



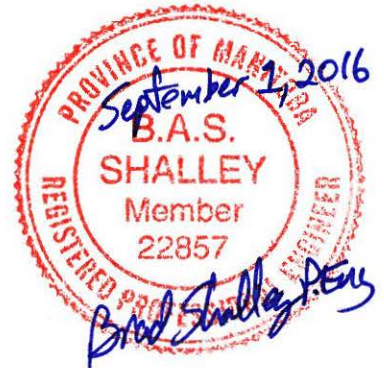
Water and Waste Department • Service des eaux et des déchets

**WEWPCC Effluent Monitoring Station
Project Commissioning Plan
S0976-14DD-PLA-0001
Rev 02
Final**

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1.0 GENERAL COMMISSIONING DETAILS

This Project Commissioning Plan provides details on how the Effluent Monitoring Station and its associated equipment will be brought on-line and verified while maintaining the existing operations of the West End Sewage Treatment Plant (WEWPCC).

The general project involves the design, construction and commissioning of a new Effluent Monitoring Station at the WEWPCC on the final effluent outfall pipeline. The new building will be located downstream of the polishing ponds but upstream of the emergency pond by-pass line. The Effluent Monitoring Station is designed to provide automated effluent flow measurement while a pumped effluent circulation system will provide a flow proportional effluent sample as required by the Environmental Act License No. 2669 E RR.

During construction, the existing overhead power lines to the plant will need to be de-energized in order to disconnect the overhead line to the existing gate chamber building and install the new disconnect switch and fuses. The plant will need to switch to the alternate electrical service to remain in operation during this transition. Temporary power will also be required for the existing gate chamber building during this transition in order to keep the existing sampling system operational while the overhead power line is de-energized.

As this project entails the construction of a new monitoring station on the existing effluent outfall pipeline downstream of the existing Gate Chamber Building, the project commissioning plan entails the following:

1. Construction of the structure and the installation of all applicable equipment.
2. Planning of the commissioning activities and development of the commissioning procedures and protocols.
3. Pre-Commissioning which is made up of the following:
 - a. Review of the commissioning procedures.
 - b. Field testing to check the operation and effectiveness of all equipment.
 - c. Review and acceptance (sign-off) of all equipment.
4. Commissioning which entails the following:
 - a. Witnessing on-site commissioning of all equipment.
 - b. Performance verification of all equipment.

5. Training of City of Winnipeg staff in the safe operation and maintenance of all Effluent Monitoring Station equipment.
6. Process Verification which is comprised of comparing the old and new effluent sampling systems for a period of 1-2 weeks.
7. Hand-over the Effluent Monitoring Station to the authorities having jurisdiction including an Asset Data Schedule and the compilation of a Commissioning Hand-over Package.

1.1 COMMISSIONING PARTICIPANTS

Commissioning for the new Effluent Monitoring Station will require the participation of the following organizations to verify the performance of the facility equipment and systems:

1. General contractor and any applicable sub-contractors.
2. Equipment manufacturers.
3. Engineering consultant – KGS Group.
4. Client – City of Winnipeg.

2.0 ROLES AND RESPONSIBILITIES

KGS is to provide comprehensive planning and leadership for the commissioning of the works and is responsible for ensuring that all commissioning activities are carried out to allow for the delivery of a fully operational facility compliant and complete in every respect. KGS Group will provide sufficient personnel to develop, manage and implement the commissioning works as illustrated by Table 1 below.

TABLE 1
ROLES AND RESPONSIBILITIES

Item	Task Description	Responsibility		
		Company	Department (If Applicable)	Individual (If Applicable)
1.0	General Requirements			
1.1	Consult and coordinate commissioning with the City Operations personnel as required.	KGS, City		PM
1.2	Schedule and coordinate all commissioning works in coordination with the contractor's schedule.	KGS		PM
1.3A	Supply all commissioning records for performance, reliability, durability, accessibility, maintainability and operational efficiency under all operating conditions.	Contractor		
13.B	Review all commissioning records for performance, reliability, durability, accessibility, maintainability and operational efficiency under all operating conditions.	KGS, City	Applicable Disciplines	Applicable Staff
1.4	Ensure that the overall commissioning records demonstrate compliance to the specifications and the overall project design requirements.	KGS	Applicable Disciplines	Applicable Staff
1.5	Ensure that all equipment and control system settings are documented.	KGS		PM
1.6	Monitor, witness and certify the accuracy of the reported records.	KGS	Applicable Disciplines	Applicable Staff
1.7	Sign-off on all commissioning and training records.	KGS	Applicable Disciplines	Applicable Staff
1.8	Contractor to ensure appropriate measures regarding safety, health and environmental aspects are implemented throughout the commissioning activities.	Contractor		
1.9	Prepare agenda as well as lead and record the minutes of the commissioning meetings.	KGS		PM
1.10	Review, access and approve the commissioning documentation produced by the Contractor.	KGS		PM
1.11	Ensure that the commissioning process meets the effluent licencing requirements.	KGS	Mechanical	Rudy Derksen,

