

CITY SUPPLIED EQUIPMENT

1. GENERAL

- .1 The City has entered into a number of equipment supply contracts based on the Bid Opportunities described in Part D. Installation of City Supplied Equipment is the responsibility of this Contractor.
- .2 The City Supplied Equipment will be delivered to and stored at the City Warehouse. The Contractor shall offload and accept equipment delivery. The cost for pick-up and delivery of equipment from the City's Warehouse to the job site will be borne by the Contractor.
- .3 The Contractor shall be responsible for all equipment at the City Warehouse.
- .4 The Contractor shall ensure that he is fully informed of precautions to be taken in the unloading of equipment and its subsequent storage including any required maintenance.
- .5 All forms referred to in this Section (Form 100, 101, 102, and 103) will be initiated by the Supply Contractor to be completed by the Contractor as detailed below.
- .6 Prior to accepting any of the equipment to be supplied by a Supply Contractor, the Contractor shall inspect the equipment. A representative from each of the following groups will be in attendance at the time of pick-up and delivery: the Supply Contractor, Contractor, and Contract Administrator. A duly executed Form 100 – Certificate of Equipment Delivery shall be completed. Any minor damage identified during the inspection shall be repaired as per the Supply Contractor's instructions at the Supply Contractor's cost. Any severe damage will be grounds for rejection of the equipment. The severely damaged equipment will be replaced at the Supply Contractor's cost. The Contractor shall accept the equipment and assume risk and responsibility for the equipment and fill out Form 100 - Certificate of Equipment Delivery.
- .7 If the Contractor's inspection reveals any deficiencies in the equipment, then these shall be noted in writing prior to the Contractor accepting the equipment. Only deficiencies noted and documented in the foregoing manner will be deemed not the responsibility of the Contractor.
- .8 The Contractor shall be responsible for the installation of City Supplied Equipment in addition to all Material supplied under this Contract. City Supplied Equipment shall be installed in accordance with the Supply Contractor's installation instructions.
- .9 For the purposes of Form 100, the Supply Contractor will be the Manufacturer.

2. SUPERVISION OF INSTALLATION, START-UP, COMMISSIONING, AND FIELD TESTING

- .1 For City Supplied Equipment, each Supply Contractor will provide the services of a qualified representative to assist in the installation, start-up, and performance testing of all of the equipment. The Contractor shall refer to Sections 01650 – Equipment Installation,

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Section 01670 – Commissioning, and Divisions 11, 15, 16, and 17 for details on the services and procedures not included in this Section. The services to be performed by the Supply Contractors are as follows:

- .1 Prior to the Contractor beginning the installation, the Supply Contractor will provide to the Contractor instructions and advice regarding the detailed requirements for the equipment installation. The Supply Contractor will be required to provide Form 101 - Certificate of Readiness to Install. The Contractor shall be required to sign Form 101 to acknowledge that he has received adequate instruction. During installation, if the Contractor has additional questions regarding installation requirements or procedures, he shall contact the Supply Contractor, with the assistance of the Contract Administrator, as required. No additional compensation to the Contractor based on claims of inadequate training from a Supply Contractor will be entertained should he install equipment improperly.
 - .2 Following the completion of the installation, the Supply Contractor will inspect the installation of the equipment to verify that it has been installed in accordance with the Supply Contractor's requirements. The Supply Contractor will be required to provide Form 102 - Certificate of Satisfactory Installation. If any deficiencies in the installation exist at the time of inspection, these shall be noted on Form 102 by the Supply Contractor. The Contractor shall be responsible for the prompt correction of these deficiencies prior to performance testing of the equipment.
 - .3 The Supply Contractor shall assist the Contractor in Performance Verification of the equipment. System Demonstration is to conform to the requirements in Section 01670 – Commissioning and Divisions 11, 15, 16, and 17.
 - .4 The Supply Contractors for City Supplied Equipment have been contracted to provide Site visits for inspection of installation and for assistance of Performance Verification.
- .2 The Contract Administrator will be responsible for the Project Master Schedule and will coordinate the services to be provided. The Contract Administrator will provide the Contractor at least twenty one (21) days advance notice of when the Supply Contractor's services will be provided.

3. OPERATION AND PERFORMANCE VERIFICATION

- .1 Equipment shall be subjected to a demonstration, running test, and performance tests after the installation has been verified and any identified deficiencies have been remedied.
- .2 Performance Verification will be conducted at two (2) different intervals, once in 2007 and the other in 2008. Performance Verification cannot be completed until the Systems Integrator integrates the controls installed under this Contract with the completed WTP SCADA system in 2008. The Contractor shall make provisions for attending all tests required during Performance Verification.

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- .3 Performance Verification tests conducted in 2007 will be conducted under the Deacon reservoir static head conditions, which is approximately 6 meters greater than the design static head condition of the future clear well.
- .4 Performance Verification in 2008 will be conducted under the design static head conditions.
- .5 Prior to any testing, the Contract Administrator will advise the Supply Contractor and the Contractor of acceptable dates when testing may be conducted. Inform the Contract Administrator at least fourteen (14) days in advance of conducting the tests and arrange for the attendance of the Supply Contractor. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Contractor and the Contract Administrator.
- .6 The Supply Contractor will conduct all necessary checks to equipment and if necessary, advise the Contractor of any further checking, flushing, cleaning, or other work needed prior to confirming the equipment is ready to run.
- .7 Once it is mutually agreed between the Contractor, Supply Contractor and the Contract Administrator that the equipment is ready to run, Performance Verification to be conducted in 2007 shall be as follows:
 - .1 Demonstration:
 - .1 The Contractor shall notify the Contract Administrator of his readiness to demonstrate the operation of the equipment. The Contract Administrator shall attend, as expeditiously as possible.
 - .2 The Contractor shall assist the Supply Contractor in demonstrating that the equipment is properly installed. Alignment, piping connections, electrical connections, etc. will be checked and if appropriate, code certifications provided.
 - .3 The Contractor shall then assist the Supply Contractor in operating the equipment for at least one (1) hour to demonstrate to himself the operation of the equipment and any required ancillary services. Local controls shall be satisfactorily verified by cycling the equipment through several start-stop operations, modulating its output, or some combination. Operating parameters such as flow, temperature, pressure, voltage, vibration, etc., will be checked to ensure that they are within the specified or Supply Contractor's recommended limits, whichever is more stringent. Any remedial measures required to ensure satisfactory operation shall be promptly undertaken.
 - .4 On satisfactory completion of the one (1) hour demonstration, the equipment shall be stopped and critical parameters, such as alignment, shall be rechecked by the Contractor.
 - .2 Running Test:
 - .1 The Contractor shall assist the Supply Contractor in performing the Running Test. The equipment shall be restarted and run continuously for a minimum of five (5)

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- days (120 hours) or as specified. During this period, as practicable, conditions shall be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the Supply Contractor, the Contractor, and Contract Administrator on the basis of the information contained in the technical specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.
- .2 Upon completion of the successful Running Test, the equipment shall be stopped and modified as necessary and be placed in a "Standby Mode" until Performance Verification in 2008. During the period between the completed installation and Performance Verification, the Contractor shall maintain the equipment as recommended by the Supply Contractor.
- .8 Once it is mutually agreed between the Contractor, Supply Contractor and the Contract Administrator, Performance Verification can be completed. Performance Verification tests shall be performed as follows:
- .1 Performance Tests:
 - .1 The Contractor shall assist the Supply Contractor in conducting the Performance tests. Testing shall be conducted under design static head conditions as practicable and agreed between the Contract Administrator, the Supply Contractor, and the Contractor.
 - .2 Performance testing will be conducted under the design static head, which means water will be drawn from the Clearwell. During the Performance testing and System Demonstration of the DBPS, water produced by the WTP will either be pumped to the in town City reservoirs or pumped back to Deacon Cell 1 via the Branch 1 Surge Tower Overflow. Pumping will be done by the Branch 1 Deacon Booster Pumps installed under this Contract.
 - .3 The equipment shall be run continuously for a minimum of seven (7) days (168 hours) in conjunction with the WTP testing. The Supply Contractor will be On-Site for a minimum of five (5) days during the performance testing.
 - .4 Performance test parameters will be as dictated in the technical specifications in the Supply Contractor's contract or as reasonably required by the Contract Administrator to prove adherence to the requirements listed in the specification.
 - .5 The Contractor shall submit the results of the Performance tests within 24 hours to the Contract Administrator, and final documented and summarized results in a format acceptable to the Contract Administrator within seven (7) Calendar Days. The Contract Administrator reserves the right to request additional testing. No equipment shall be accepted and handed over to the City prior to the satisfactory completion of the Performance test(s) and receipt of the test reports.

