistance (mΩ)	Acceptable
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
	Comments:			



**INSPECTION FORM  
GROUNDING/BONDING CONNECTION RESISTANCE**

ID:

Resistance Checks (Ductor Test)	Point A	Point B	Resistance (mΩ)	Acceptable
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
	Comments:			

Final Analysis	Monitoring / Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

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## INSPECTION FORM GROUNDING SYSTEM

ID: \_\_\_\_\_

Resistance Checks (Ductor Test)	Point A	Point B	Resistance (mΩ)	<b>Test Summary</b> <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
	Facility Ground Electrode	Main Ground Bus		
	Facility Ground Electrode	4160V Switchgear GND Bus		
	Facility Ground Electrode	System Neutral		
	Facility Ground Electrode	600V Switchgear GND Bus		
	Facility Ground Electrode	MCC : GND Bus		
	Facility Ground Electrode	MCC : GND Bus		
	Facility Ground Electrode	Other :		
	Facility Ground Electrode	Other :		
	Facility Ground Electrode	Other :		
Comments:				

Final Analysis	Monitoring / Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Performed By</b>				
<b>Checked By</b>				

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# INSTRUMENTATION SWITCH CHECKLIST

### Project

Facility:

Project Name:

Area :

Bid Opportunity:

### Instrument

Tag:

Description:

Manufacturer:

Model:

Serial Number:

### Inspection Checklist

No.	Item to be Inspected	Comments	Pass (P/F)
1.	Instrument type and class per P&ID and specification		
2.	Instrument tag(s) installed and correct		
3.	Installation of sensor complete and correct		
4.	Block and drain valves		
5.	Pneumatic / hydraulic tubing leak tested		
6.	Heat tracing / insulation / instrument housing		
7.	Wiring correct		
8.	Drawings marked up as-built		
9.	HMI Graphic symbol and tag correct		

### State Checklist

State	State Desc	PLC Input	Local HMI	SCADA	Alarm	Pass (P/F)
0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off <input type="checkbox"/> N/A	
1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off <input type="checkbox"/> N/A	

### Calibration

Transition	Setpoint Trip Point (incl. units)	Actual Trip Point (incl. units)	Setpoint Time Delay	Actual Time Delay	Pass (P/F)
0 → 1					
1 → 0					

Comments:

	Company	Name	Signature	Date (yyyy/mm/dd)
Tested By				
Witnessed By				



# INSTRUMENTATION TRANSMITTER LOOP CHECKLIST

Project	
Facility:	Project Name:
Area :	Bid Opportunity:

Instrument (Sensor / Element)		
Tag:	Description:	
Manufacturer:	Model:	Serial Number:

Transmitter		
Tag:	Description:	
Manufacturer:	Model:	Serial Number:
Units:	Design Range:	
Output	<input type="checkbox"/> 4-20 mA <input type="checkbox"/> Modbus <input type="checkbox"/> Other: <input type="checkbox"/> 0-10 V <input type="checkbox"/> Ethernet IP	

Inspection Checklist			
No.	Item to be Inspected	Comments	Pass (P/F)
1.	Instrument type and class per P&ID and specification		
2.	Instrument tag(s) installed and correct		
3.	Installation of sensor complete and correct		
4.	Block and drain valves		
5.	Pneumatic / hydraulic tubing leak tested		
6.	Heat tracing / insulation / instrument housing		
7.	Impulse lines pressure tested		
8.	Wiring correct		
9.	Drawings marked up as-built		
10.	HMI Graphic symbol, tag and units correct		



# INSTRUMENTATION TRANSMITTER LOOP CHECKLIST

Signal Validation					
Input Signal	Location	Design Value	Actual Value	Error (%)	Pass (P/F)
	Transmitter Display				
	Transmitter Output				
	Process Display				
	PLC				
	HMI				
	Transmitter Display				
	Transmitter Output				
	Process Display				
	PLC				
	HMI				
	Transmitter Display				
	Transmitter Output				
	Process Display				
	PLC				
	HMI				

Notes:

1. Attach factory calibration forms for all instruments where provided and/or specified.
2. Provide instrument parameters for each parameter changed from the factory default.

Comments:

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Tested By</b>				
<b>Witnessed By</b>				



# INSPECTION FORM INTELLIGENT OVERLOAD

Page 1 of 2

ID:

Project	Facility:	Project Name:
	Area :	Bid Opportunity:

O/L Data	Location:	Cell #:
	Manufacturer:	Model:

Visual Inspection / Cleaning	General Condition: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Cleanliness (as found) <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Unit Cleaned: <input type="checkbox"/> Yes
	Connections (as found) <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Connections Torqued: <input type="checkbox"/> Yes

Communication Settings	Static IP Address:	Subnet Mask
	Gateway:	Protocol:
	MAC Address:	

Test Meter	Manufacturer:	Model:
	Calibration Date:	Meter calibration must be within one year, unless otherwise specified.

CTs	Type: <input type="checkbox"/> Internal to O/L <input type="checkbox"/> External	External CT Ratio:
	External Ground CT: <input type="checkbox"/> Yes <input type="checkbox"/> No	Ground CT Ratio:



## INSPECTION FORM INTELLIGENT OVERLOAD

ID:

Verify accuracy of Intelligent O/L Measurements with the use of software via the communication network.									
Accuracy	Current	Nominal Test Value (A)	Phase	Calibrated Meter Measurement (A)	Intelligent O/L Measurement (A)	Difference (A)	Error (%)	Acceptable (See Specs)	
		0	A						<input type="checkbox"/> Yes <input type="checkbox"/> No
			B						<input type="checkbox"/> Yes <input type="checkbox"/> No
	C							<input type="checkbox"/> Yes <input type="checkbox"/> No	
		A						<input type="checkbox"/> Yes <input type="checkbox"/> No	
		B						<input type="checkbox"/> Yes <input type="checkbox"/> No	
		C						<input type="checkbox"/> Yes <input type="checkbox"/> No	
Measurements Applicable To: <input type="checkbox"/> As-Found <input type="checkbox"/> As-Left                      May check both boxes if applicable.									
Unit Calibration Adjusted: <input type="checkbox"/> Yes <input type="checkbox"/> No    If calibration was adjusted, complete two forms, one for as-found, the other for as-left after calibration.									

Final Analysis	Returned to Service: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Performed By</b>				
<b>Checked By</b>				

Note: The person performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.



# MODULATING CONTROL DEVICE CHECKLIST

Project	
Facility:	Project Name:
Area :	Bid Opportunity:

Control Device		
Tag:	Description:	
Manufacturer:	Model:	Serial Number:

Inspection Checklist			
No.	Item to be Inspected	Comments	Pass (P/F)
1.	Actuator type and class per P&ID and specification		
2.	Instrument tag(s) installed and correct		
3.	Installation of actuator complete and correct		
4.	Wiring correct		
5.	Drawings marked up as-built		
6.	HMI graphic symbol, tag and units correct		

Control Validation					
Control Output	Location	Design Value	Actual Value	Error (%)	Pass (P/F)
0%	PLC Output				
	Field Device				
50%	PLC Output				
	Field Device				
100%	PLC Output				
	Field Device				

Notes:

1. Attach factory calibration forms for all instruments where provided and/or specified.
2. Provide instrument parameters for each parameter changed from the factory default.

Comments:

	Company	Name	Signature	Date (yyyy/mm/dd)
Tested By				
Witnessed By				

	<b>INSPECTION FORM MOTOR STARTER, FVNR, BASIC</b>		Page 1 of 1
			ID:
<b>Project</b>	Facility:		Project Name:
	Area :		Bid Opportunity:

<b>Starter Data</b>	Load:		Starter Location:		Cell #:	
	Manufacturer:		Type:	Size:	Rated Voltage: V	
	<b>Circuit Protection:</b>	<input type="checkbox"/> Fused Disc.	Fuse Size:	A		
		<input type="checkbox"/> Breaker <input type="checkbox"/> MCP	Rating:	A	Inst. Setting:	A
	<b>Overload Protection:</b>	<input type="checkbox"/> Thermal <input type="checkbox"/> Electronic	Class:	<input type="checkbox"/> 10 <input type="checkbox"/> 20 <input type="checkbox"/> 30 <input type="checkbox"/> Unknown	Setting / Rating:	A
				Manufacturer:		
				Model:		
				Manufacturer:		
				Model:		

<b>Visual Inspection / Cleaning</b>	Starter Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No		Visual Signs of Overheating: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Cleanliness (As Found): <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor		Electro/Mechanical Interlock: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Connections <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor		Contactor Condition: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Ground Connection: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor		Overload Condition: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Cables Routed Appropriately: <input type="checkbox"/> Yes <input type="checkbox"/> No		Door Mechanical <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Exercise Circuit Breaker/MCP/Disconnect <input type="checkbox"/> Yes		Unit Cleaned: <input type="checkbox"/> Yes	
	Comments:			

<b>Final Analysis</b>	Returned to Service: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Performed By</b>				
<b>Checked By</b>				

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## INSPECTION FORM AC MOTOR, LOW VOLTAGE

Page: 1 of 2

ID:

<b>Project</b>	Facility:	Project Name:
	Area :	Bid Opportunity:

<b>Motor Data</b>	Size:                      kW /                      HP	Voltage:                      V	R.P.M:	
	Manufacturer:	Model:	Serial Number:	
	Frame Type:	FLA:                      A	Service Factor:	Other:
	Cooling: <input type="checkbox"/> Air <input type="checkbox"/> Fan	# Cooling Fans:	Winding Material:	

<b>Visual Inspection / Cleaning</b>	Motor Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No	Visual Signs of Overheating: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Connections: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Air Baffles: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Paint: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Filter Media: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Cooling Fans: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Fan Controls: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Anchorage/Alignment: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Ground Connection: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Mechanical/Electrical Noise During Operation: <input type="checkbox"/> Yes <input type="checkbox"/> No	Lubrication Required: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Cleanliness (As Found): <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Unit Cleaned: <input type="checkbox"/> Yes                      Photograph Taken: <input type="checkbox"/> Yes

<b>Winding Insulation Resistance</b>	Stator Winding	Test Voltage (Vdc)	Winding Temperature (°C)	Resistance (MΩ)			Dielectric Absorption Ratio	Polarization Index (a)
				30 Sec	1 min.	10 min. (a)		
		500					-	-
			40					
		500					-	-
			40					
		500					-	-
			40					
Notes:								
(a) Testing to 10 minutes and calculation of Polarization Index is only required for motors > 150 kW (200 HP)								
<b>Test Summary</b> <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive. Further Investigation Required. <input type="checkbox"/> Test Failed								

<b>Winding Resistance</b>	Resistance (μΩ)			<b>Test Summary</b> <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
	<b>A - B</b>	<b>B - C</b>	<b>A - C</b>	
Comments:				



## INSPECTION FORM AC MOTOR, LOW VOLTAGE

Page: 2 of 2

ID: \_\_\_\_\_

<b>Bearing Insulation Resistance</b>	<input type="checkbox"/> Not Applicable				
	<b>Bearing</b>	<b>Test Voltage (Vdc)</b>	<b>Bearing Temperature (°C)</b>	<b>Resistance (MΩ)</b>	
				<b>1 min.</b>	<b>Corrected to 40°C</b>
		500			
		500			
<b>Test Summary</b> <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive. Further Investigation Required. <input type="checkbox"/> Test Failed					

