

PART 1 GENERAL

1.1 Site Work

- .1 After project completion return the outside site conditions back to original conditions. Photos of the Site will be taken before Work begins on Site to assist in confirming that after all Work is completed, the Site is returned to its original condition in accordance with City of Winnipeg Standard Specifications.

1.2 Use of Site and Facilities

- .1 Contractor may place a construction trailer on the Site and store materials in designated areas.
- .2 Make arrangements to provide drinking water for workers as required. There is no potable water available at this site for human consumption or construction.
- .3 Provide temporary ventilation and space heat as required during construction period.
- .4 Limited power is available for construction purposes. Contractor to provide their own power supply for construction purposes.
- .5 Provide portable washroom facilities in accordance with legislative requirements.

1.3 Regulations

- .1 All Work shall be in full accordance with applicable Codes, Regulations, By-laws, and ordinances.

1.4 Permits, Fees and Inspections

- .1 Apply for all permits, supply all test certificates and pay all fees to authorities having jurisdiction regarding the installation and inspection of the systems installed under this Contract.

1.5 Existing Conditions and Other Trades

- .1 Visit the Site to determine existing conditions affecting the Work of this Division.
- .2 Examine all drawings and become fully familiar with the Work of other trades in all divisions under this Contract.
- .3 Cooperate with other trades. Pay particular attention to the proximity of the Work to electrical cables, control conduits, and utilities. Maintain maximum clear ceiling heights throughout.

1.6 Metric Conversion

- .1 All units in this division are expressed in SI units.

- .2 Submit all Shop Drawings and maintenance manuals in SI units.
- .3 On all submittals (Shop Drawings, etc.) use the same SI units as stated in the Specifications.

1.7 Cutting and Patching

- .1 Provide holes and sleeves, cutting and fitting required for mechanical Work. Relocate improperly located holes and sleeves.
- .2 Drill for expansion bolts, hanger rods, brackets, and supports.
- .3 Obtain written approval from the Contract Administrator before cutting or burning structural members.
- .4 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials.

1.8 Equipment Protection and Clean-up

- .1 Protect equipment and materials in storage on-site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping systems.
- .2 Protect equipment with crates and polyethylene covers.

1.9 Temporary Heating and Ventilation

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment. A minimum of 6 ACH of continuous ventilation is required in below grade areas.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.
- .8 Make good damage to electrical system caused by use under this Contract.

1.10 Temporary Power and Light

- .1 Provide temporary power and light as required for temporary pumping, construction power, lighting, and other requirements during shutdowns.
- .2 The existing power supply may be utilized for general power use only, provided that there are no operational impacts associated with the use of the power.
 - .1 Connect to existing power supply in accordance with Canadian Electrical Code.
 - .2 Electrical power and lighting systems installed under this Contract may be used for construction requirements provided that guarantees are not affected.
 - .3 All heating and hoarding requirements must be undertaken through the use of gas heaters.

1.11 Temporary Communication Facilities

- .1 Provide and pay for temporary telephone, fax, data hook up, line and equipment necessary for own use.

1.12 Fire Protection

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

1.13 Temporary Usage

- .1 Usage by the City of any process device, apparatus, machinery, or equipment prior to Total Performance being issued is not to be construed as acceptance.

1.14 Site Plan

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Indicate use of supplemental or other staging area.
- .3 Provide construction facilities in order to execute work expeditiously.
- .4 Remove from site all such work after use.

1.15 Scaffolding

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding and ladders.

1.16 Construction Parking

- .1 Parking will be permitted on site provided it does not disrupt performance of Work or access by the City.
 - .1 Ensure that access and parking for a minimum of one truck is provided adjacent to the gate chamber building, for use by the City. The existing effluent sampling system located in this building must remain accessible to the City and operational.
- .2 Provide and maintain adequate access to project site.

1.17 Temporary Guard Rails and Barricades

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open edges of floors and roofs, and any other fall hazards.
- .2 Provide rigid guard rails in the existing gate chamber structure where existing guard rails are of insufficient height.
- .3 Provide as required by governing authorities.