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- .9 Upon completion of the Performance testing, a twenty eight (28) day System Demonstration period will commence in accordance with the Project Master Schedule and as specified in Section 01670 - Commissioning. In summary, the equipment shall be operated by the Commissioning Operations Agent continuously over the twenty eight (28) day period without experiencing a critical failure. A critical failure is defined as one that prevents the equipment from operating for an eight (8) hour period or that presents a safety hazard. For equipment that is designed not to operate on a daily basis, the System Demonstration period shall be defined as twenty eight (28) consecutive days over which the piece of equipment is operated. Upon completion of the twenty eight (28) day System Demonstration period, the equipment shall be deemed to have been handed-over and accepted by the Contract Administrator, unless the Contractor or Manufacturer's Representative is notified otherwise.
- .10 All water, chemicals, temporary power (except portable generators), heating, or any other ancillary services required to complete the initial demonstration, running test and performance tests are the responsibility of the City.
- .11 Should the initial demonstration, running test, or performance tests reveal any defects, then those defects shall be promptly rectified and the demonstration, running tests, and/or performance tests shall be repeated to the satisfaction of the Contract Administrator. Additional costs incurred by the Contractor, the Contract Administrator, or the City, due to repeat demonstration, running tests, and/or performance tests shall be the responsibility of the Contractor or Supply Contractor as determined by the Contract Administrator.
- .12 On successful completion of the demonstration, running test, and performance tests, Form 103 – Certificate of Equipment Satisfactory Performance attached to Section 01650 – Equipment Installation will be signed by the Supply Contractor, the Contractor, and the Contract Administrator.
- .13 The Contractor shall affix to the tested equipment a 100 x 200 mm card reading "Operable Condition - Do Not Operate without Contractor's Permission" stenciled on in large black letters.

END OF SECTION

SUBMITTALS

1. SHOP DRAWINGS

1.1 General

- .1 Arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator of any deviations in Shop Drawings from the requirements of the Contract Documents to allow the Contract Administrator to assess the deviations.
- .2 Where all or part of the Shop Drawings are to be prepared under the stamp and seal of a Professional Engineer registered in the Province of Manitoba, the Contract Administrator will limit that review to an assessment of the completeness of the part of the submission so stamped and sealed.

1.2 Electrical and Controls Installation Information

- .1 Key information will be taken from Shop Drawings to prepare electrical and instrumentation Drawings and/or layout Drawings, control schematics, and interconnection wiring diagrams.

1.3 Submission Requirements

- .1 Coordinate each submission with requirements of the Work and Contract Documents. Individual submissions will not be reviewed until all related information is available.
- .2 Accompany all submissions with a transmittal letter, in duplicate, containing:
 - .1 Date
 - .2 Project title and Bid Opportunity number
 - .3 Contractor's name and address
 - .4 Specification Section number for each submittal
 - .5 Submittal number and revision number in the following format:
 - .1 35 - Spec Section # - Submittal # - Revision # (e.g. 35-15200-001-1).
 - .2 The first submittal is numbered 1 with sequential numbering after that for revisions.
 - .6 Identification and quantity of each Shop Drawing product

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- .7 Equipment tag number
- .8 Other pertinent data
- .3 Submissions shall include:
 - .1 Date and revision dates
 - .2 Project title and number
 - .3 Name, email address and address of:
 - .1 Contractor
 - .2 Manufacturer
 - .4 Contractor's stamp, signed by Contractor's authorized representative, certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 As required in the Specifications, the seal and signature of a Professional Engineer registered in the Province of Manitoba.
- .4 Details of appropriate portions of work as applicable:
 - .1 Fabrication
 - .2 Layout showing dimensions including identified field dimensions and clearances
 - .3 Setting or erection details
 - .4 Capacities
 - .5 Performance characteristics
 - .6 Standards
 - .7 Operating weight
 - .8 Wiring diagrams
 - .9 Single line and schematic diagrams
 - .10 Method of control of equipment and its communication with the City's SCADA system

1.4 Drawings

- .1 Original Drawings or modified standard Drawings provided by the Contractor to illustrate details of portions of Work, which are specific to the Contract requirements.

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- .2 Maximum sheet size: 850 x 1050 mm.
- .3 Submit digital (pdf) copies of Shop Drawings. The Contract Administrator will return one copy with comments transcribed.
- .4 Cross-reference Shop Drawing information to applicable portions of the Contract Documents.
- .5 Include reviewed Shop Drawings in all O&M Manuals.

1.5 Product Data

- .1 Product Data; Manufacturer's catalogue sheets, brochures, literature, performance charts, and diagrams used to illustrate standard manufactured products.
- .2 Submit twelve (12) copies of product data.
- .3 Sheet size: 215 x 280 mm.

1.6 Procedure and Routing

- .1 The Contractor shall provide to the Contract Administrator digital (pdf) copies of Shop Drawings and corresponding submittal transmittal form(s) complete with the information specified in Subsection 1.3 Submission Requirements.
- .2 The Contractor shall simultaneously email the .pdf version of these same Shop Drawings and submittal transmittal forms to the Contract Administrator. The Contractor shall ensure the .pdf version of the Shop Drawings and corresponding submittal transmittal form(s) are identical to the printed copies being distributed for review. When the total size of the e-mail is greater than 5 MB, the Contractor shall post the .pdf version of the Shop Drawings and submittal transmittal form(s) to an accessible place on the internet (provided by the Contract Administrator) and an e-mail notification is to be sent to all parties listed above when posting is complete.
- .3 The routing and the names of individuals responsible for receiving submittals will be identified by the Contract Administrator at the pre-construction meeting held pursuant to D4.2.
- .4 Upon review of the Shop Drawings, the Contract Administrator will e-mail the .pdf version of the annotated Shop Drawings and corresponding transmittal form(s) to the Contractor. When the total size of the e-mail is greater than 5 MB, the Contract Administrator will post the .pdf version of the Shop Drawings and corresponding transmittal form(s) to the same accessible place on the internet and an e-mail notification will be sent to the Contractor. Two (2) printed copies of the reviewed Shop Drawings will be sent back to the Contractor.

SUBMITTALS

1.7 Shop Drawing Review

- .1 Shop Drawing review by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for the approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.
- .2 Review by the Contract Administrator shall not relieve the Contractor of his responsibility for errors or omissions in Shop Drawings or for proper completion of the Work in accordance with the Contract Documents.
- .3 Shop Drawings will be returned to the Contractor with one of the following notations:
 - .1 When stamped "REVIEWED", distribute additional copies as required for execution of the Work.
 - .2 When stamped "REVIEWED AS MODIFIED", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".
 - .3 When stamped "REVISE AND RE-SUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.
 - .4 When stamped "NOT REVIEWED", submit other drawings, brochures, etc., for review consistent with the Contract Documents.
 - .5 Only Shop Drawings bearing "REVIEWED" or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.
- .4 After submittals are stamped "REVIEWED" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.
- .5 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.
- .6 Make changes in Shop Drawings which the Contract Administrator may require consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.
- .7 Shop Drawings indicating design requirements not included in the Contract Documents require the seal of a Professional Engineer registered in the Province of Manitoba. If requested, submit engineering calculations for review, sealed by a Professional Engineer.

1.8 Operating and Maintenance Manuals

- .1 Refer to Section 01730 – Operations and Maintenance Manuals.

END OF SECTION

QUALITY CONTROL

1. CODES AND STANDARDS

- .1 In the case of a conflict or discrepancy between the Contract Documents and the governing standards, the more stringent requirements shall apply.
- .2 Unless the edition number and date are specified, the reference to the Manufacturer's and published codes, standards, and Specifications are to be the latest edition published by the issuing authority, current at the date of Submission Deadline.
- .3 Reference standards and Specifications are quoted in this Specification to establish minimum standards. Work in quality exceeding these minimum standards conforms to the Contract.
- .4 Where reference is made to a Manufacturer's direction, instruction, or Specification, it is deemed to include full information on storing, handling, preparing, mixing, installing, erecting, applying, or other matters concerning the Products pertinent to their use and their relationship to the products with which they are incorporated.
- .5 Confine apparatus, the storage of products, and the operations of workers to limits indicated by laws, ordinances, permits, and by directions of the Contract Administrator. Do not unreasonably encumber the premises with Products.
- .6 Where reference is made to regulatory authorities, it includes all authorities who have, within their constituted powers, the right to enforce the laws of the Place of Work.