<b>RTD Resistance</b>	<input type="checkbox"/> Not Applicable					
	Actual Winding Temperature: _____ °C			Actual Bearing Temperature _____ °C		
	<b>RTD</b>	<b>Resistance (Ω)</b>	<b>Calculated Temperature (°C)</b>	<b>RTD</b>	<b>Resistance (Ω)</b>	<b>Calculated Temperature (°C)</b>
<b>Test Summary</b> <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive. Further Investigation Required. <input type="checkbox"/> Test Failed						

*Note: Test connection resistance of bolted connections. Report on cable inspection sheet.*

<b>Final Analysis</b>	Returned to Service:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
	Repair / Replacement Required:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				

**Note:** The person(s) performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.



## PLC DISCRETE INPUT CHECKLIST

Project	
Facility:	Project Name:
Area :	Bid Opportunity:

PLC	
PLC ID:	Description:
Rack:	Slot:

Pt	Tag	Description	State	State Desc.	PLC Input	Local HMI	SCADA	Alarm	Pass (P/F)
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	



### PLC DISCRETE INPUT CHECKLIST

			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	

Comments:

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Tested By</b>				
<b>Witnessed By</b>				



# PLC DISCRETE OUTPUT CHECKLIST

## Project

Facility:

Project Name:

Area :

Bid Opportunity:

## PLC

PLC ID:

Description:

Rack:

Slot:

Pt	Tag	Description	State	State Desc.	PLC Output	Field Device	Pass (P/F)
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	



# PLC DISCRETE OUTPUT CHECKLIST

			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	

Comments:

	Company	Name	Signature	Date (yyyy/mm/dd)
Tested By				
Witnessed By				

	<b>INSPECTION FORM PANELBOARD, LOW VOLTAGE</b>		Page 1 of 2
			ID:
<b>Project</b>	Facility:	Project Name:	
	Area :	Bid Opportunity:	

<b>Panelboard Data</b>	Location:		Fed From:		No. of Circuits:	
	Manufacturer:			Model:	Serial No:	
	Rated Voltage:	V	Current Rating:	A	Withstand Rating:	A
	<input type="checkbox"/> Single Phase		<input type="checkbox"/> 3 Phase, 3 Wire	<input type="checkbox"/> 3 Phase, 4 Wire	Neutral Bonded to Ground	<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Main Lugs					
	<input type="checkbox"/> Main Breaker:		Rating:	A	Manufacturer:	Model: Inst. Setting:
	<i>Complete separate inspection form (F-BKR-MC-LV) for main breaker if &gt;= 250A, or has long, short, or ground fault settings.</i>					

<b>Visual Inspection / Cleaning</b>	Identification Tag Installed:		<input type="checkbox"/> Yes <input type="checkbox"/> No	Visual Signs of Overheating:		<input type="checkbox"/> Yes <input type="checkbox"/> No
	Visual signs of Moisture:		<input type="checkbox"/> Yes <input type="checkbox"/> No	Visual Signs of Corona:		<input type="checkbox"/> Yes <input type="checkbox"/> No
	Fuse/Breaker Sizes Match Drawings:		<input type="checkbox"/> Yes <input type="checkbox"/> No	Cables Supported Appropriately:		<input type="checkbox"/> Yes <input type="checkbox"/> No
	Cleanliness (As Found):		<input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Connections:		<input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Door Mechanical:		<input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Ground Connection:		<input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Exercise All Circuit Breakers:		<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:		

<b>Insulation Resistance Test</b>	Test Preparation:		Source: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Source Isolated	Note: Approval of City's Representative is required, prior to leaving cables connected during the test.				Equipment Temperature: °C		
							Temperature Correction Factor to 20°C:			
	<b>Test Voltage</b>	<b>Insulation Resistance (MΩ) Ground all Phases not under test!</b>								<b>Test Summary</b> <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
		<b>A-GND</b>		<b>B-GND</b>		<b>C-GND</b>		<b>N-GND</b>		
		RDG	20°C	RDG	20°C	RDG	20°C	RDG	20°C	
Test Voltages: 120-300V → 500 VDC Test Voltage      301-600V → 1000 VDC Test Voltage										
Comments:										

<b>Breakers &lt; 100A and Without Inst. Setting</b>					
<i>List by model of breaker. Multiple breakers of varying ampacity may be listed per line.</i>					
Type	Manufacturer	Model Series	Interrupting Rating (kA)	Positions/Circuits	Notes
A					
B					
C					
D					
E					
F					



## INSPECTION FORM PANELBOARD, LOW VOLTAGE

Page 2 of 2

ID:

Breakers >= 100A or with Inst. Setting									
<i>List each breaker individually. Complete separate inspection form (F-BKR-MC-LV) for breaker if &gt;= 250A, or has long, short, or ground fault settings.</i>									
Load/Feeder Breakers	ID	Pos.	Manufacturer	Model	Trip Rating (A)	Int. Rating (kA)	Inst. Setting	Separate Form	Notes
								<input type="checkbox"/>	
								<input type="checkbox"/>	
								<input type="checkbox"/>	
								<input type="checkbox"/>	
								<input type="checkbox"/>	
								<input type="checkbox"/>	
								<input type="checkbox"/>	

<b>Final Analysis</b>	Returned to Service: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Performed By</b>				
<b>Checked By</b>				

Note: The person performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.

	<b>INSPECTION FORM</b> <b>TRANSFORMER, LIQUID-FILLED, MEDIUM VOLTAGE</b>			Page: 1 of 3
<b>Project</b>	Facility:		Project Name:	
	Area :		Bid Opportunity:	

<b>Transformer Data</b>	KVA: / /		Phase:		Primary Voltage: V		Secondary Voltage: V			
	Manufacturer:			Model:			Serial Number:			
	Primary Winding: <input type="checkbox"/> Δ <input type="checkbox"/> Y		Secondary Winding: <input type="checkbox"/> Δ <input type="checkbox"/> Y		Impedance: %Z		Temp Rise: °C		K Factor:	
	Cooling: <input type="checkbox"/> ONAN <input type="checkbox"/> ONAF		# Cooling Fans:			Winding Material:		Oil Type:		
	BIL Rating Primary:				BIL Rating Secondary:				Oil Capacity:	
	No Load Tap Changer		Tap	1	2	3	4	5		Tap Setting (As Found):
		Voltage								

<b>Visual Inspection / Cleaning</b>	Transformer Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No				Visual Signs of Overheating: <input type="checkbox"/> Yes <input type="checkbox"/> No			
	Bushings: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor				Support Insulators: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor			
	Paint: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor				No Load Tap Changer: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor			
	Fans: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor				Fan Controls: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor			
	Temp. Gauge: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor				Connections: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor			
	Ground Connection: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor				Liquid Level Correct: <input type="checkbox"/> Yes <input type="checkbox"/> No			
	Ground Conductor Size:				Radiators: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor			
	Cleanliness (As Found): <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor				Unit Cleaned: <input type="checkbox"/> Yes		Photograph Taken: <input type="checkbox"/> Yes	

<b>Operational Inspection</b>	Operational Conditions / Notes:					
	Primary Voltage:	H1:H2: V	H2:H3: V	H3:H1: V	Measured at:	
	Secondary Voltage:	X1: __: V	X2: __: V	X3: __: V	Measured at:	
	Current:	Ph A: A	Ph B: A	Ph C: A	Measured at:	
	Tap Setting:	<input type="checkbox"/> Appears Satisfactory <input type="checkbox"/> Further Monitoring Recommended. <input type="checkbox"/> Recommend Changing Tap.			Tap Setting (As Left):	
	Gauges:	Cooling Temperature:			Coolant Level:	
		Current °C	Maximum: °C			
	Pressure/Vacuum:			Other:		
Thermographic Inspection Performed:	<input type="checkbox"/> Yes		Attach report separately	Results: <input type="checkbox"/> No Issues Found <input type="checkbox"/> Potential Issue Identified.		



**TRANSFORMER INSPECTION FORM**  
**TRANSFORMER, LIQUID-FILLED, MEDIUM VOLTAGE**

Page: 2 of 3

ID:

Insulation Resistance	Winding Temperature:      °C		Temperature Correction Factor (20°C):				
	Resistance (MΩ)						
	Time	PRI-GND		SEC-GND		PRI-SEC	
		Test Voltage:		Test Voltage:		Test Voltage:	
	Reading	Corrected to 20°C	Reading	Corrected to 20°C	Reading	Corrected to 20°C	
1 min.							
2 min.							
3 min.							
4 min.							
5 min.							
6 min.							
7 min.							
8 min.							
9 min.							
10 min.							
Polarization Index							

Winding Resistance	Winding Temperature:      °C			
	Winding	Winding Resistance (mΩ)	Winding	Winding Resistance (mΩ)
	H2 – H1		X0 – X1	
	H3 – H2		X0 – X2	
H3 – H1		X0 – X3		

Turns Ratio Test	Tap (Designated)	Primary Voltage (V)	Secondary Voltage (V)	Calculated Ratio	Measured Ratios		
					H3 H1 / X0 X1	H1 H2 / X0 X2	H2 H3 / X0 X3

Connection Resistance	Note: Torque check required for all cables. Connection Resistance Test required for cables 250MCM or larger.					
	Termination	Connection Resistance (μΩ) - As Left				Torque Check
		A	B	C	N	
Source						<input type="checkbox"/> OK
Dest. / Load						<input type="checkbox"/> OK



**TRANSFORMER INSPECTION FORM**  
**TRANSFORMER, LIQUID-FILLED, MEDIUM VOLTAGE**

Page: 3 of 3

ID:

<b>Insulating Liquid Tests</b>	Dielectric Breakdown Voltage:	Colour:
	Acid Neutralization Number:	Visual Condition:
	Specific Gravity:	Power Factor or Dissipation Factor:
	Dissolved Gas Analysis:	Other:

<b>Final Analysis</b>	Returned to Service: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	<b>Company</b>	<b>Name</b>	<b>Signature</b>	<b>Date (yyyy/mm/dd)</b>
<b>Performed By</b>				
<b>Checked By</b>				

Note: The person performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.



---

**Form 103**

**CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE**

---

We certify that the equipment listed below has been continuously operated for a minimum of three (3) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found and as such are classified as "conforming".