Item	Task Description	Responsibility		
		Company	Department (If Applicable)	Individual (If Applicable)
				Brad Shalley
2.0	Planning			
2.1	Define and plan the overall commissioning activities.	KGS, Contractor	Applicable Disciplines	Applicable Staff
2.2	Develop the commissioning procedures and protocols to fully commission the facility.	KGS, Contractor	Applicable Disciplines	Applicable Staff
3.0	Pre-Commissioning			
3.1	Specify and develop pre-commissioning activities including Factory Acceptance Testing (FAT's), on-site inspection and testing of equipment incorporated into the project.	KGS	Applicable Disciplines	Applicable Staff
3.2	Contractor to perform pre-commissioning activities.	Contractor		
3.3	Manage and provide oversight for the pre-commissioning. Ensure that all required pre-commissioning work is completed.	KGS		PM
3.4	Witness the PLC and HMI FAT's.	KGS	Applicable Disciplines	Applicable Staff
3.5	Witness 33% of the pre-commissioning tests.	KGS	Applicable Disciplines	Applicable Staff
3.6	Review all pre-commissioning records including testing forms.	KGS	Applicable Disciplines	Applicable Staff
3.7	Organize and file all pre-commissioning records with the City.	KGS		PM
4.0	Commissioning			
4.1	Be present during on-site commissioning and witness commissioning activities. Start-up, test, verify and document that the flow meter, sampling system, HVAC system, automation system and all associated controls perform as designed for all operational scenarios.	KGS, City, Contractor	Applicable Disciplines	Applicable Staff
4.2	Verify performance of the flow meter.	Contractor		
4.3	Verify performance of the effluent circulation pump.	Contractor		
4.4	Verify performance of the effluent circulation vacuum priming system (pump and valve).	Contractor		
4.5	Verify performance of the air compressor.	Contractor		
4.6	Verify performance of the ISOLOK SAB sampler.	Contractor		
4.7	Verify performance of the HVAC system.	Contractor		
4.8	Verify performance of the PLC and HMI.	Contractor		
4.9	Verify performance of the upstream gate. Perform leakage tests.	Contractor		
4.10	Verify performance of the wet well gate. Perform leakage tests.	Contractor		
5.0	Training			
5.1	Coordinate and manage two one (1) hour classroom sessions to provide project overview training to City personnel. Training will include overall operation and maintenance requirements for the new Effluent Monitoring	KGS	Mechanical, Electrical, Automation	Brad Shalley, Jason Bouchard, Dustin Wilson

Item	Task Description	Responsibility		
		Company	Department (If Applicable)	Individual (If Applicable)
	Station. Appropriate training material hand-outs will be provided.			
5.2	Provide quality assurance and overall packaging of the training program, although delivery of selected portions of the training may be provided by the Contractor and/or a subcontractor.	KGS	Applicable Disciplines	Applicable Staff
5.3	Provide personnel to participate in the training for the operation and maintenance of the facility.	City		
5.4	Deliver selected portions of the equipment training.	Contractor		
6.0	Process Verification			
6.1	Compare the old and new effluent monitoring systems for a period of 1-2 weeks.	City		
7.0	Asset Data Schedule			
7.1	KGS will provide a comprehensive list of all maintainable assets along with their associated data. This spreadsheet will be in the format defined by the City for uploading into the City's Oracle Work and Asset Management (OWAM) system.	KGS	Applicable Disciplines	Applicable Staff
8.0	Commissioning Hand-over Package			
8.1	KGS will compile and handover to the City all commissioning documentation including but not limited to: i. Commissioning plans and procedures; ii. Evidence of commissioning verification; iii. Deficiency reports and corrective actions taken; iv. Training material and records. v. Other commissioning documents as required.	KGS	Applicable Disciplines	Applicable Staff

3.0 SCHEDULE

The anticipated commissioning schedule is as follows on Table 2 below.