2. TESTING AND QUALITY CONTROL

- .1 Provide to the Contract Administrator, when requested and consistent with progress of the Work, test results and designs specified in the Contract Documents or required by by-laws, statutes, and regulations relating to the Work and the preservation of public health, including the following:
 - .1 Inspection and testing performed exclusively for the Contractor's convenience.
 - .2 Testing, adjusting, and balancing of process equipment and systems, conveying equipment and systems, mechanical, electrical, and I&C equipment and systems.
 - .3 Mill tests and certificates of compliance.
 - .4 Tests for reinforcing steel unidentified by mill test reports.
- .2 The Contract Administrator will select and the City will pay for the services of a testing agency or laboratory for material quality control tests that are required but not specified. Tests required by by-laws, statutes, and regulations applicable to the Work are the responsibility of the Contractor.
- .3 Compliance and performance testing of equipment, pipe, conduit, wiring, and other items covered in other Divisions of this specification are the responsibility of the Contractor,

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- unless specified otherwise. The City may replicate any series of tests to provide random checks on the compliance and performance tests at the City's cost.
- .4 Remove and replace products indicated in inspection and test reports as failing to comply with the Contract Documents.
 - .5 Correct improper installation procedures reported in the inspection and test reports.
 - .6 Pay the costs for the re-inspection and re-testing of replaced Work.
 - .7 It is not the responsibility of the inspection and testing agents to supervise, instruct in current methods or accept or reject a part of the Work, but only to inspect, test, and to report conditions.
 - .8 Notify the Contract Administrator and the appropriate inspection and testing agent not less than forty eight (48) hours prior to the commencement of the part of the Work to be inspected and tested.
 - .9 Ensure the presence of the authorized inspection and testing agent at the commencement of the part of the Work specified to be inspected or tested.
 - .10 Ensure the inspection and testing reports are issued within forty eight (48) hours, and that the Contract Administrator is notified forthwith if the report indicates improper conditions or procedures.
 - .11 Cooperate with and provide facilities for the inspection and testing agents to perform their duties.
 - .12 Provide proper facilities for the storage of specimens or samples at correct temperature, free from vibration or damage in accordance with the instruction of the inspection and testing agent and the governing standard.
 - .13 Submit four (4) copies of each laboratory test report, unless specified otherwise, each copy signed by a responsible officer of the inspection and testing laboratory. Each report is to include:
 - .1 Date of issue
 - .2 Contract name and number
 - .3 Name and address of inspection and testing company
 - .4 Name and signature of inspector or tester
 - .5 Date of inspection or test
 - .6 Identification of the product and Specification section covering inspected or tested Work

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- .7 Location of the inspection or the location from which the tested product was derived
- .8 Type of the inspection or test
- .9 The remarks and observations on compliance with the Contract Documents
- .14 Correct defective Work within the Contract Time; the performing of such Work is not a cause for an extension of the Contract Time.

END OF SECTION

MATERIAL AND EQUIPMENT

1. PRODUCTS

1.1 Quality of Materials

- .1 Provide new materials, equipment and articles incorporated in the Work, not damaged or defective and of the best quality (compatible with Specifications) for the purpose intended. If requested furnish evidence as to type, source and quality of products provided.
- .2 Defective materials, equipment and articles whenever found may be rejected regardless of previous inspection. Inspection by the Contract Administrator or an inspector does not relieve the Contractor of his responsibility but is merely a precaution against oversight or error. Remove and replace defective materials at own expense and be responsible for all delays and expenses caused by rejection.
- .3 Should any dispute arise as to the quality or fitness of materials, equipment or articles, the decision rests strictly with the Contract Administrator based upon the requirements of the Contract Documents.
- .4 Unless otherwise indicated in the Specifications, maintain uniformity of manufacturer for any particular or like item throughout the building.
- .5 Permanent labels, trademarks and nameplates on materials, equipment and articles are not acceptable in prominent locations except where required for operating instructions and when located in mechanical or electrical rooms.

1.2 Storage, Handling and Protection of Materials

- .1 Handle and store materials in a manner to prevent damage, contamination, deterioration and soiling and in accordance with manufacturer's recommendations when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturers' seals and labels intact. Do not remove packaging or bundling until required in the Work.
- .3 Materials subject to damage from weather are to be stored in weatherproof enclosures.
- .4 Store cementitious materials clear of earth or concrete floors and away from walls.
- .5 When used for grout or mortar materials, keep sand clean and dry. Store on polyethylene and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet material, lumber, etc. on flat, solid supports and keep clear of ground.
- .7 Store and mix paints in a room assigned for this purpose. Keep room under lock and key at all times. Remove oily rags and any other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense.

MATERIAL AND EQUIPMENT

1.3 Manufacturers' Directions

- .1 Unless otherwise specified, install or erect all products in accordance with manufacturers' recommendations. Do not rely on labels or enclosures provided with products. Obtain instructions directly from manufacturers.
- .2 Notify the Contract Administrator, in writing, of any conflicts between the Specifications and manufacturers' instructions so that the Contract Administrator may establish the course of action.
- .3 Improper installation or erection of products due to failure in complying with these requirements authorizes the Contract Administrator to require any removal and re-installation that may be considered necessary, at no increase in Contract Price.

1.4 Transportation Costs of Materials

- .1 Pay all costs for transportation of materials required for the Work.

2. WORKMANSHIP

2.1 General Requirements

- .1 Workmanship is to be of the best quality executed by workers fully experienced and skilled in their respective trades.
- .2 At all times enforce discipline and good order among workers. Do not employ any unfit person or anyone unskilled in the duties assigned to him. The Contract Administrator reserves the right to require the removal from site of workers deemed incompetent, careless, insubordinate or otherwise objectionable.
- .3 Decisions as to the quality or fitness of workmanship in cases of any dispute rests solely with the Contract Administrator whose decision is final.

2.2 Coordination

- .1 Coordinate the work of all Subcontractors.
- .2 Ensure that all Subcontractors examine the Drawings and Specifications for other parts of the Work which may affect the performance of their work.
- .3 Ensure that sleeves, openings and miscellaneous equipment bases are provided as required for the Work.
- .4 Ensure that items to be built in are supplied when required with all necessary templates, measurements and Shop Drawings.

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2.3 Concealment

- .1 In finished areas conceal all pipes, ducts and wiring except where indicated otherwise on Drawings or in Specifications.
- .2 Before installation inform the Contract Administrator if there is a contradictory situation. Install as directed.

2.4 Location of Fixtures

- .1 Consider the location of fixtures, outlets, and other mechanical and electrical items indicated on Drawings as approximate. The actual location of these items is to be as required or directed to site conditions at the time of installation and as is reasonable.
- .2 Before installation inform the Contract Administrator if there is a contradictory situation. Install as directed.

2.5 Cutting and Remedial Work

- .1 Perform all cutting and remedial work that may be required to make the several parts of the Work come together properly. Coordinate and schedule the Work to ensure that cutting and remedial work are kept to a minimum.
- .2 Employ specialists familiar with the materials affected in performing cutting and remedial work. Perform in a manner to neither damage nor endanger any portion of the Work.
- .3 Do not cut, drill or sleeve any load-bearing members without written acceptance of the Contract Administrator.
- .4 The Contractor is to perform work so that no dust is generated.

2.6 Fastenings

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent material unless otherwise specified.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive, non-staining fasteners and anchors for securing exterior work unless otherwise specified.
- .4 Space anchors within their load limit or shear capacity and ensure that they provide positive permanent anchorage. Wood plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and lay out neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

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2.7 Protection of Work In Progress

- .1 Adequately protect all work completed and in progress. Repair or replace all damaged work.
- .2 Prevent overloading of any part of the Work.

3. MEASUREMENT

3.1 Metric Project

- .1 Unless otherwise noted, this Project has been designed and is to be constructed in the S.I. nominal metric system of measurements.

END OF SECTION

EQUIPMENT INSTALLATION

1. INTENT

- .1 This Section describes the general requirements for all equipment supplied under the Contract relating to the installation, supervision of installation, testing, operation, and Performance Verification. The Contractor shall be responsible for the installation work, testing, operation, and Performance Verification of equipment in this Contract and for City Supplied Equipment, reference Section 01210 – City Supplied Equipment.