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

\_\_\_\_\_  
(Authorized representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized representative of Contract Administrator)

\_\_\_\_\_  
Date



---

**Form 104**

**CERTIFICATE OF SATISFACTORY PROCESS PERFORMANCE**

---

We certify that the process system listed below has been continuously operated and tested as per the Specifications using process fluid and that the equipment meets its Performance Testing and Operating Criteria. No defects in the process system were found and as such are classified as “conforming”.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

---

(Authorized Representative of Install Contractor)

---

Date

---

(Authorized Representative of Contract Administrator  
i.e. Commissioning Lead or Design Discipline Lead)

---

Date

---

(Authorized Representative of City)

---

Date

 Winnipeg	<b>COMMISSIONING FORM SYSTEM FUNCTIONAL TEST</b>		Page 1 of 1
			System Title: New Ferric Chloride Transfer
<b>Project</b>	Facility: <b>NEWPCC</b>	Project Name: <b>Interim Phosphorus Replacement</b>	
	Area : <b>Chemical Receiving and Storage</b>	Bid Opportunity:	

<b>Functional Testing</b>	<b>System Title:</b> New Ferric Chloride Transfer	
	<b>Commissioning Process Overview</b>	Commission the new chemical transfer system with water at 10-20 °C from the new chemical storage tanks TK-F0730/40 to new ferric chloride chemical storage tanks TK-G0750 and TK-Y0790
	<b>Transfer Path 1</b>	TK-F0730 to TK-G0750
	<b>Valves:</b>	
	XV-F8706	<input checked="" type="checkbox"/> Open <input checked="" type="checkbox"/> Closed <b>XV-G87090</b> <input checked="" type="checkbox"/> Open <input type="checkbox"/> Closed
	XV-F8707	<input checked="" type="checkbox"/> Open <input checked="" type="checkbox"/> Closed <b>XV-G87095</b> <input checked="" type="checkbox"/> Open <input type="checkbox"/> Closed
	XV-F8710	<input type="checkbox"/> Open <input checked="" type="checkbox"/> Closed <b>XV-Y87150</b> <input type="checkbox"/> Open <input checked="" type="checkbox"/> Closed
	XV-F8711	<input type="checkbox"/> Open <input checked="" type="checkbox"/> Closed <b>XV-Y87155</b> <input type="checkbox"/> Open <input checked="" type="checkbox"/> Closed
	<b>Functional Testing</b>	
	<b>Equipment Tag(s):</b>	
<b>Equipment Function:</b>		
<b>Comments:</b>		

	Company	Name	Signature	Date (yyyy/mm/dd)
<b>Performed By</b>				
<b>Checked By</b>				

# **APPENDIX C**

Commissioning Deficiency Log

Item Number	Start Date (YYYY-MM-DD)	Description of Commissioning Activity	Deficiencies	Action Taken	Current Status	Completion Date (YYYY-MM-DD)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

# **APPENDIX D**

Operation and Maintenance Manual Appendix

# Winnipeg Sewage Treatment Program



## Operations Manual Specification

**DOCUMENT NUMBER: CD-CP-TO-06**

Rev	Description	Prepared by	Reviewed by	Approved by	Approved Date
2015-12-11	Final Rev A	NWA		JV	2016-02-22

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# 1 Purpose

This document details the requirements for Operating Manuals for the Wastewater Treatment, Wastewater Services (WWS), City of Winnipeg. The purpose of this document is to provide guidance for the production of the Manuals.

The specification ensures information in the operations manuals of the facilities is presented in a consistent way and allows for the content of the manuals to be updated as the facilities develop over time.

The formats of all Operations Manuals delivered to the City of Winnipeg Wastewater Services Division must follow this specification and be based on the templates and examples it contains.

# 2 General requirements

This document describes a standard approach, across Wastewater Treatment Branch , for the format and presentation for documentation within the scope of the manual.

## 2.1 Standards

The Operating Manual shall comply with the following standards where appropriate:

IEC 82079-1:2012 Preparation of instructions for use -- Structuring, content and presentation -- Part 1: General principles and detailed requirements

Where information in this ISO conflicts with the City of Winnipeg instruction, the latter shall prevail.

In order to achieve consistent terminology throughout the Operations Manual, descriptions used throughout the manual to describe or define treatment processes must refer to (with the exception of the manufacturers literature provided in the Volume 3 - Equipment and Maintenance Task Manual):

- City of Winnipeg WSTP Paint Colour Standard (this standard is currently under development)
- City of Winnipeg numbering schedule
- Plant and equipment identification used in the Asset Data Manual

## 2.2 Readership and Style

### Readership

The Operating Manuals must be written to provide information for experienced operations and maintenance staff, Engineers or Technicians who would not necessarily know the specific facilities described in the manual.

The manual must provide a comprehensive overview of the facilities for such experienced operators so that they can quickly assimilate and understand the facility, its function, and its operation.

### **Technical Language**

The Manuals are technical documents intended to be used by professionals with an understanding of wastewater treatment. Any acronyms used must be defined. Language and style should be functional rather than imaginative i.e. Plain Statement.

The Manuals will be in the English language.

### **Level of details**

The manuals will provide operations and maintenance staff with sufficient detail to be able to safely operate and maintain the facilities. Information on equipment will have sufficient detail to identify and order spare parts.

## **2.3 Number of copies and delivery**

Requirements for the number of copies are defined in "CD-CP-TO-05 Project Documentation Requirement sheet".

Electronic copies of the manual will be provided on non re-writable DVD.

### **DVD Label and Presentation**

Each DVD will have a centrally applied label as detailed in Figure 1.

Notes for Figure 1: Replace the text in the square brackets, do not include the brackets.

Note 1 – The appropriate plant name will be chosen from the following:

North End Sewage Treatment Plant (NEWPCC)

South End Sewage Treatment Plant (SEWPCC)

West End Sewage Treatment Plant (WEWPCC)

Note 2 – Insert the name of the Project

Note 3 – Where a soft copy manual extends beyond a single DVD, data shall be logically divided and issued in multiple standard depth DVD cases. Each will be numbered "DVD xx of xx", e.g, "DVD 1 of 5"

Note 4 – Insert the document number as per City of Winnipeg document numbering convention.

All DVDs shall be issued in full size jewel cases complete with the following:

- A clearly printed contents label on the spines of the jewel case, this shall typically read: [Facility Name] Operations Manual, [Project name], DVD # of #. The legend shall be read left to right in the horizontal direction with the DVD label side up.
- The rear cover of the jewel case shall include a list detailing the section contents of the DVD.
- The inside of the jewel case front insert shall contain identical data to that printed on the rear cover.
- The outside of the jewel case insert (front cover) shall contain a Repeat of the DVD label.

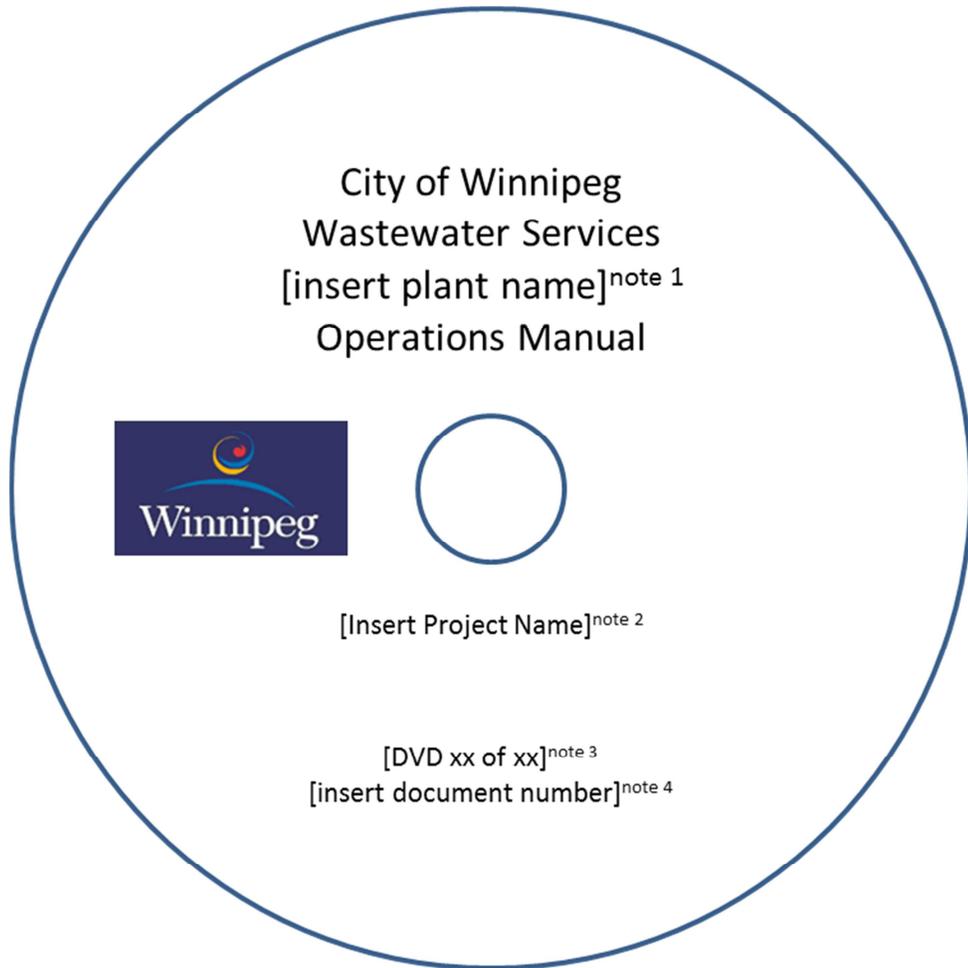


Figure 1 - Operations Manual, Typical DVD Label

## 2.4 Copyright

Operations Manuals will show copyright protection in favour of City of Winnipeg.

## 2.5 Presentation of Manuals

### 2.5.1 Operations Manual Structure

The Operating Manuals will consist of a set of volumes, constituting a complete suite of documents as follows:

#### Volume 1 – Area Process Operations Manual

Provides information on the operation of the facilities including: Safety and Health hazards and controls; Site services; Description of the Facility Control System; General description of the treatment process; Specific details of each unit process, including process control narratives; Standard Operating Procedures; Safe Work Procedure; Safety and Health records; Materials Safety Data Sheets; HAZOP Records

#### Volume 2 – Asset Data Manual

Provides data on all assets relating to the facilities, in the form of a data collection template.

#### Volume 3 – Equipment and Maintenance Task Manual

Provides information required for the maintenance of the facilities including: Technical description of installed equipment; Detailed maintenance tasks and schedule for installed equipment in the form of a data collection template; Lubricants schedule; Critical parts lists; Copies of manufacturers literature for installed equipment; List of suppliers.

#### Volume 4 – Training Manual

Provides the information used to train operations and maintenance staff for the facilities.

#### Volume 5 – Commissioning Manual

Provides a record of the plan for commissioning the facilities as carried out; Provides commissioning records and test documentation; Provides guidance on de-commissioning the facilities.

#### Volume 6 – Drawing Manual

Provides an index of drawings provided for the facilities and provides copies of key drawings required for operation and maintenance of the facilities.

Refer to xxx for an example of a completed Operating Manual.

Each Volume will be constructed of multiple sections. Refer to the specific part of this specification for an explanation of the organization of sections in each volume.

## 2.5.2 General Format Requirements

### 2.5.2.1 Headers and Footers

Footer will contain as a minimum: Volume number; page number and revision number

The principle intent is to ensure that if any section of the manual is removed from the hardcopy, staff will have no trouble to replace it.

### 2.5.2.2 Title pages,

Each volume will have a clear title page. Each section will have a clear section title page. The back of title pages will be left blank.

### 2.5.2.3 Schematic Diagrams

Whenever possible, schematic diagrams will be incorporated to simplify the description or operating philosophy. These are for illustration purposes only and for more accurate information, the appropriate 'as built' should be referred to.

Schematic diagrams will be provided in native format in the electronic copy to allow for future updates.

### 2.5.2.4 Figures – Illustrations

Illustrations shall be used for the purpose of increasing or improving communication and should complement or replace text. Unnecessary illustrations should be avoided. Where multiple references are made to the same illustration on different pages, pullout [11x17] illustrations should be used, [11x17] size illustrations should allow the relevant illustration to be seen when using any of the related text pages. If it is inappropriate to use a pullout, the illustration must be relocated.

A list of abbreviations and symbols will be provided when producing process flow schematic illustrations.

On schematic drawings, valves / control gates to be shown in the normal operating position, with open valves / control gates to be in outline and closed valves / control gates to be blocked in.

Illustrations will be provided in native format in the electronic copy to allow for future updates.

### 2.5.2.5 Photographs

Photographs should be used following the same criteria as for illustrations. When digital photography is used, photographs must be saved using the medium JPEG format.

### 2.5.2.6 Colour

Grey scale is acceptable. In order to accommodate colour blindness, it is recommended that where colour is used to identify a specific feature on an illustration, a secondary form of identification is used as a back up such as hatching or shading to give different forms of visible patterns.