TABLE 2
SCHEDULE

Item	Date	Description	Responsibility
1	21/11/16	Construction commences.	Contract Administrator, City and Contractor
2	24/03/17	Commissioning Planning commences	KGS
3	07/04/17	Pre-Commissioning Tasks commence	KGS and Contractor
4	28/04/17	Performance Verification starts	KGS
5	12/05/17	Commissioning Tasks commence.	KGS and Contractor
6	16/05/17	Training	KGS, City and Contractor
7	18/05/17	Prepare Commissioning Handover Package	KGS
8	22/05/17	Present Handover Package to City.	KGS

4.0 COMMISSIONING SPECIFICATIONS AND OBJECTIVES

Deliverables relating to the commissioning process are to provide information for the start-up, testing, operation and acceptance of the components, equipment and systems installed as part of the design of the Effluent Monitoring Station facility. Specific deliverables include:

1. Commissioning specifications.
2. Start-up, pre-commissioning activities and documentation requirements for the equipment and systems.
3. Completed installation checklists (ICL).
4. Completed product information (PI) sheets/reports.
5. Completed performance verification (PV) reports.
6. Descriptions of commissioning activities and documentation.
7. Witnessed tests.
8. Training Plans.
9. Commissioning reports.
10. Prescribed activities during warranty period.

Commissioning specifications applicable to the design and construction of the Effluent Monitoring Station are as follows:

1. The Contractor shall submit testing and field commissioning procedures for review and acceptance by KGS Group and the City of Winnipeg. The procedures are to include record sheets on which the results of the various checks and tests shall be recorded, dated and approved by the supplier and/or installation contractor and KGS Group.
2. All submitted procedures and tests are to reference the applicable drawings and measurements that are to be taken including tolerances.
3. The Contractor shall advise KGS Group and the City of Winnipeg in writing when the work may be inspected before proceeding with the next phase of the installation and commissioning. The equipment and systems shall not be started before the approval of KGS Group has been obtained and the equipment has been properly lubricated (if applicable) and all guards or other safety devices have been installed.

4. The Contractor shall perform all site tests of the individual equipment and systems to demonstrate that the systems meet the requirements of the technical specifications.
5. The Contractor is responsible for providing all of the necessary equipment for conducting the required field tests. The proposed test plan and schedule shall first be approved by KGS Group and the City of Winnipeg and the testing shall be performed in the presence of KGS Group.
6. Any defects which become evident during the testing shall be immediately corrected at the Contractor's expense and the tests repeated until the work is proven satisfactory.
7. The site tests, at a minimum, shall prove the following:
 - a. Static tests (i.e.: pressure tests, valve leak tests, etc.)
 - b. Running tests to prove the following:
 - i. All clearances and alignments are in order.
 - ii. Lubrication (if applicable) is adequate.
 - iii. Intakes, headers, strainers, seals and filters are sufficiently quiet.
 - iv. Control devices operate correctly and satisfactorily.
 - v. All circuits, controls and interlock sequences of operation are correct.
 - vi. All protective and indicating devices operate satisfactorily.
 - vii. Motor/pump running currents under no load and full load are within acceptable ranges.
8. No approval, written or implied, by KGS Group or the City of Winnipeg of any of the work or supply of the systems covered within the technical specifications shall relieve the Contractor from providing equipment and systems in accordance with the technical specification.
9. The Contractor is responsible for providing all necessary "commissioning spare parts". Required commissioning spare parts are:
 - a. HVAC Filters
 - b. Sample hose between the ISOLOK sampler and the refrigerator.

Commissioning spare parts are to be clearly identified as "commissioning spare parts" so they do not get mixed up with the City of Winnipeg's spare parts or the installation parts of the original supply. Commissioning spare parts will be interchangeable with, and of the same materials and workmanship as the corresponding parts of the work covered by the technical specification.
10. The Contractor is responsible for submitting the Operation and Maintenance (O&M) Manuals in accordance with the technical specifications.
11. Upon completion of the installation, all original site installation and field commissioning records shall be submitted to KGS Group for the final hand-over package.