2. EXPERTISE AND RESPONSIBILITY

- .1 The Contract Administrator recognizes the expertise of the Contractor.
- .2 Should the Contract Administrator issue an Addendum, Field Order, Change Order, or Instruction to change the Work which would, in the opinion of the Contractor, compromise the success or safety of the Work, then it shall be incumbent on the Contractor to notify in writing the Contract Administrator to this effect within two (2) days.

3. EQUIPMENT DELIVERY

- .1 The Contractor shall be responsible for equipment delivery to the Site. When the Contractor accepts the equipment delivery, he shall certify the delivery by completing Form 100 – Certificate of Equipment Delivery, where required by the Contract Administrator.
- .2 Ten (10) days before delivery, notice shall be given to the Contract Administrator so that arrangements for receipt and for inspection can be made. The shipping lists of materials will be carefully checked by the Manufacturers Representative in the presence of the Contract Administrator and the Contractor.
- .3 The Contractor shall be responsible for all equipment at the Site or any alternative storage location.
- .4 The Contractor shall ensure that he is fully informed of precautions to be taken in the unloading of equipment and its subsequent storage including any required maintenance.
- .5 If equipment off-site storage is required, then the second move of the equipment to the Site will be at the Contractor's cost.

4. INSTALLATION ASSISTANCE

- .1 Before commencing installation of equipment, the Contractor shall arrange for the attendance of the Manufacturer's Representative to provide instructions in the methods, techniques, precautions, and any other information relevant to the successful installation of the equipment.

EQUIPMENT INSTALLATION

- .2 The Contractor shall inform the Contract Administrator, in writing, of the attendance at the Site of any Manufacturer's Representative for installation training at least fourteen (14) days prior to arrival.
- .3 When the Manufacturer's Representative is satisfied that the Contractor is aware of all installation requirements, he shall so certify by completing Form 101 – Certificate of Readiness to Install attached to this Specification.
- .4 The completed form shall be delivered to the Contract Administrator prior to departure of the Manufacturer's Representative from the site.
- .5 Installation of the equipment shall not commence until Contract Administrator has advised that he has received the completed Form 101 – Certificate of Readiness to Install.
- .6 Separate copies of Form 101 – Certificate of Readiness to Install shall be used for different equipment.

5. INSTALLATION

- .1 If necessary, or if so directed by the Contract Administrator during the course of installation, the Contractor shall contact the Manufacturer's Representative to receive clarification of installation procedures, direction, or any other additional information necessary to continue or complete the installation in an appropriate manner.
- .2 If it is found necessary, or if so directed by the Contract Administrator, the Contractor shall arrange for the Manufacturer's Representative to visit the site to provide assistance during installation, all at the Contractor's cost.
- .3 Prior to completing installation, the Contractor shall inform the Manufacturer's Representative and arrange for the attendance at the site of the Manufacturer's Representative to verify successful installation.
- .4 The Manufacturer's Representative shall conduct a detailed inspection of the installation including alignment, electrical connections, belt tensions, rotation direction, running clearances, lubrication, workmanship and all other items as required to ensure successful operation of the equipment.
- .5 The Manufacturer's Representative shall identify any outstanding deficiencies in the installation.
- .6 The deficiencies shall be rectified by the Contractor and the Manufacturer's Representative will be required to re-inspect the installation, at the Contractor's cost.
- .7 When the Manufacturer's Representative accepts the installation, he shall certify the installation by completing Form 102 – Certificate of Satisfactory Installation, attached to this Specification.
- .8 Deliver the completed Form 102 – Certificate of Satisfactory Installation to the Contract Administrator prior to departure of the Manufacturer's Representative from the Site.

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- .9 Tag the equipment with a 100 x 200 mm card stating "Equipment Checked. Do Not Run." stenciled in large black letters. Sign and date each card.
- .10 Provide separate copies of Form 102 – Certificate of Satisfactory Installation for different equipment.

6. OPERATION AND PERFORMANCE VERIFICATION

- .1 Equipment will be subjected to a demonstration, running test, and performance test after the installation has been verified and any identified deficiencies have been remedied.
- .2 Performance Verification will be conducted at two (2) different intervals, once in 2007 and the other in 2008. Performance Verification cannot be completed until the Systems Integrator integrates the controls installed under this Contract with the completed WTP SCADA system in 2008. The Contractor shall make provisions for attending all tests required during Performance Verification.
- .3 Performance Verification in 2007 will be conducted under the Deacon reservoir static head conditions, which is approximately 6 meters greater than the design static head condition of the future clear well.
- .4 Performance Verification in 2008 will be conducted under the design static head conditions.
- .5 During the demonstration, running tests, and performance tests, the Contractor shall operate equipment as required to complete the Performance Verification required from all Divisions of this Specification.
- .6 Prior to any testing, the Contract Administrator will advise the Contractor of acceptable dates when testing may be conducted. Inform the Contract Administrator at least fourteen (14) days in advance of conducting the tests and arrange for the attendance of the Manufacturer's Representative. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Contractor and the Contract Administrator.
- .7 The Manufacturer's Representative shall conduct all necessary checks to equipment and if necessary, advise the Contractor of any further checking, flushing, cleaning, or other work needed prior to confirming the equipment is ready to run.
- .8 The Contractor shall then operate the equipment for at least one (1) hour to demonstrate to himself the operation of the equipment and any required ancillary services. Any remedial measures required to ensure satisfactory operation shall be promptly undertaken.
- .9 Once it is mutually agreed between the Contractor and the Contract Administrator that the equipment is ready to run, Performance Verification to be conducted in 2007 shall be as follows:
 - .1 Demonstration:

EQUIPMENT INSTALLATION

- .1 The Contractor shall then notify the Contract Administrator of his readiness to demonstrate the operation of the equipment. The Contract Administrator shall attend, as expeditiously as possible.
 - .2 With the assistance of the Manufacturer's Representative, the Contractor shall demonstrate that the equipment is properly installed. Alignment, piping connections, electrical connections, etc. will be checked and if appropriate, code certifications provided.
 - .3 The equipment shall then be run for one (1) hour. Local controls shall be satisfactorily verified by cycling the equipment through several start-stop operations, modulating its output, or some combination. Operating parameters such as temperature, pressure, voltage, vibration, etc., will be checked to ensure that they are within the specified or Manufacturer's Representative's recommended limits, whichever is more stringent.
 - .4 Specific to the Medium Voltage Soft Starters, demonstration of the operation of this equipment shall be conducted for one (1) hour for each pump
 - .5 On satisfactory completion of the one (1) hour demonstration, the equipment shall be stopped and critical parameters, such as alignment, shall be rechecked by the Contractor.
- .2 Running Test:
- .1 The equipment shall be restarted and run continuously for a minimum of five (5) days (120 hours) or as specified. During this period, as practicable, conditions shall be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the Contractor and Contract Administrator on the basis of the information contained in the technical specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.
 - .2 Upon completion of the successful Running Test, the equipment related to the Branch 2 Pumps shall be stopped and modified as necessary in order to maintain the pre-construction functionality until Performance Verification is completed in 2008. During the period between the completed installation and System Demonstration, the Contractor shall maintain the equipment as recommended by the Equipment Manufacturer(s).
- .10 Once it is mutually agreed between the Contractor and the Contract Administrator, Performance Verification can be completed. Performance Verification tests shall be performed as follows:
- .1 Performance Tests:
 - .1 Performance tests shall be conducted subsequent to the running test, as practicable and agreed between the Contract Administrator and the Contractor.