### 2.5.2.7 Warnings, Cautions and Notes

Warnings, Cautions and Notes must be used throughout the manual where appropriate to convey the following information: -

**WARNING:** TO CALL ATTENTION TO INSTRUCTIONS OR INFORMATION WHICH MUST BE ACKNOWLEDGED TO AVOID POSSIBLE DEATH OR INJURY TO PERSONNEL.

**Caution:** To call attention to instructions, which must be acknowledged to prevent damage to plant and equipment or degradation of plant product quality.

**Notes:** used to document Items of importance about use of a system, activity etc.... Notes may be non-safety or safety related but not be “Warnings” or “Cautions”.

### 2.5.2.8 Referencing

Cross referencing out-with each individual Document will not be used. Material referred to within that Document MUST be contained within the Document. With the following exceptions:

Volume 1 (sections on Health and Safety) will contain references to other Volumes to reduce duplication and

Volume 3 Equipment and Maintenance Task Manual, may contain references to Volume 2 – Asset Data Manual.

Volume 6 Drawing manual – Drawings from Volume 6 may be referenced in other volumes and not reproduced in those volumes.

The use of cross referencing to other procedures within a procedure shall only be used if absolutely necessary. Its use leads to complications when amending the manual and introduces increased risk of errors.

Where possible referenced material should be located in the appropriate section. Referenced material can be added in a specific reference section where it is referenced in multiple parts of that document.

## 2.5.3 Hard Copy Format Requirements

### 2.5.3.1 Operations Manual Identification and Binders

Operations Manuals will be printed in colour.

Volumes 1 to 5 of the Operating Manuals shall be contained in durable D ring ring-binders with three rings for 8.5" x 11" pages. The binders will have a maximum spine depth of 75 mm, hard backed with white PVC covers of suitable quality to last the expected life duration of the plant.

Volume 6 – Drawings Manual: Drawings shall be provided as 11"x17" pages in D ring durable ring-binders with three rings. The binders will have a maximum spine depth of 75 mm, hard backed with white PVC covers of suitable quality to last the expected life duration of the plant.

The binders for Volumes 1 to 6 will be organized in order of index. The D rings shall allow the manual pages to sit square and horizontal when the binder is opened on a flat surface.

Each Volume of the Operating Manuals Binders must have sufficient capacity for any individual page to be turned without jamming or tearing and allow at least 25% spare capacity for any future additions.

The binders shall have a clear PVC pocket at the front and on the spine for top entry insertion of a white title card headed with the City of Winnipeg logo which shall be printed in black.

Each binder will have a contents page which includes all volumes and binders, which will include: Volume; section; description.

Each binder will be labelled with the volume number, or numbers if more than one volume is included in a single binder.

The following will be in separate binders:

- Volume 4 - Training Manual
- Volume 6 – Drawings Manual

See Manuals Templates and Example Manual for example layout of the manual.

### 2.5.3.2 Separators for Sections

Divider cards for each Sections Within the individual Volumes shall be multiple part polypropylene coloured dividers, having stepped sides and rounded corners.

### 2.5.3.3 Table of Contents Pages for Sections

Bright blue paper shall be used at the beginning of each Section for the Table of Contents page.

#### 2.5.3.4 Text Pages

Text pages shall be [letter] sized (portrait) having 3 No. punched holes. Final copy for issue shall be 90grms quality; draft pages may be produced in 80grms quality.

- Each Part shall begin on a new page
- Each Operating Procedure shall begin on a new page.
- [11x17] pullouts shall be 100 grms single sided.

Blank pages, including pull-outs, must have standard headers and footers with page numbers and must have the words – “This page intentionally blank” printed on them.

The first two pages of the manual shall be printed on white 130grm card to prevent tearing at the rings.

#### 2.5.4 Electronic Format Requirements

All electronic data will be provided on labelled DVDs’ and MUST be in a recognizable directory / file structure. An example Operating Manual file structure is shown in Appendix 0-1.

Manuals shall be produced using Microsoft Word 2010, illustrations or Schematics may be provided in AutoCAD 20xx or Microsoft Visio 2010. A native file copy of all Illustrations or Schematics to be provided with a unique reference to associate them with their use in the manual.

The manual to be electronically presented as a searchable pdf complete with in-built Thumbnails and Bookmarks.

##### **Provision of Native Files**

All data and documentation to be provided in the NATIVE FORMAT of one the following software packages as appropriate for their creation.

- MS Word in .docx format
- MS Excel in .xlsx format
- MS Visio in .vsd format
- Presentations in MS Powerpoint .pptx format
- Photographic in .jpeg format, medium quality
- Adobe .pdf format
- AutoCAD or AutoCAD LT in .dwg format and saved in the version presently used in the City of Winnipeg Wastewater Department (WWD). Third party fonts, hatch patters, custom linetypes or shapefiles, shall not be used in Drawing Files submitted to the WWD.
- Audio visual in .mp3 format

To aid updating the Operations Manual over time, a single electronic file (Native file format and pdf) will not contain the material for more than one Section of the Operating Manual.

Specific variations to these requirements are specified in specific volumes of the Operations Manual.

Electronic formats related to manufacturers bespoke literature, instruction books etc.. will be acceptable, any bespoke or proprietary software required to read these formats will be provided.

### **3 Volume 1 – Area Process Operating Manual**

The Area Process Operating Manual will be provided prior to substantial completion. The manuals will be structured by process area following the flow of the treatment process from inlet pumping to final effluent discharge and from raw (and WAS) sludge capture to final removal from site. Sub-sections will describe unit processes within each process area.

The Operating Manual will be structured as defined in this specification.

References will be made within the Area Process Operating Manual where necessary to avoid duplication of material. With the exception of the Asset Data Manual, or unless specifically defined in this specification, references will not be made to information outside of this manual.

To simplify updating of the manual, each section identified in this specification (x; x.x; x.x.x; etc...) will begin on a new page.

#### **3.1 Introduction**

This section will provide:

- Location and address of the facility;
- General description of the facility including a process flow diagram,
- Plant layout diagram;
- Key data such as dry weather and maximum treatment capacity, licence limits etc..

#### **3.2 Safety (common)**

This section will provide information on safety that is common to all process areas, and include the following sections.

##### **3.2.1 Safety and Health Hazards (Facility Wide)**

This section is to provide information on safety and health hazards that are common across all process areas in the facility.

Example hazards (area specific hazards will be moved to that specific section(s) of the manual):

- Chemicals Hazards
  - Chemical exposure; list of chemicals used in facility
  - Compressed gasses
  - Asbestos
- Physical Hazards (for example)
  - Temperature
  - Local exhaust ventilation (LEV)
  - Arc flash
  - Confined spaces
  - Electrical safety
  - Hazardous gasses

- Explosive atmospheres
- Pressurized systems
- Noise
- Manual handling
- Traffic
- Hazardous materials
- Buried services
- Overhead cables
- Vibration
- Lighting levels
- Biological Hazards
  - Bacteria and viruses
  - Bacteria

Include identification of all site services and restrictions – For example: Deliveries, Chemicals, gas, electricity, telecom, water, spills, discharges, drainage.

### 3.2.2 Hazard Controls

This section will describe the design features of the facility that have been used to mitigate each of the identified facility wide safety and health hazards.

The hierarchy of controls applied to mitigate hazard will be explained. For example:

- Engineering Controls;
- Administrative Controls
- and PPE controls.

Reference should be made to the appropriate section in the Area Process Manual where required.

A table of Safe Work Procedures (SWPs) common to all areas will be provided. Note: the SWPs themselves will be provided in the Appendix. The following process will be used for selection or creation of SWPs.

#### **Process for allocation and creation of SWPs**

- Review manufacturers or designers requirements as per their literature
- Review existing library of SWPs, provided by the City, and identify closest match.
- If there is an existing SWP with an acceptable match to the requirement, assign the existing SWP in Asset Loading Template (Appendix 2-1).
- If no suitable existing SWP is available, propose a new SWP using the template SWP in Appendix 1-1 and assign it to the asset in Asset Loading Template (Appendix 2-1).
- The Plant Supervisor will review proposed SWP and finalize.

### 3.2.3 Confined Space

This section will provide warning of the hazards of confined spaces in the facilities and reference the applicable legislation and Safe Work Procedures.

## 3.2.4 Fire Protection

### 3.2.4.1 Portable fire extinguishers

Include the following text in the Manual: Refer to the plant Fire Safety Plan for type and location of portable fire extinguishers.

### 3.2.4.2 Fixed fire protection systems

Include the following text in the Manual: Refer to the plant Fire Safety Plan for type and location of fixed fire protection systems.

Asset data and equipment details for fixed fire protection systems will be provided in Volume 2, Asset Data Manual and Volume 3, Equipment and Maintenance Task Manual respectively.

## 3.2.5 Hazardous Location Plan Drawings

This section will include a reference to a drawing (or set of drawings) identifying hazardous locations in accordance with the Electrical Design Guide with respect to explosive atmospheres and their classification. A reference will be made to the appropriate volume of the Operations Manual for special equipment installed and operational mitigation procedures.

Other hazardous areas which are not included in the scope of the Electrical Design Guide, will be identified on the Hazard Location Plans.

## 3.2.6 Signage

This section will include a list of all statutory and safety and health signage included in the design. The specification of the signage will be provided and location installed will be referenced.

## 3.3 Site services

This section will provide an overview of all site services including and any restrictions or constraints that apply. Reference will be made to the appropriate drawings. Site services scope will include:

- Electricity supply;
- Domestic services;
- Water supply;
- Telecommunications;
- Sewerage;
- Drainage;
- Chemicals;
- Containment of chemical /Fuel /Gas Discharges;
- Delivery of process chemicals. Etc;

## 3.4 Process By Area

The manual will organize the plant into physical treatment areas and then into unit processes within each process area.

The process areas will be plant specific, however suggested process areas are as follows, this list is not exhaustive:

- Inlet Pumping
- Head works
- Primary Treatment
- Sludge Thickening
- Secondary Treatment (including Return Activated Sludge and Waste Activated Sludge)
- UV Treatment or Disinfection
- Sludge Digestion
- Sludge Dewatering
- HVAC (For all buildings)
- Central effluent flushing water system

A description of applicable plant utilities (including: sump pumps; effluent wash water; compressed air; potable water) will be included in each process area.

To aid updating of the Area Process Manual, the section of the manual for each unit process will begin on the front side of a new page.

An example of the structure of each area is as follows.

### 3.4.1 General description of process area (E.g. Head works)

A general description of the process area will be provided and refer to the Process Flow Diagram (PFD).

### 3.4.2 Unit processes 1 – Bar Screens and Screenings Conveyor

#### 3.4.2.1 Unit Process Description

This section will explain the function of each unit process within the process area. An explanation of following will be included: Process objective; process description. Reference will be made to process flow diagrams, P&IDs, SOPs, SWPs and control narratives where applicable. P&IDs will be provided in the Drawings Manual and not reproduced in this manual.

#### 3.4.2.2 Design Criteria

Process design criteria for the specific unit process will be provided.

### 3.4.2.3 Operation and Process Control

This section will provide, for the specific unit process:

- The process control narratives, including control philosophy in manual and automatic modes;
- Use of manual controls;
- Process control parameters and key control parameters;
- Process trouble shooting guides;
- Description of protection systems installed;
- Emergency shut down and power failure procedures;
- Sampling and analysis requirements;
- Key HMI screen shots will be used to illustrate operation and process control;

Alarm and Warning limits are volatile data. A record of the recommendations of alarm and warning limits for each process parameter as commissioned will be provided in Volume 5 – Commissioning Manual. The values will be transferred to and maintained in the Process Control Management Plan (PCMP) by Operations.