5.0 EQUIPMENT AND TOOLS

The anticipated resources and equipment required to complete these commissioning activities are to include, but are not limited to the following:

1. One portable Siemens In-situ SITRANS F M verification tool is to be provided by the Contractor and handed over to the City of Winnipeg's WEWPCC staff as part of this project. The tool is valued at around \$25,000.
2. Any other portable equipment required to calibrate and commission the ISOLOK Series SAB Automatic Sampler, the electrical systems, the PLC and/or the HMI.

6.0 PRE-COMMISSIONING AND START-UP PROCEDURES

The pre-commissioning tasks are broken up by discipline as follows. For each of the tasks outlined below, detailed procedure and record sheets will be developed to document the pre-commissioning of the facility. Refer to Appendix B.1 for relevant City of Winnipeg Electrical and Instrumentation Checklists to be employed during pre-commissioning. Any forms not provided shall be developed in an organized fashion, in a computer generated format.

The Contractor shall be responsible for the pre-commissioning work, including the pre-startup testing of the equipment under the direction and leadership of the Contract Administrator.

6.1 ARCHITECTURAL AND STRUCTURAL

The architectural and structural pre-commissioning tasks include the following:

1. Conduct thermographic surveys of the exterior building envelope after it has been completed to ensure appropriate level of tightness. Perform the test before the outdoor ambient temperature rises above the indoor ambient temperature. Record the weather conditions at the time of the test.

6.2 MECHANICAL

The mechanical pre-commissioning tasks entail the following:

1. Electromagnetic flow meter pre-commissioning includes:
 - a. Factory Acceptance Testing (FAT's) for the flow meter sensor and transmitter.
 - b. Perform calibration on the electromagnetic flow meter in-situ utilizing the portable verification tool.
2. Perform effluent circulation loop pump "Bump" tests for rotation and flow.
3. Perform dry well sump pump "Bump" tests for rotation and flow.
4. Perform pressure (leak) tests on all water and air piping.
5. Perform tests on the air compressor for pressure and flow.
6. Perform tests on the vacuum pumping system to ensure a vacuum is available to prime the effluent circulation loop pump.

7. Perform tests on the HVAC fan for rotation, RPM and belt tension.
8. Perform tests on the Duct Heater for operation.
9. Perform tests on the Unit Heaters for operation.
10. Perform tests on all modulating dampers for actuation and positive closure.
11. Verify that all flow control valves (check valves, ball valves, etc.) operate correctly.
12. Verify pressure gauges operate correctly.

6.3 ELECTRICAL

The electrical pre-commissioning tasks are as follows:

1. Perform high voltage (12.47 kV) cable testing, disconnect switch testing and operation, verify that the correct high voltage fuses are installed and perform 45 kVA transformer testing.
2. Verify that all distribution panel boards are installed and that the breakers are operational.
3. Verify that all motor starters operate as required in both automatic and manual modes.
4. Verify the operation of all lights, both indoor and outdoor.
5. Verify that the motion sensor light switch controls the lighting and the HVAC system.
6. Verify that the new power supply to the existing effluent gate chamber building is energized and that all existing equipment is operational on the new power supply.

6.4 AUTOMATION

The automation pre-commissioning tasks are as follows:

1. Perform fibre-optic cable testing as follows:
 - a. Perform cable length measurement, fiber fracture inspection and construction defect inspection using an optical time domain reflectometer.
 - b. Perform connector and splice integrity test using an optical time domain reflectometer.

- c. Perform cable attenuation loss measurement with an optical power loss test set.
 - d. Perform connector and splice attenuation loss measurement from both ends of the optical cable with an optical power loss test set.
2. PLC panel pre-commissioning includes:
- a. Factory Acceptance Testing (FAT's) for all panel internal wiring, the PLC and the HMI.
 - b. Loop checks to all field device signals to the PLC including the flow meter, temperature transmitters, motor starts, level switches and the like.
 - c. Verify the PLC program operations.
 - d. Verify communications between the PLC and the HMI.
 - e. Verify HMI operations.
 - f. Verify operation of the UPS and the duration of the battery power.
 - g. Verify communications to and from the plant DCS system.
 - h. Verify all signals and alarms on the HMI are correct.
3. Verify that all signals and alarms on the plant DCS system indicate correctly.

6.5 START-UP

Equipment manufacturers and suppliers (under the Contractor's direction), are required to start-up the following equipment and systems:

1. Electromagnetic flow meter (Siemens).
2. PLC and HMI systems.

KGS Group will monitor at least 33% of these start-up activities called out in the RFP. Any start-up deficiencies discovered will be rectified by the Contractor to the satisfaction of the Contract Administrator.