EQUIPMENT INSTALLATION

- .2 Performance testing will be conducted under the design static head, which means water will be drawn from the Clearwell. During the Performance testing of the DBPS, water produced by the WTP will either be pumped to the in town City reservoirs or pumped back to Deacon Cell 1 via the Branch 1 Surge Tower Overflow. Pumping will be done by the Branch 1 Deacon Booster Pumps installed under this Contract.
- .3 The equipment shall be run continuously for a minimum of seven (7) days (168 hours) in conjunction with the WTP testing.
- .4 Performance testing parameters shall be as dictated in the technical Specifications for each item of equipment or as reasonably required by the Contract Administrator to prove adherence to the requirements listed in the Specification.
- .5 The Contractor shall submit the results of the performance tests within 24 hours to the Contract Administrator, and final documented and summarized results in a format acceptable to the Contract Administrator within seven (7) Calendar Days. The Contract Administrator reserves the right to request additional testing. No equipment shall be accepted and handed over to the City prior to the satisfactory completion of the performance test(s) and receipt of the test reports.
- .11 Upon completion of the Performance testing, a twenty eight (28) day System Demonstration period will commence in accordance with the Project Master Schedule and as specified in Section 01670 - Commissioning. In summary, the equipment shall be operated by the Commissioning Operations Agent continuously over the twenty eight (28) day period without experiencing a critical failure. A critical failure is defined as one that prevents the equipment from operating for an eight (8) hour period or that presents a safety hazard. For equipment that is designed not to operate on a daily basis, the System Demonstration period shall be defined as twenty eight (28) consecutive days over which the piece of equipment is operated. Upon completion of the twenty eight (28) day System Demonstration period, the equipment shall be deemed to have been handed-over and accepted by the Contract Administrator, unless the Contractor is notified otherwise.
- .12 All water, chemicals, temporary power (except portable generators), heating, or any other ancillary services required to complete the initial demonstration, running test and performance tests are the responsibility of the City.
- .13 Should the initial demonstration, running test or performance tests reveal any defects, then those defects shall be promptly rectified and the demonstration, running tests, and/or performance tests shall be repeated to the satisfaction of the Contract Administrator. Additional costs incurred by the Contractor, the Contract Administrator, or the City, due to repeat demonstration, running tests, and/or performance tests shall be the responsibility of the Contractor.
- .14 On successful completion of the demonstration, running test, and performance tests, Form 103 – Certificate of Equipment Satisfactory Performance attached to this Specification will be signed by the Manufacturer's Representative, the Contractor, and the Contract Administrator.

EQUIPMENT INSTALLATION

- .15 The Contractor shall affix to the tested equipment a 100 x 200 mm card reading "Operable Condition - Do Not Operate without Contractor's Permission." stenciled on in large black letters.

EQUIPMENT INSTALLATION

**CERTIFICATE OF EQUIPMENT DELIVERY
FORM 100**

We certify that the equipment listed below has been received and delivered into the care of the Contractor. The equipment has been found to be in satisfactory condition. No defects in the equipment were found.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

(Authorized Signing Representative of the Contractor)

Date

(Authorized Signing Representative of the Manufacturer)

Date

(Authorized Signing Representative of the Contract Administrator)

Date

EQUIPMENT INSTALLATION

**CERTIFICATE OF READINESS TO INSTALL
FORM 101**

I have familiarized the Contractor of the specific installation requirements related to the equipment listed below and am satisfied that he understands the required procedures.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

(Authorized Signing Representative of the Manufacturer)

Date

I certify that I have received satisfactory installation instructions from the equipment Manufacturer.

(Authorized Signing Representative of the Contractor)

Date

EQUIPMENT INSTALLATION

**CERTIFICATE OF SATISFACTORY INSTALLATION
FORM 102**

I have completed my check and inspection of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

OUTSTANDING DEFECTS: _____

(Authorized Signing Representative of the Manufacturer)

Date

(Authorized Signing Representative of the Contractor)

Date

(Authorized Signing Representative of the Contract Administrator)

Date

EQUIPMENT INSTALLATION

**CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE
FORM 103**

We certify that the equipment listed below has been continuously operated for at least seven (7) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

(Authorized Signing Representative of the Manufacturer) Date

(Authorized Signing Representative of the Contractor) Date

(Authorized Signing Representative of the Contract Administrator) Date

1. Acknowledgement of Receipt of O&M Manuals.

(Authorized Signing Representative of the City) Date

END OF SECTION

TRAINING

1. DESCRIPTION

- .1 This Section contains requirements for training the City's personnel, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the equipment and systems supplied and installed under this Contract. Training for City Supplied Equipment will be provided by the Supply Contractors.
- .2 Two categories of training sessions are required: one set during the Commissioning Period, and Supplemental Training, within six (6) months after Total Performance. The intent of the latter training session is to enable the City's personnel to ask particular questions on the operation of the specified equipment, based on their actual experience. There will be four different training sessions and four different trips.
 - .1 Provide two sessions in two different trips during the Commissioning Period.
 - .2 Provide Supplemental Training during the Warranty Period as requested by the Contract Administrator.
- .3 Each training session will include a minimum of 4 to 8 hours for each item of equipment and sub-system. Refer to the technical specifications for specific time periods for specific equipment.
- .4 All training sessions will be coordinated with the Contract Administrator.
- .5 Training requirements may be modified by the Contract Administrator. In this event, the Contractor will be compensated for training requirements above and beyond the training requirements of this Contract.
- .6 It is the Contractors responsibility to provide Manufacturer's Representatives as specified for training purposes.

2. QUALITY ASSURANCE

- .1 Training includes instruction of the City's personnel in equipment operation and preventive maintenance and instruction of mechanics, electricians, instrumentation and communications technicians in normal maintenance up to major repair.
- .2 Where required by the detailed Specifications, provide on-the-job training of the City's personnel. Training sessions shall be conducted by qualified, experienced (two years minimum), factory-trained representatives of the various equipment manufacturers. Trainers shall be capable of providing "qualified trainers" in the sessions provided as agreed upon by the Contract Administrator.

TRAINING

3. SUBMITTALS

- .1 Submit the following information in accordance with Section 01300 – Submittals. For phased testing and start-up activities, separate submittals can be prepared for equipment items or systems. The material will receive a "reviewed" or "reviewed as modified" status by the Contract Administrator no later than four (4) weeks prior to delivery of the training:
 - .1 Lesson plans and training manuals, handouts, visual aids, and other reference materials for each training session to be conducted by the Manufacturer's Representatives.
 - .2 Date, time, and subject of each training session and identity and qualifications of individuals to be conducting the training.
 - .3 Training schedule. Concurrent classes will not be allowed unless approved by the Contract Administrator.
 - .4 The Contract Administrator requires a minimum of ten (10) business days to review training materials.
- .2 Provide the following to verify the trainer's qualifications:
 - .1 Certification in related coursework.
 - .2 Three references for similar assignments where training was conducted for O&M staff.

4. LOCATION

- .1 Where specified, conduct training sessions for the City's O&M personnel on the operation, care, and maintenance of the equipment and systems installed under this Contract. Training will take place at the Site or within the City of Winnipeg at an alternative site designated by the City, and under the conditions specified in the following paragraphs.
- .2 Field training sessions will take place at the Site. Classroom training will take place at the Site or within the City of Winnipeg at an alternative location designated by the City. The Contract Administrator will confirm the location of classroom training.

5. LESSON PLANS

- .1 Prepare formal written lesson plans for each training session and coordinate with the Contract Administrator. Lesson plans to contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan will contain a time allocation for each subject. Furnish twenty (20) copies of final training manuals, handouts, visual aids and reference materials at least two (2) weeks prior to each training session.

TRAINING

6. FORMAT AND CONTENT

- .1 Include time in the classroom and at the location of the equipment or system for each training session. As a minimum, cover the following topics for each item of equipment or system:
 - .1 Familiarization
 - .2 Safety
 - .3 Operation
 - .4 Instrumentation and Control
 - .5 Troubleshooting
 - .6 Preventive and regular maintenance
 - .7 Corrective maintenance
 - .8 Parts
 - .9 Local representatives

7. DVD RECORDING

- .1 DVD record each training session to provide a permanent record for the City's use. Turn CD or DVDs over to the Contract Administrator after the training is completed. Advise all Manufacturers providing training sessions that the training material will be video recorded.

8. TRAINING

8.1 General Requirements

- .1 Conduct training in conjunction with the Commissioning Period. Schedule classes such that classroom sessions are interspersed with field instruction in logical sequence. Arrange to have the training conducted on consecutive days, with no more than 6 hours of classes scheduled for any one day.
- .2 Provide acceptable O&M manuals prior to Form 103 – Certificate of Equipment Satisfactory Performance.
- .3 Contractor shall be responsible for any Audio-Visual aids required for training sessions.

TRAINING

8.2 Operator Classroom Training

- .1 As a minimum, classroom equipment training for operations personnel shall include:
 - .1 The equipment's specific location in the DBPS and an operational overview. Use slides, computer presentations, and drawings to aid discussion.
 - .2 Purpose and function of the equipment.
 - .3 The operating theory of the equipment.
 - .4 Start-up, shutdown, normal operation, and emergency operating procedures, including system integration and electrical interlocks, if any.
 - .5 Safety items and procedures.
 - .6 Routine preventive maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.
 - .7 Operator detection, without test instruments, of specific equipment trouble symptoms.
 - .8 Required equipment exercise procedures and intervals.
 - .9 Routine disassembly and assembly of equipment if applicable for purposes such as operator inspection of equipment.