1.18 Availability

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify the Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Contract

Administrator reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.19 Construction Plan

- .1 Within limitations defined in these specifications, the Contractor shall be responsible for his project work plan and sequence of work. The construction site and gate chamber building will be turned over to the Contractor, once temporary pumping has been commissioned and is performing reliably. This will give the contractor flexibility to develop a work plan that best meets his requirements.

1.20 Project Cleanliness

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the City.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Contract Administrator. Do not burn waste materials on site.
- .3 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .4 The Contractor will be responsible to clear snow and ice from access to construction site. This includes the roadway from the main plant, around the polishing ponds to the new effluent monitoring station. Pile snow in designated areas only. See Drawing C01.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Provide on-site containers if required for collection of waste materials and debris.
- .7 Dispose of waste materials and debris off site.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each Working Day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Clean-up work area as Work progresses.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.21 Contractor Use of Premises

- .1 Obtain and pay for use of appropriate additional storage or Work areas needed for operations under this Contract.

- .2 Remove or alter existing Work to prevent injury or damage to portions of existing Work which remain.
- .3 Repair or replace portions of existing Work which have been altered during construction operations to match existing or adjoining work, as directed by Contract Administrator.
- .4 Execute Work with least possible interference or disturbance to building operations, and normal use of premises. Arrange with Contract Administrator to facilitate execution of Work.
- .5 Where security is reduced by Work, provide temporary means to maintain security.

1.22 Existing Services

- .1 Notify Contract Administrator of intended interruption of any service required in order to complete Work, and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Contract Administrator 48 hours notice for necessary interruption of mechanical or electrical service throughout course of Work. Minimize duration of interruptions.
- .3 Submit schedule to and obtain approval from Contract Administrator for any shut-down or closure of active service or facility including power services. Adhere to approved schedule and provide notice to Contract Administrator.

1.23 Documents Required

- .1 Maintain at job Site, one copy of each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Notices and Change Orders.
 - .7 Field Test Reports.
 - .8 Copy of Approved Work Schedule.
 - .9 Health and Safety Plan and Other Safety Related Documents.
 - .10 Other documents as specified.

1.24 Building Smoking Environment

- .1 Comply with smoking restrictions. Smoking is not allowed in any City buildings.

1.25 Offices

- .1 Subcontractors to provide their own offices as necessary.

- .2 Provide a heated, site trailer with electrical service for Contractor and Contract Administrator use. Trailer shall be approximately 300 ft² and suitable for hosting site meetings for up to ten (10) people. Provide suitable tables, and chairs as required.

1.26 Demolition and Waste Disposal

- .1 Unless specified otherwise, all material no longer required at the Site, including electrical cabling, hydro poles, MTS line, slide gate valve and other materials shall become the Contractor's property. Contractor may retain them for salvage value or dispose of them at an acceptable licensed disposal facility.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

1.27 Submittals Procedures

- .1 Administrative
 - .1 Submit to Contract Administrator for review. Submit with reasonable promptness and in orderly sequence so as not to cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of contract time and no claim for extension by reason of such default will be allowed. Work affected by submittals to proceed only after review is complete.
 - .2 Review submittals prior to submission to Contract Administrator. Stamp and sign submittals certifying review of submission. This review represents that necessary requirements have been checked and coordinated with requirements of Work and contract documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
 - .3 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of contract documents stating reasons for deviations.
 - .4 Verify field measurements and that affected adjacent Work is coordinated.
 - .5 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
 - .6 Contractor's responsibility for deviation in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
 - .7 Keep one reviewed copy of each submission on Site.
- .2 Expedited Shop Drawings
 - .1 Refer to Section E8 of Part E – Specifications