7.0 COMMISSIONING PROCEDURES

The commissioning tasks are also broken up by discipline as follows. For each of the tasks outlined below, detailed procedure and record sheets (developed by KGS Group and the equipment suppliers and approved by the City of Winnipeg) will be employed to document the commissioning of the facility. Again, please refer to Appendix B.1 for relevant City of Winnipeg Electrical and Instrumentation Checklists to be employed during pre-commissioning (and commissioning as appropriate). The Contractor will perform the tests under the direction and leadership of the Contract Administrator. KGS Group will monitor the commissioning activities as specified in Section 2.0, Roles and Responsibilities above; and upon satisfactory completion of the commissioning, will prepare the commissioning report.

7.1 ARCHITECTURAL AND STRUCTURAL

There are no architectural or structural commissioning tasks required.

7.2 MECHANICAL

The high level mechanical commissioning tasks below will review and validate the performance of the following. Detailed commissioning tasks will be developed by KGS Group further into the project:

1. Review operation of the new slide gate in the existing gate chamber. Perform a gate leakage test on the new slide gate installed on the effluent discharge pipeline to ensure no flow passes the seals. Verify the operation of the slide gate pedestal operator.
2. Review operation of the new slide gate in the Effluent Monitoring Station wet well. Perform a gate leakage test on the new slide gate installed in the wet well weir. Verify the operation of the slide gate pedestal operator.
3. Review operation of the electromagnetic flow meter and perform flow tests. Generate three different flows by adjusting the stop logs and verify that the sample time and quantity is proportional to the flow.
4. Review and verify operation of the ISOLOK automatic sampling system to confirm capture of the effluent for the daily composite sample.
5. Review and verify operation of the effluent circulation loop pumping system.

6. Perform Testing, Adjusting and Balancing (TAB) on the HVAC system. TAB reports to be approved by the Consultant.
7. Review and verify operation of the building HVAC system. Perform supply fan balancing and confirm the inline duct heater operation for various heating scenarios by adjusting the thermostat set points.
8. Review and verify operation of the compressed air system.
9. Review and verify operation of the dry well sump pump system.

7.3 ELECTRICAL

The high level electrical commissioning tasks below will review and validate the performance of the following. Detailed commissioning tasks will be developed by KGS Group further into the project:

1. Power supply to the new Effluent Monitoring Station and demonstrate the operation of the new high voltage disconnect switch.
2. Operation of the power distribution system, all new panel boards and convenience receptacles.
3. Interior lighting system and HVAC system operation on the motion sensor.
4. Operation of the emergency lighting system and the illumination levels after 30 minutes.
5. Exterior lighting operation.

7.4 AUTOMATION

The high level automation commissioning tasks below will review and validate the performance of the following. Detailed commissioning tasks will be developed by KGS Group further into the project:

1. PLC operation with the following instrumentation:
 - a. Electromagnetic flow meter
 - b. Temperature
 - c. Humidity
 - d. Circulation loop flow

- e. Circulation pump prime
 - f. Sump level.
2. HMI operation and alarms.
 3. Operation of the 24VDC UPS for 1 hour with utility power removed.
 4. Operation of communications with the plant DCS through the fibre optic communication link.
 5. Operation of communications for the external portable sampler connection.
 6. Wet well and dry well level alarm operations.
 7. Building temperature monitor operation.
 8. Flow meter display and operation.
 9. Operation of the entire automation system under various conditions.
 10. Plant DCS system operation and alarms to ensure all indications and alarms appear and are displayed correctly.

8.0 PERFORMANCE VERIFICATION AND CERTIFICATION

The Effluent Monitoring Station systems will be monitored for alarms. Any alarms that could relate to a Contractor deficiency shall be added to the Contractor's deficiency list. Furthermore, 30 days performance is not a requirement of Substantial Performance.

8.1 ARCHITECTURAL AND STRUCTURAL

There are no architectural or structural performance verification tasks required.

8.2 MECHANICAL

The mechanical process verification tasks required are as follows:

1. City of Winnipeg will verify the performance of the ISOLOK automatic sampling system against the existing sampler inside the Gate Chamber Building for a period of 1-2 weeks to ensure equivalent volumes and appropriate sample quality.
2. The ventilation and temperature of the Effluent Monitoring Station will be monitored via the HMI trending for 30 days and will validate that there are no abnormal deviations.