8.3 Operator Hands-On Training

- .1 As a minimum, hands-on equipment training for operations personnel shall include:
 - .1 Identifying instrumentation: Location of primary element; location of instrument readout; discuss purpose, basic operation, and information interpretation.
 - .2 Discussing, demonstrating, and performing standard operating procedures and round checks.
 - .3 Discussing and performing the preventive maintenance activities.
 - .4 Discussing and performing start-up and shutdown procedures.
 - .5 Performing the required equipment exercise procedures.
 - .6 Performing routine disassembly and assembly of equipment if applicable.
 - .7 Identifying and reviewing safety items and performing safety procedures, if feasible.
 - .8 Safety procedures.

TRAINING

8.4 Maintenance Classroom Training

- .1 Classroom equipment training for the maintenance and repair personnel shall include:
 - .1 Basic theory of operation.
 - .2 Description and function of equipment.
 - .3 Routine start-up and shutdown procedures.
 - .4 Lockout procedures and the location of lockouts.
 - .5 Normal and major repair procedures.
 - .6 Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
 - .7 Routine and long-term calibration procedures.
 - .8 Safety procedures.
 - .9 Preventive maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.

8.5 Maintenance Hands-On Training

- .1 Hands-on equipment training for maintenance and repair personnel shall include:
 - .1 Locating and identifying equipment components.
 - .2 Reviewing the equipment function and theory of operation.
 - .3 Reviewing normal repair procedures.
 - .4 Performing routine start-up and shutdown procedures.
 - .5 Reviewing and performing the safety procedures.
 - .6 Performing City-approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.
 - .7 Reviewing and using equipment manufacturer's manuals in the hands-on training.

8.6 Equipment and Systems for Training

- .1 As a minimum, provide training during the Commissioning Period for all equipment and sub-systems listed in all Divisions in the technical specifications and shown on the Drawings.

TRAINING

- .2 City Supplied Equipment training during Commissioning Period will be provided by the Supply Contractors.
- .3 Provide training for the equipment during the Warranty Period six (6) months after Total Performance.
- .4 Coordinate and finalize with the Contract Administrator on training schedules and duration of each training session.

8.7 Training Completion Forms

- .1 Form T1: To be completed for initial training. One (1) form is to be used for each equipment/system for which training has been provided.

TRAINING

**CERTIFICATE OF SATISFACTORY TRAINING
FORM T1**

We certify that the initial training for the equipment listed below has been provided as per the Specifications.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

(Trainer)

Date

(Contractor)

Date

(Authorized Signing Representative of the City)

Date

END OF SECTION

COMMISSIONING

1. GENERAL

- .1 Due to the sequential tendering and construction approach for the Winnipeg WTP, the Commissioning of the DBPS will be divided into several phases to improve Commissioning efficiency and reduce overall System Demonstration time. Before the System Demonstration can begin, all dependant processes must have been checked out and to be determined in conformance with the Specifications. All equipment manufacturers must have verified the correct installation of their respective equipment and they must have performed running tests and performance tests as specified.
- .2 This Section describes the commissioning plan and the Contractor's responsibilities in the Commissioning of the process, mechanical, electrical, and other systems to be installed as part of this Contract.
- .3 Equipment furnished under this Contract and the City Supplied Equipment will be Commissioned by the Contract Administrator and the Commissioning Team with assistance from the Contractor and Supply Contractors. The Contractor shall provide the services of a qualified representative to assist in the System Demonstration and Performance Verification of all of the equipment installed under this Contract. System Demonstration and training activities cannot begin until Forms 102 – Certificate of Satisfactory Installation and 103 – Certificate of Equipment Satisfactory Performance have been completed for all equipment installed under this Contract.
- .4 The Contractor shall refer to Sections 01210 – City Supplied Equipment, 01300 – Submittals, 01650 – Equipment Installation, 01664 – Training, and Divisions 11, 15, 16, and 17 for details on the System Demonstration procedures not included in this Section.
- .5 System Demonstration of DBPS is expected to begin in 2008. The DBPS Start-up and System Demonstration procedures will also be linked to Start-up and System Demonstration of ancillary facilities such as the Chemical Storage/Chemical Feed Building, the On-site Hypochlorite Generation Building and the main WTP.

2. DEFINITIONS

- .1 System: For the purpose of this Section, a system shall be defined as the equipment, piping, controls, ancillary devices, electrical power, etc. which together perform a specific function at the facility.
- .2 Sub System: For the purpose of this Section, a Sub System is defined as a smaller grouping of equipment, piping, controls, ancillary power, electrical devices, etc which performs an even more specific function than a System.
- .3 Commissioning: The process of ensuring that systems and sub-systems are installed, functionally tested, and capable of being operated and maintained to perform in conformity

COMMISSIONING

with the design intent over the long-term. Commissioning is a process that is not limited to the start-up period.

- .4 Start-up: All inspection, preparation, testing, adjustment calibration and tuning required to put devices and systems into operating condition. Start-up includes; Demonstration, Running Tests, and Performance Tests.
- .5 Demonstration: During Start-up, comprises of running equipment for one (1) hour to demonstrate that equipment is properly installed.
- .6 Running Test: During Start-up, comprises of running equipment continuously for a minimum of five (5) days (120 hours) or as specified. During this period, as practicable, maximum, average, and minimum conditions will be simulated.
- .7 Performance Test: During Start-up, comprises of equipment running continuously for a minimum period of five (5) days (120 hours) or as specified. The Performance Test will be conducted subsequent to the Running Test as advised by the Contract Administration. On successful completion of Demonstration, Running Tests, and Performance Tests, Form 103 – Certificate of Equipment Satisfactory Performance shall be completed. Performance testing will occur once the main WTP is commissioned (2008).
- .8 System Demonstration: For the purpose of this specification section, shall be defined as the successful operation of the DBPS in accordance with its design requirements for a total period of twenty-eight (28) days, the last seven (7) of which shall be consecutive, unless otherwise specified. On successful completion of System Demonstration, Form 104 – Certificate of Satisfactory Process Performance will be completed.
- .9 Commissioning Operations Agent: A qualified maintenance/operations team retained by the City under a separate contract that takes primary responsibility for operation of the WTP during the Commissioning Period or longer as specified by their contract.
- .10 Commissioning Period: Period between Start-up and Total Performance during which a system is operated under Commissioning Operations Agent's control to demonstrate to the City that it operates in conformance with the design intent.
- .11 Commissioning Team: Team led by the Contract Administrator which is made up of members from the City and the Contractor. The Commissioning Team will coordinate the Commissioning activities through the Contract Administrator and develop an overall commissioning plan and schedule.

3. SEQUENCE

- .1 The general sequence of events is summarized by the following table. Due to the phased nature of construction, this sequence of events will be further developed by the Contract Administrator to suit specific equipment, system, sub systems, processes, and critical events.

COMMISSIONING

SEQUENCE ITEM	DESCRIPTION
<p>A. Equipment Delivery</p>	<ol style="list-style-type: none"> 1) Contract Administrator, Contractor, Supply Contractor inspect equipment delivery 2) Contractor accepts equipment delivery 3) Contractor Sign-off Form 100 – Certificate of Equipment Delivery 4) Equipment stored on Site or City Warehouse
<p>B. Complete Installation and Demonstration and Running Tests</p>	<ol style="list-style-type: none"> 1) Supply Contractor or Manufacturers Representatives to provide installation instructions/training to Contractor 2) Supply Contractor or Manufacturers Representatives to Complete Form 101 – Certificate of Readiness to Install 3) Contractor to complete installation 4) Supply Contractor or Manufacturers Representatives inspect installation 5) Supply Contractor or Manufacturers Representatives to complete Form 102 – Certificate of Satisfactory Installation 6) Begin Start-up Process 7) Complete 1 hour Demonstration 8) Complete minimum 5 day Running Test 9) Complete process related deficiency list items 10) Tag all components ready for Performance Testing
<p>C. Performance Testing and Completion of Start-up</p>	<ol style="list-style-type: none"> 1) Contractor to inform Contract Administrator 14 days in advance of Performance Testing 2) Confirm required staff is available 3) Review safety procedures as required with Contract Administrator 4) Review operational requirements (output and performance) with Contract Administrator 5) Supply Contractor or Manufacturers Representatives to conduct all necessary checks prior to confirming equipment ready to run 6) Commence Performance Testing period – minimum 5 days 7) Sign-off Form 103 – Certificate of Equipment Satisfactory Performance 8) Within 14 days of Substantial Performance, provide final O&M manuals
<p>D. System Demonstration</p>	<ol style="list-style-type: none"> 1) After Form 103 completed, Commissioning Operations Agent to operate and maintain plant 2) Review safety procedures as required with Contract Administrator 3) Review operational requirements (output & performance) with Contract Administrator 4) Commence System Demonstration Testing
<p>E. Training</p>	<ol style="list-style-type: none"> 1) After completion of Form 103 – Certificate of Equipment Satisfactory Performance and prior to completion of Form T1 – Certificate of Satisfactory Training, 2) Supply Contractors include training as part of their contracts 3) After all training included in Contract complete, sign-off Form T1 – Certificate of Satisfactory Training 3) After completion of Form T1 – Certificate of Satisfactory Training, Contractor to provide additional training on as-required time and material basis