Reference will be made to process flow diagrams, P&IDs, SOPs, SWPs and control narratives where applicable. P&IDs will be provided in the Drawings Manual and not reproduced in this manual.

### 3.4.2.4 Safety and SWPs

This section will contain safety information specific to the unit process, including safety hazards and safety controls.

Safe Work Procedures (SWPs) will be provided for all activities required for the safe operation of the unit process.

A reference table of all SWPs relevant for each unit process will be provided in the relevant section of the Area Process Manual, by following the process below. A complete list of SWPs will be included as an Appendix to Volume 1- Area Process Operating Manual.

#### **Process for allocation and creation of SWPs**

- Review manufacturers or designers requirements as per their literature
- Review existing library of SWPs, provided by the City, and identify closest match.
- If there is an existing SWP with an acceptable match to the requirement, assign the existing SWP in Asset Loading Template (Appendix 2-1).
- If no suitable existing SWP is available, propose a new SWP using the template SWP in Appendix 1-1 and assign it to the asset in Asset Loading Template (Appendix 2-1).

### 3.4.2.5 Standard Operating Procedures (SOPs)

Standard Operating Procedures (SOPs) will be provided for all activities required for the proper operation of the unit process.

A reference table of all SOPs relevant for each unit process will be provided in the relevant section of the Area Process Manual by following the process below. A complete list of SOPs will be included as an Appendix to Volume 1-Area Process Operating Manual.

**Process for allocation and creation of SWPs**

- Review manufacturers or designers requirements as per their literature
- Review existing library of SOPs, provided by the City, and identify closest match.
- If there is an existing SOP with an acceptable match to the requirement, assign the existing SOP in Asset Loading Template (Appendix 2-1).
- If no suitable existing SOP is available, create a new SOP using the template SOP in Appendix 1-2 and assign it to the asset in Asset Loading Template (Appendix 2-1).

### 3.4.3 Unit processes 2 – Channel Aeration

#### 3.4.3.1 Unit Process Description

#### 3.4.3.2 Safety and SWPs

#### 3.4.3.3 Design Criteria

#### 3.4.3.4 Operation and Process control

#### 3.4.3.5 Standard Operating Procedures (SOPs)

### 3.4.4 Unit processes 3 – Grit Removal System

#### 3.4.4.1 Unit Process Description

#### 3.4.4.2 Safety and SWPs

#### 3.4.4.3 Design Criteria

#### 3.4.4.4 Operation and Process control

#### 3.4.4.5 Standard Operating Procedures (SOPs)

### 3.4.5 Unit processes 4 – Grit Pumping and De-watering

#### 3.4.5.1 Unit Process Description

#### 3.4.5.2 Safety and SWPs

#### 3.4.5.3 Design Criteria

#### 3.4.5.4 Operation and Process control

#### 3.4.5.5 Standard Operating Procedures (SOPs)

## 3.5 Volume 1 – Appendices

The following appendices will be included with the Area Process Operating Manual.

### 3.5.1 Appendix - Safe Work Procedures (SWPs)

An index of all SWPs will be provided.

SWPs will be provided for all activities identified in the Area Process Manual.

SWPs will be provided as individual files.

SWPs will be provided using the template in Appendix 1-2.

#### **Process for providing Safe Work Procedures (SWP's)**

The Wastewater Treatment Division holds standard SWPs for common tasks, which should be referenced to avoid duplication.

- Identify SWPs required
- Review existing SWPs, provided by the CWMS team, and identify closest match.
- Where there is an existing SWP with an acceptable match to the requirement, that SWP should be referenced
- If no suitable SWP is available, create a SWP using the template (Appendix 1-2)

### 3.5.2 Appendix - Standard Operating Procedures (SOPs)

An index of all SOPs will be provided.

SOPs will be provided for all activities identified in the Area Process Manual.

SOPs will be provided as individual files.

SOPs will be provided using the template in Appendix 1-2.

### 3.5.3 Appendix - Material Safety Data Sheets

Operations maintain a copy of all materials data sheets on an online application. This appendix will provide an index of materials data sheets applicable to the facility, a “pdf” version of the Material Safety Data Sheet will be provided in the electronic version of the Manual.

### 3.5.4 Appendix - HAZOP Records

This appendix will include a copy of records from any Hazard and Operability Study (HAZOP) produced by the project, all control measures (engineering and operational) identified in the HAZOP should be included in the hazard control section of this manual.

## 4 Volume 2 – Asset Data Manual

### 4.1 Purpose of the Asset Data Manual

This section describes a standard approach, across Wastewater Services (WWS), for the provision of asset data on new or modified assets.

The City of Winnipeg Water and Waste Department use Oracle Work and Asset Management (OWAM) as their Computerized Work Management System

### 4.2 Asset Data Submission Process and Timeline

This section sets out the process for submitting asset data to the City of Winnipeg resulting from a change in assets through a capital project.

- The City will provide current asset data for the facilities as an Excel file prior to the end of Preliminary Design.
- The Consultant will identify and flag assets, that are to be modified or retired, in the Excel file. The modified file will be submitted to the Project Manager as part of the Detail Design deliverables.
- The Consultant will fully complete asset data for new or modified assets using the Asset Loading Template (Appendix 2-1) no later than two (2) prior to Substantial Completion.

### 4.3 Guidance on Completion of the Asset Loading Template

The following table provides guidance for the completion of the Asset Template file. Fields marked as Mandatory must be populated for the file to be accepted.

Field	Mandatory	Description	Codes
ASSET_NO	To be left blank	To be left blank.  Asset reference number will be generated by OWAM.	Not applicable (n/a)
TAG_ID	Yes	Smart numbered Tag ID using City of Winnipeg standard format.	Refer to TAG specification.
PLANT	Yes	This refers to the OWAM database instance.	01
ASSET_RECORD_TYPE	Yes	Asset Record Type from code list	E = Equipment B = Building A = Virtual (used in Asset Hierarchy Structure)
ASSET_ID	Yes To be completed by the City CWMS	Same as Asset Number - to be left blank.	n/a

Field	Mandatory	Description	Codes
	Specialist		
ASSET_TYPE	Yes	Asset Type from code list	Appendix 2-3  If no appropriate Asset Type is listed provide proposed new Asset Type to City of Winnipeg for consideration.
ASSET_DESC	Yes	<p>The Asset Description is the name by which plant staff would commonly refer to the asset. The description consists of the following separated by spaces:</p> <p>1 - Wastewater Process Area Code = Building Code, excluding name of the plant</p> <p>2 – Type (this is NOT the Asset_Type): this is the sub process of the Wastewater Process Area that is used to group similar assets and components together. See Note 1.</p> <p>3 – TAG ID (smart number)</p> <p>4 – Noun or Common Name: E.g. pump; Switch; Valve; Transmitter etc...</p> <p><u>Examples of "Asset_Desc":</u></p> <ul style="list-style-type: none"> <li>• Admin motor M681-F81ventilation fan motor</li> <li>• Grit hoist G565-CR 2 ton electric crane c/w monorail trolley hoist</li> <li>• Grit DCS PCU8-SA MMU Cabinet 15</li> <li>• Grit switch G257-BS barscreen reverse switch</li> <li>• Grit switch G245-TSHblower high temperature switch</li> <li>• Primary valve P212 P213-FV1 transfer control valve</li> </ul>	Appendix 2-2
ASSET_STATUS	Yes	Asset status from code list	ACTIVE
DEPARTMENT	Yes	City department from code list	WWD
AREA	Yes	Water or Waste	Water Waste
PARENT_ASSET_ID	To be left blank	To be left blank. City to define asset hierarchy.	n/a

Field	Mandatory	Description	Codes
	To be completed by the City CWMS Specialist		
ACCOUNT_NO	Yes To be completed by the City CWMS Specialist	City account reference number	n/a
CRITICALITY	Yes	Asset criticality value	Criticality values are defined in the Asset Management Manual.
BUILDING	Yes	Select Building in which asset is located from code list.  If no appropriate Building is listed provide proposed new Building to City of Winnipeg for consideration.	Appendix 2-2
LOCATION	Yes	Description of the general physical location within the Building.  Examples: Gallery XX, Tunnel XX, Basement, Upper Level, Lower Level, Mezzanine, West Wall etc. Main Level  Maximum data length = 30 characters	n/a
PARENT_ASSET_RECO RD_TYPE	To be left blank To be completed by the City CWMS Specialist	Record Type of the Parent Asset.	n/a
ROOM	Yes	Name of room where the Asset is located.  Chlorine, Pump, Control, Motor etc.  Maximum data length 20 characters	n/a
<b>The following fields are used to capture data from name plates. The data will be completed as fully as possible. Not all data will be applicable to every asset.</b>			
MANUFACTURER	Yes	The manufacturer of the Asset.	n/a

Field	Mandatory	Description	Codes
		Maximum data length 50 characters	
<b>MODEL_NO</b>	<b>Yes</b>	The Make of the Asset Maximum data length 50 characters	n/a
<b>SERIAL_NO</b>	<b>Yes</b>	Serial number from the Asset Maximum data length 50 characters	n/a
<b>TYPE</b>	Where available	Provide relevant information, which is not covered by other fields, which helps define the asset.  Maximum data length 50 characters	n/a
<b>SIZE</b>	Where available	Asset size if applicable.  E.g: 6 Inch Diameter  Maximum data length 50 characters	n/a
<b>CAPACITY</b>	Where available	Asset Capacity if applicable.  E.g: 5 MLD.  Maximum data length 50 characters	n/a
<b>PUMP_BEARING</b>	Where available	Type of pump bearing if applicable. Format: OD: ABC123 ODE: DEF456 Maximum data length 50 characters	n/a
<b>HEAD_PRESSURE</b>	Where available	Design head pressure of pumps, if applicable Maximum data length 50 characters	n/a
<b>HP</b>	Where available	Motor or engine Horse Power if applicable. Maximum data length 50 characters	n/a
<b>VOLTS</b>	Where available	The design voltage of the asset where applicable. Maximum data length 50 characters	n/a
<b>AMPS</b>	Where available	Full Load Amperage (FLA) as indicated on the motor nameplate.  Example: 50 Amps  Maximum data length 50 characters	n/a
<b>PHASE</b>	Where available	Electrical Phase from code list.	1 3
<b>OUTPUT</b>	Where available	State the output of instrument assets.  Examples: 4-20 mA 3-15 PSI  Maximum data length 50 characters	n/a
<b>RANGE</b>	Where available	State the range of instrument assets.  Examples: 50MLD 1,500 LPS  Maximum data length 50 characters	n/a

<b>Field</b>	<b>Mandatory</b>	<b>Description</b>	<b>Codes</b>
<b>LOOP</b>	<b>Yes</b> for instrumentation or control assets	Relevant loop drawing reference number. Maximum data length 50 characters	n/a
<b>PID</b>	<b>Yes</b>	Relevant P&ID drawing reference number. Maximum data length 50 characters	n/a
<b>MOTOR_BEARING</b>	Where available	Type of motor bearing if applicable. Format: OD: ABC123 ODE: DEF456  Maximum data length 50 characters	n/a
<b>OTHER</b>		Other relevant drawing numbers.  Maximum data length 50 characters	n/a
<p>Note 1 – Asset Description:  Examples of most common process “Type” description: HVAC, RAS, DCS, Sump, Electrical, Sludge, Centrifuge, Scum, Hoist, Flushing water, WAS, Clarifier, Potable water, Bridge, Bailey, Boiler, Polymer, Storage bin, Overhead, Security, Heat exchanger, Raw sewage, Wet well, Generator, LOX, PSA, SCADA, Safety, Air System, Effluent, Influent.  This list is not exhaustive.</p>			

## 5 Volume 3 – Equipment and Maintenance Task Manual

### 5.1 Purpose of the Equipment and Maintenance Task Manual

This section describes a standard approach, across Wastewater Services (WWS), for the format, presentation and numbering procedure for documentation within the scope of the manual.