8.3 ELECTRICAL

The electrical process verification tasks required are as follows:

1. Voltage and current monitoring and recording (logging) of the Effluent Monitoring Station equipment under various operating scenarios.
2. Record the illumination levels during normal operation.
3. Record the emergency lighting illumination levels after operation for 30 minutes.

8.4 AUTOMATION

The automation process verification tasks required are as follows:

1. City of Winnipeg to monitor the Effluent Monitoring Station Automation System including all alarms.

9.0 PROJECT TRAINING PLAN

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

1. How to operate the systems within the station safely, reliably and in a cost-effective and energy-efficient manner in both normal and emergency modes under all conditions.
2. How to provide effective on-going inspection and measurement of the system's performance.
3. Proper preventative maintenance practices along with diagnosis and trouble-shooting information.

For the training sessions, KGS Group will provide a description of the facility systems with instruction on the design philosophy, criteria and intent. The Contractor and any required certified factory-trained manufacturers' personnel will provide specific instruction on the start-up, operation and shut-down of their specific equipment with emphasis on the components, control features, servicing and maintenance. It is expected that Siemens will provide instruction on how to operate the electromagnetic flow meter and the Contractor will provide instruction on the operation of the PLC and HMI system.

The project training plan for the overall operation and maintenance of the equipment within the Effluent Monitoring Station is comprised of the following subsections.

9.1 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

Training for the operation and maintenance of the following Effluent Monitoring Station equipment is required:

1. Siemens electromagnetic flow meter.
2. Sentry ISOLOK series SAB automatic sampler.
3. Effluent circulation loop pump.
4. Effluent circulation loop vacuum pumping system.
5. Building HVAC system.

6. Wet Well slide gate.
7. Automation System including the PLC and the HMI.

9.2 TRAINING RESPONSIBILITIES

As summarized under Item 5 from Section 2.0, Roles and Responsibilities above, KGS Group is responsible for the coordination, quality assurance, overall packaging and presentation of two one (1) hour classroom sessions to provide training to City of Winnipeg personnel. Delivery of selected portions of the training will be provided by the Contractor and/or a subcontractor as illustrated below. Training will include the overall operation and maintenance requirements for the new Effluent Monitoring Station and appropriate training material hand-outs will be provided.

The City of Winnipeg is responsible for providing appropriate personnel to participate in the training for the operation and maintenance of the facility.

The Contractor is responsible for delivery of selected portions of the equipment operation and maintenance training including but not limited to:

- Electromagnetic flow meter supplier - Siemens flow meter sensor and transmitter.
- ISOLOK automatic sampling system supplier - Sentry ISOLOK Series SAB automatic sampler system.
- Pump and vacuum pump supplier - effluent circulation loop pumps.
- PLC control panel supplier - PLC system.

KGS Group foresees providing the training for the following activities:

- KGS Group electrical personnel to provide training on the operation and maintenance for the Effluent Monitoring Station electrical, controls and automation.
- KGS Group mechanical personnel to provide training on the operation and maintenance for the balance of plant equipment, namely the HVAC and sampling systems.

9.3 SESSION CONTENT

Although KGS Group is responsible for the overall training package, the individual equipment instructors will be responsible for the content and quality of their respective sections. In general, the training session content is to include:

1. A review of the facility.
2. The functional requirements of the facility.
3. The monitoring system philosophy and any limitations of the systems.
4. A review of the system layout, the equipment, controls and emergency procedures.
5. Equipment and system start-up, operation, monitoring, servicing (including trouble-shooting diagnosis), maintenance and shut-down procedures.
6. System operating sequences, including step-by-step directions for starting, operating and shutting down applicable valves, dampers, switches and control settings.
7. A review of the O&M Manual documentation.

All training materials are to be in an acceptable format to the City that permits future training procedures that provide the same degree of detail. Final review and approval of all training manuals and materials is required by the City of Winnipeg prior to the training sessions. Training materials in general will include the following:

1. "As-Built" contract documents.
2. Operating Manuals.
3. Maintenance Manuals.
4. Product Information (PI) sheets as required.
5. Supplemental training materials like presentations, training videos and/or equipment models.