.3 Shop Drawings

- (a) This Specification shall revise, amend and supplement the requirements of CW 1110 of the City of Winnipeg's Standard Construction Specifications.
 - (i) The term 'shop drawings' means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work.
 - (ii) The Contractor shall submit specified shop drawings to the Contract Administrator for review. All submissions must be in metric units. Where data is in imperial units, the correct metric equivalent shall also be show on all submissions for Contract Administrator review.
- (b) Shop Drawings
 - (i) Original drawings are to be prepared by the Contractor, Subcontractor, Supplier, Distributor, or Manufacturer, which illustrate appropriate portion of Work; showing fabrication, layout, setting or erection details as specified in appropriate sections.
- (c) Contractor's Responsibilities
 - (i) Review shop drawings, product data and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.
 - (ii) Verify:
 - (a) Field measurements
 - (b) Field construction criteria
 - (c) Catalogue numbers and similar data
 - (iii) Coordinate each submission with requirements of Work and Contract Documents. Shop drawings of separate components of a larger system will not be reviewed until all related drawings are available.
 - (iv) Notify Contract Administrator, in writing at time of submission, of deviations from requirements of Contract Documents.
 - (v) Responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator's review of submission, unless Contract Administrator gives written acceptance of specified deviations.
 - (vi) Responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
 - (vii) The Contractor shall make any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.
 - (viii) After Contract Administrator's review and return of copies, distribute copies to sub- trades as appropriate.
 - (ix) Maintain one (1) complete set of reviewed shop drawings, filed by Specification Section Number, at the Site for use and reference of the Contract Administrator and Subcontractors.

- (d) Submission Requirements
- (i) Schedule submissions at least 14 Calendar Days before dates reviewed submissions will be needed, and allow for a 14 Calendar Day period for review by the Contract Administrator of each individual submission and re-submission, unless noted otherwise in the Contract Documents.
 - (ii) Submit one (1) electronic .pdf copy of shop drawings. The Contractor is advised that the Contract Administrator will return an electronic copy to the Contractor.
 - (iii) Accompany submissions with transmittal letter, containing:
 - (a) Date
 - (b) Project title and Bid Opportunity number
 - (c) Contractor's name and address
 - (d) Number of each shop drawing, product data and sample submitted
 - (e) Specification Section, Title, Number and Clause
 - (f) Drawing Number and Detail/Section Number
 - (g) Other pertinent data
 - (iv) Submissions shall include:
 - (a) Date and revision dates.
 - (b) Project title and Bid Opportunity number.
 - (c) Name of:
 - ◆ Contractor
 - ◆ Subcontractor
 - ◆ Supplier
 - ◆ Manufacturer
 - ◆ Separate detailer when pertinent
 - (d) Identification of product of material.
 - (e) Relation to adjacent structure or materials.
 - (f) Field dimensions, clearly identified as such.
 - (g) Specification section name, number and clause number or drawing number and detail/section number.
 - (h) Applicable standards, such as CSA or CGSB numbers.
 - (i) Contractor's stamp, initialed or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.
- (e) Other Considerations
- (i) Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.
 - (ii) Material and equipment delivered to the Site will not be paid for until pertinent shop drawings have been submitted and reviewed.
 - (iii) Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.
 - (iv) No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions and review of shop drawings.

1.28 Closeout Submittals

- .1 Project Record Documents
 - .1 Maintain at construction Site, two sets of white prints for record drawing purposes. Mark one set "FIELD DRAWINGS" and use to record initial data when field measurements are made. Mark other set "RECORD DRAWINGS".
 - .2 Store record drawings in field office apart from other documents used for construction. Maintain record drawings in clean, dry and legible condition. Do not use record drawings for construction purposes.
 - .3 Record "as-built" information in red ink, accurately and concurrently with construction progress. Do not conceal Work until required information is recorded.
 - .4 Legibly mark each item to record actual construction, including:
 - .1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .2 Changes made by Addendum, Change Order or Field Instruction.
 - .3 Details not on original Contract Drawings.
 - .4 References to related shop drawings and modifications.
 - .5 At completion of project and prior to final inspection, neatly transfer "as-built" notations to second set of white prints and submit to Contract Administrator along with field drawings.
 - .5 Provide an electronic copy (PDF) of all final shop drawing in an orderly fashion on one CD.
- .2 Spare Parts, Maintenance Materials and Special Tools
 - .1 Provide items of same manufacture and quality as items in Work, and of same production run and dye lot as installed materials.
 - .2 Provide special tools with tags identifying their associated function and equipment.
 - .3 Keys and Maintenance Tools for Hardware and Specialties.
 - .1 Turn over to Contract Administrator all keys and special tools required for maintenance of all finish hardware, cabinet hardware, equipment, etc. (including electrical and mechanical products) such as lock wrenches, door closer wrenches, dogging keys, etc.
 - .2 Properly tag all keys and tools, giving names of equipment, hardware, or item to which they are used.
 - .4 Receive and catalogue all items, and submit inventory listing to Contract Administrator. Include copy of inventory listing in Operation and Maintenance Manuals.
 - .5 Obtain receipt of delivered spare parts, maintenance and extra materials from Contract Administrator and submit with request for final payment.