COMMISSIONING

F. Total Performance	<ol style="list-style-type: none">1) Completion of Form T1 – Certificate of Satisfactory Training and successful Performance Testing2) Final completion and cleanup3) Complete Form 104 – Certificate of Satisfactory Process Performance4) Certificate of Total Performance complete5) Provide warranty services as provided under the Contract
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- .2 Final O&M Manuals shall be available as per the requirements of Section 01730 – Operation and Maintenance Manuals at least fourteen (14) days prior to the start of System Demonstration and prior to the completion of Form 103 – Certificate of Equipment Satisfactory Performance.
- .3 The Contract Administrator will make Operating Descriptions available prior to Commissioning.
- .4 During Start-Up, start and run systems in manual mode. Turn separate items of equipment to automatic in a planned and logical manner as directed by the Contract Administrator. Ensure that the control system is operating the equipment in a manner which precludes damage of the equipment and which is consistent with the process operating requirements.
- .5 System Demonstration Testing Period of twenty-eight (28) days. The equipment shall operate continuously and successfully through the last seven (7) days of the System Demonstration Period as approved by the Contract Administrator.

4. COMMISSIONING ROLES AND RESPONSIBILITIES

- .1 Contractor
 - .1 Coordinate with and report directly to the Contract Administrator
 - .2 Meet with the Supply Contractors and Manufacturers Representatives and be trained on the installation of all equipment. Sign-off Form 101 – Certificate of Readiness to Install.
 - .3 Maintenance of equipment and subsystems.
 - .4 Liaise with the Supply Contractors and Manufacturers Representatives as required during installation to ensure proper equipment installation and sign-off Form 102 – Certificate of Satisfactory Installation.
 - .5 Correct all installation deficiencies as required by the Supply Contractors and Manufacturers Representatives.
 - .6 Red tag, lockout and maintain control of all power supplies, valves, etc.
 - .7 Attend Commissioning related meetings in Winnipeg.

COMMISSIONING

- .8 As directed by the Contract Administrator, provide personnel representing the appropriate trades and equipment Manufacturers during training and Commissioning Period as per the Contract Work Schedule and Specifications.
 - .9 Operate all equipment under the direction of the Supply Contractors and Manufacturers Representatives as required to demonstrate satisfactory performance. Issue Form 103 – Certificate of Satisfactory Performance.
 - .10 After completion of Form 103 – Certificate of Satisfactory Performance, green tag, and turn over control of all power supplies, valves, etc., to the Commissioning Operations Agent.
 - .11 List of all personnel who the Contractor plans for System Demonstration and hand-over with information indicating their qualifications for this work.
 - .12 Operate all equipment installed under this contract, and with the assistance of the Supply Contractors and Manufacturers Representatives as required, to complete Performance Verification.
 - .13 Provide the Contract Administrator with red-lined drawings for record drawing preparation.
- .2 Manufacturer's Representatives
- .1 Provide installation training to the Contractor and issue Form 101 – Certificate of Readiness to Install.
 - .2 Provide inspection of the installation of equipment supplied by them and issue Form 102 – Certificate of Satisfactory Installation.
 - .3 Attend Commissioning scoping meetings in Winnipeg.
 - .4 Provide Shop Drawings and O&M Manuals.
 - .5 Review Commissioning Team's test procedures to ensure safety and feasibility.
 - .6 Direct the Contractor and execute Performance Tests witnessed by the Contract Administrator and issue Form 103 – Certificate of Satisfactory Performance.
 - .7 Assist the Contractor during the Commissioning Period and train the City's operating personnel.
 - .8 For the City Supplied Equipment, the Supply Contractors will provide similar services as outlined above.

COMMISSIONING

5. COMMISSIONING PLAN

- .1 The Commissioning Team will develop a detailed methodology for the System Demonstration of each system at least ninety (90) Calendar Days prior to planned start of System Demonstration. The plan will include the following:
 - .1 Detailed schedule of events, including but not limited to the schedule for completion of testing of all component parts of the system in accordance with Section 01210 – City Supplied Equipment and Section 01650 – Equipment Installation prior to System Demonstration.
 - .2 Methods and criteria for water management; sending water to the City, recycling or disposing of partially treated water, emergency overflows, and disposing of any sludge or other residual solids generated during the Commissioning Period and during Performance Verification.
 - .3 Sampling and analytical program for tests necessary to verify compliance with specified performance criteria.
 - .4 Training requirements and planned attendance schedule for Manufacturer's Representatives.
 - .5 Workplace Health and Safety Plan.
 - .6 Chemical handling procedures and responsibilities.
 - .7 Contingency plans in the event of a process malfunction.
 - .8 Drawings and sketches as required to illustrate the planned sequence of events.
 - .9 List and details for all temporary equipment (pumps, etc.) required to facilitate System Demonstration.

6. PREPARATION FOR START-UP AND SYSTEM DEMONSTRATION

- .1 All process, mechanical, electrical, control and miscellaneous equipment related to a System shall be successfully installed and tested by the Contractor in accordance with S Section 01210 – City Supplied Equipment and Section 01650 – Equipment Installation and any specific requirements noted in other Divisions. Form 103 – Certificate of Satisfactory Performance shall be completed for each item.
- .2 Piping, wiring, and other conduit systems shall be finished and tested. Form 103 – Certificate of Satisfactory Performance shall be completed.
- .3 Electrical connections shall be completed, inspected, and tested per the requirements of Division 16.

COMMISSIONING

- .4 Control systems shall be completed and the related control software debugged, as per Divisions 11, 15, and 17.
- .5 Temporary equipment shall be installed and tested as necessary to ensure that it functions reliably and consistently through the Commissioning Period.
- .6 Prior to completing Form 103 – Certificate of Satisfactory Performance, all applicable regulatory inspections shall be completed to the satisfaction of the governing authorities.

7. CONTROLS

- .1 All controls installed by the Contractor shall be tested prior to System Demonstration.
- .2 The Contract Administrator will arrange for the simulation of the control sequences or will allow for the operation of the system without the features included in the work of others. Every effort shall be made to ensure that the Commissioning Period provides for the full and comprehensive operation of the equipment under all anticipated normal and adverse operating conditions.

8. WTP UTILITY SERVICES

- .1 Utility services will be provided by the City as specified in Section 01210 – City Supplied Equipment and Section 01650 – Equipment Installation. Provision of these services will be limited to reasonable levels as determined by the Contract Administrator.

9. MANPOWER

- .1 Supply all competent staff required during the Commissioning Period as requested by the Contract Administrator to assist the Commissioning Team, Operations Agent, and City's staff in the operation of the WTP.
- .2 Supply competent staff capable of maintaining, repairing and adjusting the equipment and controls to achieve the intended design functions during the Commissioning Period.
- .3 Ensure equipment Manufacturer's Representatives are available as necessary to certify adjustments in equipment, to guide in setting correct operating limits, to provide training, and to generally provide input as required for the appropriate operation of the equipment.

10. OPERATING DESCRIPTIONS

- .1 Operating descriptions have been prepared for the WTP systems. To some degree, the intent of these have been included in the Drawings and technical Specifications. Information outlining the operating requirements is available from the Contract Administrator.