10.0 COMMISSIONING DOCUMENTATION

Following the completion of all commissioning tasks required for the delivery of a fully operational and compliant facility; KGS Group will review all commissioning records for performance, reliability, durability, accessibility, maintainability and operational efficiency under all operating conditions. KGS Group will then compile all commissioning documentation into one package which demonstrates compliance to the specifications and the overall project design requirements. Once compiled, the package will be handed over to the City and will include (but not be limited to) the following:

1. Commissioning plans and procedures that meet the effluent licencing requirements.
2. Documented equipment and control system settings.
3. Evidence of pre-commissioning and commissioning verification. All records are to be filed with the City.
4. Deficiency reports and corrective actions taken.
5. Training materials and records.
6. A comprehensive list of all maintainable assets along with their associated data. This spreadsheet will be in the format defined by the City for uploading into the City's Oracle Work and Asset Management (OWAM) system.
7. Other commissioning documents as required.


11.0 STATEMENT OF LIMITATIONS AND CONDITIONS

11.1 THIRD PARTY USE OF REPORT

This report has been prepared for the City of Winnipeg (City) and their Contractors and/or potential bidders for the WEWPCC Effluent Monitoring Station project to whom this report has been addressed and use by any other party of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

APPENDIX B.1

CITY OF WINNIPEG ELECTRICAL AND INSTRUMENTATION COMMISSIONING CHECKLISTS


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

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

Visual Inspection	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:			

Insulation Resistance Test	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		Page 1 of 2
	AUTOMATION – TWISTED SHIELDED PAIRS		Cable ID:
Project	Facility:		Project Name:
	Area :		Bid Opportunity:

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

Visual Inspection	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:			

Insulation Resistance Test	Test Voltage: V		Ambient Temperature: °C		All conductors not under test grounded for each reading: <input type="checkbox"/> Yes <input type="checkbox"/> No					
	Pr	ID	Cond. 1 (+) to Gnd (MΩ)	Cond. 2 (-) to Gnd (MΩ)	Shield to Gnd (MΩ)	Pr	ID	Cond. 1 (+) to Gnd (MΩ)	Cond. 2 (-) to Gnd (MΩ)	Shield to Gnd (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. 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 and shields 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										




**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				

	INSPECTION FORM POWER CABLE, 4160V		Page 1 of 3
			Cable ID:
Project	Facility:	Project Name:	
	Area :	Bid Opportunity:	

Cable Data	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:				

Visual Inspection	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/Corona: <input type="checkbox"/> Yes <input type="checkbox"/> No	Cable Supported Appropriately: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Damage to Splices/Terminations: <input type="checkbox"/> Yes <input type="checkbox"/> No	Shield Grounded: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Bend Radius Acceptable: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

Insulation Resistance Test	Test Preparation:	Source: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Source 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.	
	Test Voltage	Insulation Resistance (MΩ)			Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
			A-GND	B-GND	
	2500V	Reading			
	Corrected to 20°C				
Comments:					



INSPECTION FORM 4160V POWER CABLE

Cable ID:

High Potential Very Low Frequency (VLF) Test	Test Preparation:		Source: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Source 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.	
	Frequency: 0.1 Hz		Waveform: sinusoidal		Ground all conductors not under test for each reading.	
	Test Voltage (RMS)	Elapsed Time (min)	Peak Leakage Current (uA)			Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
			A-GND	B-GND	C-GND	
	7000V	0				
	7000V	1				
	7000V	2				
	7000V	3				
	7000V	4				
	7000V	5				
	7000V	6				
	7000V	7				
	7000V	8				
	7000V	9				
	7000V	10				
7000V	11					
7000V	12					
7000V	13					
7000V	14					
7000V	15					
Comments:						



INSPECTION FORM 4160V POWER CABLE

Page 3 of 3

Cable ID:

Dissipation Factor (Tangent Delta) Test	Frequency: 0.1 Hz Waveform: sinusoidal										
	Test Voltage (RMS)	A			B			C			
		Tan Delta	Capacitance (nF)	Current (μ A)	Tan Delta	Capacitance (nF)	Current (μ A)	Tan Delta	Capacitance (nF)	Current (μ A)	
	2400V										
	4800V										
	Difference		/	/		/	/		/	/	
Test Summary		Comments:									
<input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed											

Connection Resistance	Termination	Connection Resistance ($\mu\Omega$) - As Left			Torque Check
		A	B	C	
	Source				<input type="checkbox"/> OK
	Dest. / Load				<input type="checkbox"/> OK
Comments:					

Final Analysis	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	

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

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.