- .3 Storage, Handling And Protection
 - .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
 - .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
 - .3 Store paints and freezable materials in heated and ventilated room.
 - .4 Remove and replace damaged products to satisfaction of Contract Administrator.
- .4 Operation And Maintenance Manuals
 - .1 Operation and maintenance instructions and technical data to be sufficiently detailed with respect to design elements, construction features, component function, correct installation procedure and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation. Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.
 - .2 Combine operating and maintenance information of various components in binders with the project name identified on the cover. Divide the manual into appropriate sections for the components the information pertains to.
 - .3 Submit 3 complete copies of operating and maintenance manuals to the Contract Administrator for review. Revise initial manual as required by the Contract Administrator prior to final submission. Re-submit 6 complete copies. If there are no corrections, additions or revisions required to the original submission, provide 3 additional complete copies to the Contract Administrator.
- .5 Warranties and Bonds
 - .1 Provide warranties and bonds as specified.
 - .2 Assemble warranties and bonds, executed by each of respective manufacturers, suppliers, and subcontractors.
 - .3 Provide Table of Contents neatly typed, in orderly sequence. Provide complete information for each item:
 - .1 Product or work item.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Date of beginning of warranty or bond.
 - .4 Duration of warranty or bond.
 - .5 Proper procedure in case of failure.
 - .4 Instances which might affect validity of warranty or bond.
- .6 Except for items put into use with Contract Administrator's permission, leave date of beginning of time of warranty until Date of Total Performance is determined.

- .7 Verify that documents are in proper form, contain full information, and are notarized.
- .8 Co-execute submittals when required.
- .9 Retain warranties and bonds until time specified for submittal.
- .10 Submit with Contractor's Application for Certificate of Total Performance, warranties and bonds as required, executed in duplicate by subcontractors, suppliers, and manufacturers.
- .11 For items of Work, where acceptance is delayed materially beyond Date of Total Performance, provide updated submittal within 10 Calendar Days after acceptance, listing date of acceptance as start of warranty period.

1.29 Equipment Installation

- .1 Intent
 - .1 This Section describes general requirements for all equipment supplied under the Contract relating to the supervision of installation, testing, operation, and performance verification. The Contractor shall be responsible for the supply, installation, testing, operation, and performance verification of the specified equipment.
- .2 Definitions
 - .1 Manufacturer: the manufacturer is the person, partnership, or corporation responsible for the manufacture and fabrication of equipment provided to the Contractor for the completion of the Work.
 - .2 Manufacturer's Representative: the manufacturer's representative is a trained serviceman empowered by the manufacturer to provide installation, testing, and commissioning assistance to the Contractor in his performance of these functions.
- .3 Expertise and Responsibility
 - .1 The Contract Administrator recognizes the expertise of the manufacturer.
 - .2 Should the Contract Administrator issue a Field Order, Authorization for Contract Change, 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) Calendar Days.
- .4 Equipment Delivery
 - .1 Equipment shall be delivered to the construction Site to the Contractor who shall be responsible for taking delivery, off-loading, and placing into storage of the equipment. Any minor damage identified during inspection of delivered materials shall be repaired as per the manufacturer's recommendations by the Contractor.

Any severe damage will be grounds for rejection of the equipment. Severely damaged equipment shall be replaced.

- .2 Ten (10) Calendar 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 supplier in the presence of the Contract Administrator and the Contractor.
- .3 The Contractor shall ensure that he is fully informed of precautions to be taken in the unloading of equipment and its subsequent storage.

.5 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.