COMMISSIONING

11. COMMISSIONING PERIOD

- .1 All components and systems will be operated in the automatic/manual and the remote/local modes as required to prove proper operation.
- .2 Samples of process flows, when necessary to prove performance, will be obtained and analyzed on a regular basis by others.

12. ACCEPTANCE

- .1 System Demonstration shall be considered acceptable when the DBPS has operated in a stable manner, satisfying the design criteria for a period of 28 days, the last 7 of which shall be continuous and consecutive, unless otherwise specified.
- .2 When the Contractor achieves Substantial Performance, the Systems will be formally accepted for operation and routine maintenance by the Commissioning Operations Agent. On successful completion of System Demonstration and Training, Form 104 – Certificate of Satisfactory Process Performance, attached to this Specification will be signed by the representative of the Manufacturer, Contractor, Contract Administrator, and City.
- .3 An acceptance meeting must be held at the end of the System Demonstration test to confirm the status of each system. Contractor shall attend the acceptance meeting.

COMMISSIONING

**CERTIFICATE OF SATISFACTORY PROCESS PERFORMANCE
FORM 104**

We certify that the equipment listed below has been operated and tested as per the Specifications using water and that the equipment meets its Performance Testing Criteria. The equipment is therefore classed as “conforming”.

PROJECT: _____

SYSTEM DESCRIPTION: _____

TAG NO (S): _____

**REFERENCE
SPECIFICATION (S):** _____

(Authorized Signing Representative of the Manufacturer) _____ Date _____

(Authorized Signing Representative of the Contractor) _____ Date _____

(Authorized Signing Representative of the Contract Administrator) _____ Date _____

(Authorized Signing Representative of the Commissioning Operations Agent) _____ Date _____

(Authorized Signing Representative of the City of Winnipeg) _____ Date _____

END OF SECTION

OPERATION AND MAINTENANCE MANUALS

1. DESCRIPTION

- .1 This Section supplements the requirements for the provision of O&M Manuals as described in Section 01300 – Submittals.
- .2 Furnish complete operations manuals and maintenance information as specified in this Section for installation, check-out, operation, maintenance, and lubrication requirements for each unit of mechanical, electrical, and instrumentation equipment or system and each instrument.
- .3 Customize the operations manuals and maintenance information to describe the equipment actually furnished. Do not include extraneous data for models, options, or sizes not furnished (cross out or remove if required). When more than one model or size of equipment type is furnished, show the information pertaining to each model, option, or size.
- .4 Assemble, coordinate, bind, and index required data into an O&M Manual.
- .5 Three (3) draft copies of the manuals shall be submitted a minimum of sixty (60) days prior to Substantial Performance of the Work for review and comments. A maximum of eight (8) weeks after review, twelve (12) copies of the final manuals shall be supplied.
- .6 In addition to the twelve (12) hard copies, submit an electronic version of the O&M Manual.
- .7 Materials: Label each Section with tabs protected with celluloid covers, fastened to hard paper dividing sheets.
- .8 Type lists and notes.
- .9 Drawings, diagrams and Manufacturer's literature must be legible. Drawings larger than 280 x 430 mm must be folded and placed inside plastic pockets.

2. OPERATION AND MAINTENANCE MANUAL CONTENTS AND ORGANIZATION

- .1 Provide the Manufacturer's standard O&M manuals for the equipment or instruments supplied. If the Manufacturer's standard manuals do not contain all the required information, provide the missing information in supplementary documents and Drawings inserted behind appropriate tabs in the manual binder.
- .2 When more than one (1) piece of identical equipment or instruments are supplied, provide only one (1) set of operations manuals.
- .3 One (1) set of operations manuals may be provided when more than one (1) piece of similar equipment or instruments are supplied, such as different sizes of the same model, and all similar pieces are covered in the same standard Manufacturer's O&M manual.
- .4 When similar equipment or instruments are provided by the same Manufacturer, but are not covered in the same standard Manufacturer's O&M manual, their specific manuals may be

OPERATION AND MAINTENANCE MANUALS

bound in the same 3-ring binder. Separate specific manuals with tab dividers labelled with the appropriate equipment numbers.

- .5 Provide a cover sheet, bound as the first page of each manual, with the following information:
 - .1 Contract name and number.
 - .2 Equipment number or, if more than one (1) piece of equipment is provided, equipment numbers for equipment or instruments covered by the manual. Include functional description of equipment after each number.
- .6 Provide a table of contents listing the contents of the manual and identifying where specific information can be located.
- .7 Insert the specific information described below in the O&M manuals in a format similar to that listed:
 - .1 Tab 1 – General Information
 - .1 Functional title of the system, equipment, material, or instrument.
 - .2 Relevant Specification Section number and Drawing reference.
 - .3 Address and telephone number of the Manufacturer and the nearest Manufacturer's Representative.
 - .2 Tab 2 - Equipment Data
 - .1 Insert Specification Section and completed Equipment and Instrumentation Data sheets for equipment supplied. Attach all Addenda, Change Orders, and change directives that refer to that specific item of equipment.
 - .3 Tab 3 – Operation Information
 - .1 Include the Manufacturer's recommended step-by-step procedures for starting and stopping under normal and emergency operation. Include all specified modes of operation including recommended operation after the assembly or equipment has been in long-term storage.
 - .2 Provide control diagrams with data and information to explain operation and control of systems and specific equipment. Identify normal operating setpoints and alarm conditions.
 - .3 Provide technical information on all alarms and monitoring devices provided with the equipment.
 - .4 Provide troubleshooting information. Clearly identify which problems to look for and how to solve them.

OPERATION AND MAINTENANCE MANUALS

- .4 Tab 4 - Technical Data
 - .1 Insert Manufacturer's Technical Specification and data sheets.
 - .2 Insert Manufacturer's certified performance and calibration curves for the equipment and instruments.
- .5 Tab 5 - Maintenance Information
 - .1 Include the description and schedule for all Manufacturers' recommended routine preventative maintenance procedures including specific lubrication recommendations. Indicate whether procedure is to be done daily, weekly, monthly, quarterly, semi-annually, annually, or fill in hours of operation.
- .6 Tab 6 - Maintenance Instructions
 - .1 Provide requirements to set up and check out each system for use. Include all required and recommended step-by-step inspections, lubrications, adjustments, alignments, balancing, and calibrations. Include protective device settings, warnings, and cautions to prevent equipment damage and to insure personnel safety.
 - .2 Provide Manufacturer's description of routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair.
 - .3 Provide Manufacturer's recommendations on procedures and instructions for correcting problems and making repairs.
 - .4 Provide step-by-step procedures to isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
 - .5 Provide step-by-step procedures and list special required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required.
- .7 Tab 7 - Assembly Drawings
 - .1 Provide Drawings which completely document the equipment, assembly, subassembly, or material for which the instruction is written. Provide the following Drawings as applicable: fabrication details, wiring and connection diagrams, electrical and piping schematics, block or logic diagrams, Shop Drawings, installation Drawings, layout and dimension Drawings, and electrical component fabrication Drawings.

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.2 Provide clear and legible illustrations, Drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

.8 Tab 8 - Bills of Materials

.1 Provide a clear, legible copy of the Bill of Materials that was shipped with the equipment. The Bill of Materials should list all equipment, instruments, components, accessories, tools, and other items that were shipped with the equipment.

.9 Tab 9 - Lubrication Data

.1 Provide a table showing recommended lubricants for specific temperature ranges and applications.

.2 Provide charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

.3 If the equipment or instrument is not lubricated, add a sheet under this Tab with the words "NOT APPLICABLE".

3. FIELD CHANGES

.1 Following the acceptable installation and operation of an equipment item, modify and supplement the item's instructions and procedures to reflect any field changes or information requiring field data.

4. COMMISSIONING DATA

.1 Provide in hard cover 3-ring binders for 215 x 280 mm paper labelled "COMMISSIONING DATA" one (1) copy of:

.1 All completed equipment testing and commissioning forms (Forms 100 – 104).

.2 All completed equipment checklists and performance reports, including noise and vibration analysis, instrumentation calibration data, and all other relevant information.

.3 All system performance reports.

OPERATION AND MAINTENANCE MANUALS

5. WARRANTIES

- .1 Provide in hard cover 3-ring binders for 215 x 280 mm paper labelled "Warranties" one (1) copy of:
 - .1 Manufacturers' standard Warrants and Guarantees. Include the name and telephone number of the contact person. Indicate the time frame of each Warrant or Guarantee on the list.

END OF SECTION