The Equipment and Maintenance Task Manual will be provided at least two (2) weeks prior to substantial completion.

Where a partial treatment works, or item of Plant or Equipment is replaced, an update to the plant Equipment Manual will be provided.

### 5.2 Maintenance Benchmark Work Orders

Maintenance Benchmark Work Orders are template work orders (with work order task, planned materials, craft, and estimated labour hours, checklists and safe work procedures) which are used to generate a real work order. They are used primarily for setting up reoccurring preventive maintenance type work orders.

Detailed instructions on maintenance requirements of each item of equipment will be provided in the form of a Maintenance Benchmark Work Order using the template in Appendix 3-1, which may require reproduction of information from manufacturers' documentation. To avoid duplication, the maintenance benchmark may refer to Volume 4 - Asset Data Manual.

The benchmarks will contain sufficient information to allow the plant & equipment to be maintained safely. Requirements for regular inspections by all trades, including operations, will be included.

Benchmark work orders are reviewed on regular basis using data from completed work to adjust the estimated labour hours and provided more accurate information for maintenance planning.

#### **Process - Manufacturers Maintenance Requirements**

New assets will initially be maintained to manufactures recommendations in order to respect warranties.

- Review manufacturers maintenance requirements as per their literature
- Review existing Maintenance Benchmark Work Orders, provided by the CWMS team, and identify closest match.
- If there is a benchmark Work Order with an acceptable match to the maintenance requirement, assign the benchmark work order to the asset in OWAM Asset List (Appendix 2-1).
- If no suitable benchmark Work Order is available, propose new benchmark Work Order and assign it to the asset in OWAM Asset List (Appendix 2-1).
- Maintenance Engineer will review proposed benchmark Work Orders and finalize.

Safety precautions such as equipment handling requirements including details of specific lifting points will be included in the Benchmark Work Order through referenced Safe Working Procedure attachments (SWPs).

### 5.3 Maintenance Task Intervals

This section will define the frequency at which maintenance tasks to be carried out on the specific assets in the form of a schedule that is used to build the Planned Maintenance Master (PM Master).

#### **Process - Manufacturers Maintenance Requirements**

New assets will initially be maintained to manufactures recommendations in order to respect warranties. The process to be used to define the initial maintenance task intervals is as follows:

- Review manufacturers maintenance requirements as per their literature
- Identify appropriate maintenance benchmark Work Orders
- Assign a frequency for execution of the Benchmark Work Order in the Asset Loading Template (Appendix 2-1). This data will be incorporated to manually build the PM Master.

### 5.4 Lubricants Schedule

A complete schedule of all lubricants used will be provided in the form of a matrix of lubricants against each asset using the Lubricant schedule template in Appendix 3-2.

### 5.5 Critical Parts lists

Critical spare parts will be identified using the process in the Wastewater Treatment Asset Management Manual. A list of critical spare parts for each assets identified through this process will be provided using the template schedule in Appendix 3-3.

Appendix 3-3 to include:

- Asset TAG ID;
- Asset description (as Volume 2 – Asset Data Manual);
- Asset location (as Volume 2 – Asset Data Manual);
- Critical spare part description (as per manufacturers manual);
- Equipment manufacturers item number;
- Reference to manufacturers documentation;
- Supplier name, at time of commissioning;

### 5.6 Manufacturers Literature

All applicable original literature from manufacturers SPECIFIC to the equipment installed will be provided. Where manufacturers' literature contains information on multiple equipment types or variants the SPECIFIC equipment installed will be clearly identified.

Manufacturers' literature will be provided as both hard copy and electronic formats as defined in the General Specification. Where either hard copy or electronic files are not available this will be clearly stated.

Manufacturers' literature will be provided by Process Area following a logical order. An index of manufacturers literature will be provided at the front of the section.

Where electronic versions of Manufacturers documentation are available through either the intranet or within equipment electronic interfaces, an electronic copy will be provided as part of this manual as per the General Specification.

## 5.7 Equipment Suppliers

A schedule of equipment suppliers, as existing at the time of commissioning, will be provided and will contain:

- Relevant Material Management award reference number (Bid Opp number);
- Supplier contact details (Supplier Name; Address; e-mail address; Telephone numbers etc..)

The schedule will be sorted by supplier name. Supplier names will be those used in the Critical Spare Parts schedule.

## 6 Volume 4 – Training Manual

This section describes a standard approach, across Wastewater Treatment, Wastewater Services (WWS), for the format, presentation and numbering procedure for documentation within the scope of the manual.

The Training material will be organized first by Discipline (Operations; Electrical; Mechanical; Automation etc.) then by process area.

The Training Manual shall provide the information required to train Operations and Maintenance staff (including control systems staff) in the safe and efficient operation and maintenance of plant and equipment. The Training Manual will be specific to the scope of a project, training material to include where applicable to that project but not be limited to:

- Works operation in fully automatic and manual mode
- Plant and equipment routine and non-routine procedures (operation and maintenance)
- Use of facility Operating & Maintenance Manual
- Facility external layout
- Facility internal layout
- Facility drainage
- Roof drainage
- Facility P&IDs
- Facility process flow
- All installed equipment
- As installed mechanical and electrical drawings
- Individual unit processes.
- Individual chemical process.
- Safety and Health risk assessments.
- Hazardous area classification.
- Electrical classification.
- Works specific emergency procedures
- Training in all specific electronic equipment (PCS, PLC's, HMI's Data Networks and Interfaces, Telemetry, security systems).
- Facility specific commissioning

The Training Manual will be a stand-alone Volume which may be contained in multiple binders.

The content of training courses will be focused on understanding how that subject is impacted / expressed through the project, rather than a tutorial on the subject itself. For example, training on P&IDs and electrical drawings will be make staff familiar with the drawings for the specific project, rather than how to read and interpret P&ID or electrical drawings.

## 6.1 Training Planning and Administration

This specification applies to all training for Operations and Maintenance staff required under the scope of the project.

Training will be planned in advance. The City sewage treatment plants are full time operations, planning and advance notice is required to ensure the appropriate operations and maintenance staff are able to attend training courses. Where training impacts plant operations and maintenance staff, multiple training sessions will be arranged to minimize the disruption to wastewater service delivery.

A training plan will be produced in advance of any training. A **two week** review period will be allowed for the City to provide comments on the training plan. The training plan will demonstrate arrangements to “mop up” training delegates who may not have been able to attend a planned session due to operational reasons.

The training plan will include: an assessment of training needs; a schedule of training which identifies training delegates, course title, dates, times and locations of individual training courses.

The training plan will include training on all SWPs/SOPs provided by the project.

A minimum of **two weeks'** notice is required to be given to delegates attending a particular training session once the training plan has been agreed, unless otherwise directed by the Project Manager.

Attendance registers will be completed for each training course. Post training evaluation forms will be issued at the end of each training course and the results compiled in a summary.

For certain types of training courses it may be appropriate to use quizzes, learning reviews or other methods to test the understanding of course delegates of the training material. Consideration will be given to these techniques in the training plan. Quizzes (or similar) will be used on safety and health specific training courses.

The following forms will be used, unless agreed otherwise with the Project Manager:

- Attendance registers, Appendix 4-1.
- Individual post training course evaluation forms, Appendix 4-2.

## 6.2 Training Program

In coordination with the Training Coordinator, the Consultant will identify staff who will be impacted by the Project. The scope and content of the training material will be tailored for the specific audience.

### **Plant Start-up**

The training plan will describe how operations and maintenance staff involved in start-up will be trained prior to their involvement in start-up activities. It can be the case that lessons are

learned during the start-up of a process that will be useful to the long term operator, start-up lessons learned will be documented for communication to staff who may have had training prior to start-up. Start-up lessons learned will be included in the final record of training material.

## 6.3 General Training Requirements

### 6.3.1 Training Documentation Requirements

This minimum documentation required for a training session are:

- Training objectives. (May be contained in the course notes)
- Training course program (may be contained in the course notes)
- Training course notes / hand-outs

The Operations Manuals are to be used as part of training courses (where appropriate). The objective is to minimize the amount of bespoke training material required to be created and to allow training delegates to become familiar with where to find relevant information.

The contents of any specific training course will be specific to that course and subject. The training manual will contain copies of all material used during the training sessions.

Where quiz or knowledge assessments are used in the training, copies of the forms and anticipated answers will be provided.

#### **Audio and/or Video Recording of Training**

The City may identify particular courses from the training program to be recorded for future use. Where Audio and/or Video material is used in the training a copy will be provided.

### 6.3.2 Training Manual Contents

This section defines the structure of the Training Manual to be provided at the end of the training program. The manual is to be provided within four weeks of the completion of the training program.

The Training Manual will include the following sections as a minimum:

#### 6.3.2.1 Purpose

Describe the purpose of the Training Manual.

*For example*

*The purpose of the Training Manual is to contain a record of training delivered during the commissioning and handover of new assets to operations and to provide a copy of all training materials used to enable such training to be repeated as required during the operations and maintenance of the facilities.*

### 6.3.2.2 Training Program

Provide a summary of the scope of the training provided and a copy of the final training program as carried out.

### 6.3.2.3 Training Records

This section will contain copies of the completed training attendance sheets and a summary of post course evaluations for each course in the program. The summary of post course evaluations will not contain information to match comments to specific individuals.

The training records will be organized first by Discipline (Operations; Electrical; Mechanical; Automation etc....) then by process area.

#### *Discipline 1*

##### *Process Area 1*

###### *Training Course [Title]*

- *[insert typical attendance sheets]*
- *[insert typical summary of post course evaluation]*

###### *Training Course [Title]*

- *[insert typical attendance sheets]*
- *[insert typical summary of post course evaluation]*

#### *Discipline 2*

##### *Process Area 2*

###### *Training Course [Title]*

- *[insert typical attendance sheets]*
- *[insert typical summary of post course evaluation]*

###### *Training Course [Title]*

- *[insert typical attendance sheets]*
- *[insert typical summary of post course evaluation]*

### 6.3.2.4 Training Material Organized By Discipline Then Process Area

This section to provide a copy of all materials used in each training course within the training program. The Training material will be organized first by Discipline (Operations; Electrical; Mechanical; Automation etc....) then by process area.

#### *Discipline 1*

##### *Process Area 1*

*Training Course [Title]*

- *List of course materials*
- *Training objectives*
- *Training course program*
- *Training course notes / hand-outs*

*Training Course [Title]*

- *List of course materials*
- *Training objectives*
- *Training course program*
- *Training course notes / hand-outs*

*Process Area 2*

*Training Course [Title]*

- *List of course materials*
- *Training objectives*
- *Training course program*
- *Training course notes / hand-outs*

*Training Course [Title]*

- *List of course materials*
- *Training objectives*
- *Training course program*
- *Training course notes / hand-outs*

*Discipline 2*

*Process Area 1*

*Training Course [Title]*

- *List of course materials*
- *Training objectives*
- *Training course program*
- *Training course notes / hand-outs*

*Training Course [Title]*

- *List of course materials*
- *Training objectives*
- *Training course program*
- *Training course notes / hand-outs*

*Process Area 2*

*Training Course [Title]*

- *List of course materials*

- *Training objectives*
- *Training course program*
- *Training course notes / hand-outs*

*Training Course [Title]*

- *List of course materials*
- *Training objectives*
- *Training course program*
- *Training course notes / hand-outs*

## 7 Volume 5 – Commissioning Manual

The WSTP IMS contain a number of Basis Of Design documents and standards which detail certain commissioning requirements depending upon the trade and the type of installation. This manual will document the outcome of those requirements.