Project	Facility:	Project Name:
	Area :	Bid Opportunity:

Cable Data	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:	


Visual Inspection	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:

Insulation Resistance Test	Test Preparation:	Source: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Source 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.	
	Test Voltage	Insulation Resistance (MΩ)			Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
			A-GND	B-GND	
	V	Reading			
	Corrected to 20°C				
Utilize 1000VDC Test Voltage for 600V rated cables, 500VDC for cables rated <= 300V.					
Comments:					

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

Final Analysis	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	

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

	INSPECTION FORM EMERGENCY LIGHTING		Page 1 of 1
			ID:
Project	Facility:	Project Name:	
	Area :	Bid Opportunity:	

Battery Unit Data	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:				

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

Visual Inspection / Cleaning	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:							

Battery Testing	Equipment Temperature:		°C	Test Summary		
	Test Results					
	Stated Design Time (From Drawings):		Min			
	Time Until Lamps Turn Off:		Min			
Comments:						

Final Analysis	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)
Performed By				
Checked By				

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:

Project	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				

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 SYSTEM

ID: _____

Resistance Checks (Ductor Test)	Point A	Point B	Resistance (mΩ)	Test Summary <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)
Performed By				
Checked By				

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.



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)
Tested By				
Witnessed By				



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)
Performed By				
Checked By				

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				

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

Starter Data	Load:		Starter Location:		Cell #:	
	Manufacturer:		Type:	Size:	Rated Voltage: V	
	Circuit Protection:	<input type="checkbox"/> Fused Disc.	Fuse Size:	A		
		<input type="checkbox"/> Breaker <input type="checkbox"/> MCP	Rating:	A	Inst. Setting:	A
	Overload Protection:	<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:		

Visual Inspection / Cleaning	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:			

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)
Performed By				
Checked By				

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INSPECTION FORM AC MOTOR, LOW VOLTAGE

Page: 1 of 2

ID:

Project	Facility:	Project Name:
	Area :	Bid Opportunity:

Motor Data	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:	

Visual Inspection / Cleaning	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

Winding Insulation Resistance	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				-	-
								-
Notes:								
(a) Testing to 10 minutes and calculation of Polarization Index is only required for motors > 150 kW (200 HP)								
Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive. Further Investigation Required. <input type="checkbox"/> Test Failed								

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



INSPECTION FORM AC MOTOR, LOW VOLTAGE

Page: 2 of 2

ID: _____

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

RTD Resistance	<input type="checkbox"/> Not Applicable					
	Actual Winding Temperature: _____ °C			Actual Bearing Temperature _____ °C		
	RTD	Resistance (Ω)	Calculated Temperature (°C)	RTD	Resistance (Ω)	Calculated Temperature (°C)
Test Summary <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.

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)
Performed By				
Checked By				

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PID CONTROLLER CHECKLIST

Project

Facility:	Project Name:
Area :	Bid Opportunity:

Controller Loop

Tag:	Description:
------	--------------

Test Checklist

No.	Item to be Inspected	Comments	Pass (P/F)
1.	Startup Test		
2.	Input signal positive bump test		
3.	Input signal negative bump test		
4.	Bumpless auto-manual control transition		
4.	Manual output capability		
5.	Bumpless manual-auto control transition		
6.	HMI graphic symbols, tag and units correct		
7.	HMI equipment faceplate correct		

Final PID Tuning Values

P :	I :	D :
------------	------------	------------

Notes:

1. Attach printouts of trends for various tests, with final PID tuning values.

Comments:

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



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)
Tested By				
Witnessed By				



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"/>	
			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				

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

Panelboard Data	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 >= 250A, or has long, short, or ground fault settings.</i>					

Visual Inspection / Cleaning	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:		

Insulation Resistance Test	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:			
	Test Voltage	Insulation Resistance (MΩ) Ground all Phases not under test!								Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
		A-GND		B-GND		C-GND		N-GND		
		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:										

Load/Feeder Breakers	Breakers < 100A and Without Inst. Setting					
	<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					



INSPECTION FORM PANELBOARD, LOW VOLTAGE


ID:

Breakers >= 100A or with Inst. Setting									
<i>List each breaker individually. Complete separate inspection form (F-BKR-MC-LV) for breaker if >= 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"/>	

Final Analysis	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)
Performed By				
Checked By				

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

Transformer Data	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 Voltage	1	2	3	4	5				Tap Setting (As Found):

Visual Inspection / Cleaning	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	

Operational Inspection	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:

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

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)
Performed By				
Checked By				

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