Scope of the Commissioning Manual will include commissioning, re-commissioning and eventual de-commissioning considerations.

This Commissioning Manual will consist of two key parts:

### **Part 1 – Commissioning Plan**

The commissioning plan is a set of documents which comprehensively document the procedures required to commission the facility. This includes acceptance criteria for the commissioning tests.

### **Part II – Commissioning Records**

The commissioning records are a set of documents which record and demonstrate the results of the commissioning process and that the acceptance criteria have been met. The records will include test result documentation, checklists, letters of conformity and certificates.

Where sections of the plant are commissioned in phases of one project, or as separate projects, it is acceptable for the Commissioning Manual to be provided in parts aligned to the completion of each project or project phase.

The Commissioning Manual is to be provided within four (4) weeks of the completion of the facility commissioning for each project or project phase.

The Commissioning Manual will include the following sections.

### 7.1 Purpose

This section will describe the purpose of the Commissioning Manual.

*For example:*

*The purpose of the Commissioning Manual is to contain a record of the commissioning process and handover of new assets to operations. The commissioning manual will enable operations and City personnel to re-commission systems as required.*

### 7.2 Part I - Project Commissioning Plan

The Project Commissioning Plan defines the overall requirements for testing and commissioning the facility. The Commissioning Plan will document the methods and procedures for commissioning the works **as carried out (past tense)**.

The commissioning plan will include information arranged under the following section headings:

### 7.2.1 General

Provide an overall description of the commissioning approach.

### 7.2.2 Roles and Responsibilities

Provide an explanation of roles and responsibilities of organizations and personnel involved in the commissioning.

### 7.2.3 Scope

Provide a description of the scope of the works.

### 7.2.4 Sequence / Schedule

## 7.3 Commissioning Specification and Objectives

This section will describe the commissioning tests required to demonstrate the design intent of the project, along with the approved acceptance criteria.

## 7.4 Commissioning Procedures

The commissioning procedures provide the detailed information to describe the specific field activities necessary to complete the commissioning process and ensure the commissioning specification and objectives are met. Multiple documents will be included for various facility processes.

The commissioning procedures will be organized in a logical fashion most appropriate to the scope of work.

## 7.5 Part II – Project Commissioning Records

The commissioning records to be included within the Commissioning Manual are a subset of the complete set of Commissioning Records. The records included will be limited to safety, process and system performance verification, and not verification of individual components.

An index of certificates will be provided.

Examples of commissioning records to be included are as follows (but not limited to):

#### **Safety**

- Pressure vessel test certificates
- Fixed lifting equipment test certificates
- Portable lifting equipment test certificates
- Certificates of Acceptance, AHJ (Authority Having Jurisdiction).
- Engineers letter of Certification
- Fire alarm test certificates

#### **Other**

- Process
- Performance tests certificates.
- Structural
- Mechanical
- Equipment Commissioning Certificates
- Pressure Test Certificates.
- Electrical
- Power distribution system acceptance documentation
- Fire alarm acceptance documentation
- Security system acceptance documentation
- CCTV system acceptance documentation
- Automation
- Process Control System SAT (Site Acceptance Test) acceptance documentation, but not necessarily documentation of all detailed tests.
- Network acceptance documentation
- Equipment control limits as commissioned

The commissioning records section will be organized as follows:

### 7.5.1 Facility

This section will contain copies of the completed records, tests and certificates that are applicable to the entire facility. For example – Facility effluent quality commissioning record.

### 7.5.2 Area A

This section to provide a copy of all major completed commissioning records that are applicable to process area A.

#### 7.5.2.1 System 1

This section to provide a copy of all major completed commissioning records that are applicable to the specific system. The records would detail overall system performance, but would not necessarily include detailed test results of components, such as cable testing forms.

#### 7.5.2.2 System 2

Similar to System 1 ... and continued for all systems.

### 7.5.3 Area B

Similar to Area A and continued for all systems.

## 8 Volume 6 – Drawing Manual

### 8.1 Purpose of the Drawing Manual

This section describes a standard approach, across Wastewater Treatment, Wastewater Services (WWS), for the format, presentation and numbering procedure for documentation within the scope of the manual.

“As Built” versions of all drawings will be provided as per the requirements of this specification no later than four weeks after Total Performance.

### 8.2 Index of Drawings

An index of all as constructed drawings provided as part of the design will be provided, the index will include:

- Drawing Number
- Drawing Title (Title Box Description)
- Version number
- Date of issue
- Type (Process and Instrumentation Drawings (P&ID); Electrical; Mechanical; Civil etc...)
- Process Area
- File name (as per file naming convention)

The index will be provided in an Excel file and in hard copy in this manual. The hard copy index will be arranged by process area then by drawing number.

The index of drawings should include, this list is not exhaustive:

- Civil Drawings
- Cranage points and load bearing capacity drawings for siting of mobile cranes during maintenance lifting operations
- Mechanical Drawings
- Pneumatic control systems
- Hydro electrical supply and gas supply drawings
- Telephone and other communication line drawings
- Telemetry drawings
- Electrical drawings
- Process flow diagrams
- P&IDs
- Works layout
- Works Drainage (Drainage, Chemical and Foul)
- Internal layout plans,
- Hazardous location plans
- Shop drawing
- Any Drawings referred to within any documentation.

Where 3D models have been provided, information will be included on how to navigate the tool.

### 8.3 Drawings General

The drawings produced to be in conformance with “CD-CP-TO-05 Project Documentation Requirement sheet”

Submit draft drawings for review in both paper and electronic format, use a paper size suitable for a detailed review. Draft drawings will be amended and finalized as requested.

All drawings will be saved with the first layout tab active.

All final files will be fully purged prior to submittal.

### 8.4 Number of copies

Requirements for the number of copies are defined in “CD-CP-TO-05 Project Documentation Requirement sheet”.

Two (2) hard copies and one (1) electronic of all final shop drawings will be provided.

Electronic and hard copies will be provided in the format as described in the General Specification.

## 9 Appendix

**Drafting note:** this appendix contains reference information needed for the completion of the manual, templates, reference lists etc. but will not end up in the final Operations Manuals.

## 9.1 Appendix 0-1 - Example electronic folder and file structure

The file and folder structure for the Operations Manuals are described here. The file and folder structure has been organized such that once it is applied to a specific wastewater facility the files and folders can be readily transferred to the City server for access by the relevant stakeholders.

The root folder will contain a full index of the complete Operations Manual consisting of six volumes.

The Technical Document Numbering System describes the convention for naming of files assuming the use of a Document Management System. Operations Manuals will finally reside on a City server in a traditional folder hierarchy, this document provides guidance on the required folder structure.

Individual files will be named according to the IMS document PG-RC-PC-03 Technical Document Numbering System.

E.g. Operations Manual files for the WEWPCC Perimeter Road Pumping Station will be in the format:

A-0103-OMAN-Axxx

Each volume will be a separate file or set of files within a folder hierarchy titles with the volume number and title. i.e. files from different Volumes will not be mixed within a folder.

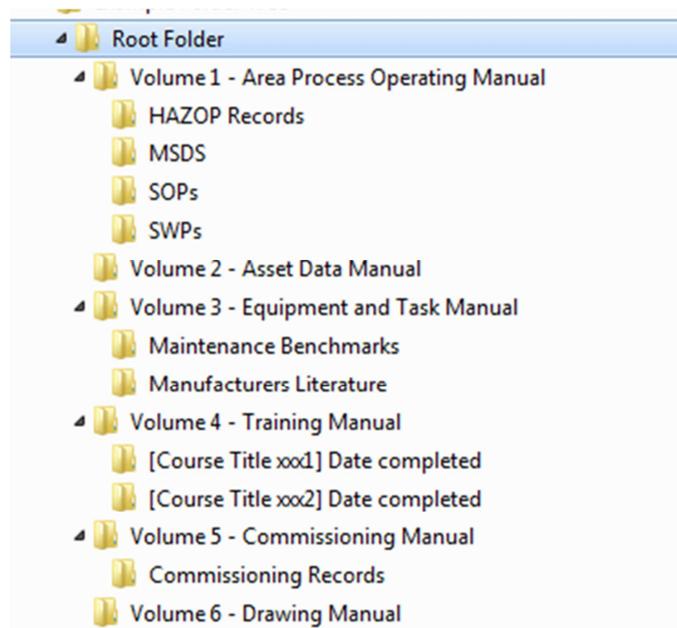


Figure 2 - Typical Operations Manual Electronic Version Folder Structure

The Volume folders will sit under a root Operations Manual Folder which will only contain a complete index of the entire Operations Manual.

**Volume 1 – Area Process Operating Manual**

- Sections 1 to 3 of the specification may be created as a single file or split into individual files depending on the size and complexity of the specific Manual.
- To aid document change control, sections 4 will be created as separate files for each Process Area. A Process Area may be split into multiple files depending on the size and complexity of the specific Manual. Where a Process area is split into multiple files they will follow a logical order.

**Volume 1 Appendices:**

- SOPs; SWPs; MSDSs and HAZOP Records will be contained in separate folders as Figure 1
- Each SOP; SWP; MSDS will be a separate file within the relevant folder
- The folder for HAZOP Records will be organized logically appropriate to the specific content
- Further Appendix folders may be included if appropriate to the specific Operations Manual

**Volume 2 – Asset Data Manual**

This volume consists of an Excel workbook(s) which will be in its own folder. No other files are required within this folder.

Multiple Excel workbooks may be provided depending on the specific Operations Manual if required depending on the complexity.

**Volume 3 – Equipment and Maintenance Task Manual**

The following sections of the specification will be provided as separate files within the Volume 3 folder:

- Maintenance Task Intervals
- Lubrication schedule (Excel File)
- Critical parts list (Excel File)
- Equipment suppliers

Maintenance Benchmark Work Orders will be provided in a separate folder.

Manufacturers literature will be provided in a separate folder. The folder will contain appropriate sub folders and be organized in a logical manner to suite the specific content. An index will be provided as an Excel file. Files provided by manufacturers and suppliers consisting of their proprietary literature and documentation do not need to be renamed to follow the Technical Document Numbering Standard, however the index must allow the documents to be identified without opening the specific files.

For organization of the DVD copy of the Operations Manual, Manufacturers Literature may be spread across multiple DVDs depending on the size of the specific Manual.

**Volume 4 – Training Manual**

The training Program will be provided as a separate file.

Training material will be organized into separate folders for specific training courses. Specific folders may contain sub folders as required to suite the material.

Training records will be provided as separate files in a specific folder.

A summary of training feedback forms will be provided as separate file. Copies of completed feedback forms are not to be provided.

**Volume 5 – Commissioning Manual**

The Commissioning Manual will be provided as a separate file(s).

Commissioning Records will be provided as separate files as appropriate to the content within a sub-folder, which will be organized into further sub folders appropriate to the content.

**Volume 6 – Drawing Manual**

Drawings files will be provided as pdf and numbered as per the Technical Document Numbering Standard.

An index of all drawings will be provided as an Excel file.

## 9.2 Appendix 1-1 Template Safe Work Procedure (SWP)

Refer to IMS document:

CD-CP-TO-xx Safe Work Procedure Template.doc.docx

CD-CP-TO-xx - Developing SWP Guideline.pdf

CD-CP-TO-xx - SWP Template Instructions.pdf

## 9.3 Appendix 1-2 Template Standard Operating Procedure (SOP)

Refer to IMS document: CD-CP-TO-01 Standard Operating Procedure Template.doc.doc

## 9.4 Appendix 2-1 –Asset List Loading Template – Excel File

Refer to IMS document: CD-CP-TO-xx - Asset Loading Template.

## 9.5 Appendix 2-2 – Building Codes

<b>BUILDING_CODE</b>	<b>BUILDING_DESCRIPTION</b>
NEWPCC ADMIN	NEWPCC MAIN ADMINISTRATION
NEWPCC BOILER	NEWPCC BOILER
NEWPCC DEWATERING	
NEWPCC DIGESTER	NEWPCC DIGESTER
NEWPCC DRYING BEDS	
NEWPCC GARAGE	NEWPCC MAIN GARAGE
NEWPCC GAS BURNER	
NEWPCC GAS SPHERE	
NEWPCC GRIT	NEWPCC GRIT
NEWPCC HAULED WASTE	
NEWPCC LAB	NEWPCC MAIN LAB
NEWPCC LEACHATE	NEWPCC LEACHATE
NEWPCC MAIN	NEWPCC MAIN PUMPING
NEWPCC N-REMOVAL	
NEWPCC P-REMOVAL	
NEWPCC PRIMARY	NEWPCC PRIMARY
NEWPCC REACTOR	NEWPCC REACTOR
NEWPCC SECONDARY	
NEWPCC UV	NEWPCC ULTRA VIOLET/TERTIARY
SEWPCC ADMIN	SEWPCC ADMINISTRATION
SEWPCC GENERATOR	
SEWPCC GRIT	SEWPCC GRIT
SEWPCC MAINT	SEWPCC MAINTENANCE
SEWPCC OIL STORAGE	
SEWPCC OUTFALL	SEWPCC OUTFALL
SEWPCC PRIMARY	SEWPCC PRIMARY
SEWPCC REACTOR	SEWPCC REACTOR
SEWPCC SECONDARY	
SEWPCC SEPTAGE	SEWPCC SEPTAGE
SEWPCC UV	SEWPCC ULTRA VIOLET/TERTIARY
WEWPCC ADMIN	WEWPCC ADMINISTRATION
WEWPCC DAF	WEWPCC DAF & CHEMICAL FEED
WEWPCC FERMENTER	
WEWPCC HEADWORKS	

<b>BUILDING_CODE</b>	<b>BUILDING_DESCRIPTION</b>
WEWPCC OUTFALL	WEWPCC OUTFALL
WEWPCC PRIMARY	WEWPCC PRIMARY
WEWPCC PRPS	WEWPCC PREIMETER ROAD PUMP STATION
WEWPCC SECONDARY	
WEWPCC UTILITY	WEWPCC UTILITY

## 9.6 Appendix 2-3 – Asset Type Codes

<b>Asset Type Code</b>	<b>Description</b>
ACTUATOR	VALVE ACTUATOR
ACU	AIR CONDITIONING UNIT
AHU	AIR HANDLING UNIT
ANALYZER	PROCESS ANALYSIS INSTRUMENTS CL2 / DE / DO / NH3 / NO3 / PO4
ARRESTER	FLAME / SPARK ARRESTER
AUGER	AUGER
BACKFLOW	BACKFLOW PREVENTER
BARSCREEN	BARSCREEN
BLOWER	PROCESS BLOWER
BOAT	MOTORBOAT / CANOE
BOILER	BOILER
BRAKE	BRIDGE MOTOR BRAKE
BREAKER	ELECTRICAL BREAKER
BRIDGE	CLARIFIER BRIDGE
BUILDING	BUILDING
BURNER	WASTE GAS BURNER
CATHODIC	CATHODIC PROTECTION
CELL	LOAD CELLS
CENTRIFUGE	CENTRIFUGE
CHANNEL	CHANNEL
CHARGER	BATTERY CHARGER
CHILLER	CHILLER AIR CONDITION UNIT
CHLORINATR	CHLORINE CHLORINATOR
CLASSIFIER	CLASSIFIER
CNTL PANEL	CONTROL PANEL FDP / TC / LCP / MCP
COMM	COMMUNICATION EQUIPMENT
COMP-AIR	RADIOS/PAGERS/TELEPHONE/PAGING SYSTE
COMP-GAS	AIR COMPRESSOR
COMPUTER	GAS COMPRESSOR
CONDENSER	COMPUTER EQUIPMENT
CONVEYOR	CONDENSER
CRANE	GRIT CONVEYOR
CULVERT	CRANE
DAMPER	CULVERT
DCS	DAMPER
DESTRUCT	DISTRIBUTED CONTROL SYSTEM EQUIPMENT
DETECTOR	OZONE CATALYTIC DESTRUCT
	GAS DETECTOR CL2 / CO / H2S / LEL / O2

<b>Asset Type Code</b>	<b>Description</b>
DIFFUSER	DIFFUSER
DIST PANEL	ELECTRICAL DISTRIBUTION PANEL
DRYER-AIR	AIR DRYER
DUCT HTR	ELECTRIC HEATING COIL
ELECTROLYZ	ELECTROLYZER
ELEVATOR	ELEVATOR
ENGINE	GAS / DIESEL ENGINE
EVAPORATOR	CHLORINE EVAPORATOR
FAN	FANS EXHAUST / CIRCULATION / FUMEHOOD
FEEDERMAIN	DISTRIBUTION FEEDERMAIN
FILTER	FILTER AIR / MOISTURE / OIL
FIRE	FIRE EQUIPMENT
FLEET	Fleet Asset
FLOWTUBE	FLOWTUBE
FLUIDCPLG	FLUID COUPLING
FORCEMAIN	SEWER FORCEMAIN
FOUNTAIN	RETENTION BASIN FOUNTAIN
FURNACE	FURNACE
GATE	GATE
GAUGE	GAUGE
GEARBOX	GEARBOX
GENERATOR	STANDBY GENERATOR
GRATE	GRATE FOR CULVERTS, OUTFALLS, ETC
GROUNDS	GROUNDS
HEAT EXCH	HEAT EXCHANGER
HEAT TRACE	HEAT TRACE
HMI	HUMAN MACHINE INTERFACE
HOIST	CRANE / HOIST UNIT
HOPPER	HOPPER
HYDRANT	HYDRANT
INDICATOR	VERTICAL SCALE INDICATOR
INJECTOR	CHLORINE INJECTOR
INLET	INLET GRATES
INSTRUMENT	INSTRUMENTATION EQUIPMENT
LAWNMOWER	LAWNMOWER
LIGHTING	ELECTRICAL LIGHTS
LOUVER	HVAC LOUVER
LUBRICATOR	AIR LINE LUBRICATOR
MANHOLE	MANHOLE
MCC	MOTOR CONTROL CENTRE
METER-GAS	GAS METER
METER-WTR	WATER METER

<b>Asset Type Code</b>	<b>Description</b>
MIXER	MIXER
MOTOR	MOTOR
MOTOR-PROT	MOTOR PROTECTION EQUIPMENT
OVRHD-DOOR	OVERHEAD DOOR
PGM	PERSONAL GAS MONITOR
PIPE	PIPE PROCESS / SERVICE
PIT	PIT METER / VALVE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLUMBING	DOMESTIC PLUMBING
POSITIONER	VALVE POSITIONER
PROPERTY	PROPERTY INFORMATION
PUMP	PUMP
PUMP-UNIT	ENTIRE PUMP UNIT
RECIRC	GAS RECIRCULATOR
RECTIFIER	RECTIFIER
REGULATOR	PRESSURE REGULATOR
RESERVOIR	WATER DISTRIBUTION RESERVOIR
RIVER CROS	RIVER CROSSING
ROLLUP	COST ROLLUP ASSET
RTD	RESISTIVE TEMPERATURE DETECTOR
RTU	REMOTE TERMINAL UNIT
SAFETY	SAFETY RELATED EQUIPMENT
SAMPLER	PROCESS SAMPLER
SCADA	SUPERVISORY CONTROL AND DATA AQUISITION
SCALE	WEIGH SCALE
SCBA	SELF CONTAINED BREATHING APPARATUS
SCRUBBER	ODOUR CONTROL SCRUBBER
SECURITY	SECURITY EQUIPMENT
SERVICE	ELECTRICAL SERVICES
SEWERMAIN	SEWERMAIN
SHAFT	PUMP SHAFT
SIGNAL	DCS / SCADA CONTROL SYSTEM SIGNAL
SILENCER	SILENCER
SKID	PSA SYSTEM
SKIMMER	DAF SKIMMER MECHANISM
SLUICE	SLUICE GATE
SOFTSTART	SOLIDSTATE MOTOR STARTER
SRB	STORM RETENTION BASIN
STACK	CHIMNEY OR ODOUR DISPERSION STACK
STRAINER	STRAINER
SWEEP	CLARIFIER & FERMENTER SWEEP MECHANISM
SWITCH	SWITCH LEVEL / PRESSURE / TEMPERATURE / VIBRATION

<b>Asset Type Code</b>	<b>Description</b>
SWITCHGEAR	ELECTRICAL SWITCHGEAR
SYSTEM	SYSTEM RELATING TO COMPUTER OR SOFTWARE
TANK	TANK HOLDING / DIGESTOR / CLARIFIER / AERATION
TEST	TEST EQUIPMENT
TOOL	SHOP EQUIPMENT AND TOOLS
TRACK	RAILWAY TRACK
TRANS-SW	TRANSFER SWITCH
TRANSDUCE	TRANSDUCER
TRANSFORM	TRANSFORMER
TRANSMIT	TRANSMITTER FLOW / LEVEL / PRESSURE / TEMPERATURE
UNIT-HTR	UNIT HEATER
UPS	UNINTERRUPTIBLE POWER SUPPLY
USC	ULTRASONIC CLEANER
UV MOD	ULTRA VIOLET LIGHT MODULAR LAMP ASSEMBLY
UV UNIT	ULTRA VIOLET LIGHT PROCESS UNIT
VALVE	VALVE
VSD	VARIABLE SPEED DRIVE
WATERMAIN	WATERMAIN

## 9.7 Appendix 3-1 Maintenance Benchmark Template

Format of the maintenance benchmark is under development and will be defined from the maintenance project.

## 9.8 Appendix 3-2 Lubricant schedule

Refer to IMS document: CD-CP-TO-xx - Lubricant Schedule Template.xlsx

## 9.9 Appendix 3-3 Critical Parts schedule

Refer to IMS document: CD-CP-TO-xx - Critical Parts Schedule Template.xlsx

## 9.10 Appendix 4-1 – Example attendance registers

Refer to IMS document: CD-CP-TO-xx - Training attendance register.doc

The attendance record should contain the information in the template as a minimum. Training providers may use their own format.

## 9.11 Appendix 4-2 – Example individual post training course evaluation forms

Refer to IMS document: CD-CP-TO-xx - Post Course Evaluation Form.docx

The training course evaluation should contain the information in the template as a minimum. Training providers may use their own format.

## 9.12 Appendix 5 – Example manual (WEWPCC Perimeter Road Pumping Station)

Refer to IMS document: CD-CP-TO-xx-Example Operations Manual

**KGS**  
GROUP

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Experience in Action