.6 Installation

- .1 If necessary, or if so directed by the Contract Administrator during the course of installation, contact the manufacturer 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, arrange for the manufacturer's representative to visit the Site to provide assistance during installation.
- .3 Prior to completing installation, inform the manufacturer 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, 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.

.7 Operation and Performance Verification

- .1 Equipment will be subjected to a demonstration, running test, and performance tests after the installation has been verified and any identified deficiencies have been remedied.
- .2 Inform the Contract Administrator at least fourteen (14) Calendar 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.

- .3 The manufacturer's representative 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.
- .4 Then operate the equipment for at least one hour to demonstrate the operation of the equipment and any required ancillary services. Any remedial measures required to ensure satisfactory operation shall be promptly undertaken.
- .5 Then notify the Contract Administrator of readiness to demonstrate the operation of the equipment. The Contract Administrator shall attend, as expeditiously as possible.
- .6 With the assistance of the manufacturer's representative, demonstrate that the equipment is properly installed. Alignment, piping connections, electrical connections, etc., will be checked and if appropriate, code certifications provided.
- .7 The equipment shall then be run for one 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 recommended limits, whichever is more stringent.
- .8 On satisfactory completion of the one-hour demonstration, the equipment will be stopped and critical parameters will be rechecked.
- .9 Then restart and run continuously for three (3) Calendar Days. During this period, as practicable, conditions will be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the manufacturer's representative, the Contractor, and Contract Administrator on the basis of the information contained in the Specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.
- .10 Performance tests will be conducted either concurrent with or subsequent to the running test, as practicable and agreed between the Contract Administrator, the manufacturer's representative, and the Contractor.
- .11 Performance tests shall be as dictated in the Specifications for each item of equipment or as reasonably required by the Contract Administrator to prove adherence to the requirements listed in the Specification.

- .12 Submit the results of the performance tests to the Contract Administrator, documented in a format acceptable to the Contract Administrator. 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 tests and receipt of the test reports.
- .13 All water, temporary power, heating, or any other ancillary services required to complete the initial demonstration, running test and performance tests are the responsibility of the Contractor.
- .14 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.

1.30 Training

.1 Description

- .1 This Section contains requirements for training the City staff, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this Contract.
- .2 Training sessions are required during the equipment testing.
- .3 As a minimum, the Contractor is to allow at least four hours of training per shift, as required for each item of equipment or system.
- .4 The intent is that the City should receive sufficient training on the equipment and systems that they are going to operate and maintain. The Contract Administrator shall have the authority to determine the duration and content of each training session required. Specific training will be required for the following:
 - .1 Control Systems.
 - .2 Sampling Systems/Flow Meter.
 - .3 HVAC

.2 Quality Assurance

- .1 Where required by the equipment Specifications, provide on-the-job training of the City staff. Training sessions will be conducted by qualified factory-trained representatives of the various equipment suppliers with a minimum of two years experience. Training includes instruction of City staff in equipment operation and preventive maintenance and instruction on mechanics, electricians, instrumentation, and communications technicians in normal maintenance up to major repair.
- .2 The trainers proposed by the Contractor shall be experienced in training plant operators and shall have relevant experience in similar Work.

.3 Submittals

.1 Submit the following information in accordance with this Section. 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 Contractor's trainer(s).

.2 Date, time, and subject of each training session. The Contractor shall give the Contract Administrator one weeks notice prior to conducting training.

.3 Training schedule. Concurrent classes will not be allowed.

.4 Location

.1 Where specified, conduct training sessions for the City staff, operations and maintenance personnel, on the operation, care, and maintenance of the equipment and systems installed under this Contract. Training will take place at the Site of the Work and under the conditions specified in the following paragraphs.

.2 Field training sessions will take place at the Site of the equipment. Classroom training is to take place in the Contractor's site trailer. The Contract Administrator may direct the classroom training to take place at another suitable location.

.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 ten (10) copies of necessary training manuals, handouts, visual aids, and reference materials at least two weeks prior to each training session.

.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 Troubleshooting

.5 Preventive maintenance

.6 Corrective maintenance

- .7 Parts
 - .8 Local representatives
- .7 Video Recording
- .1 Advise all suppliers providing training sessions that the training material may be videotaped. The City may record each training session, and the material may be edited and supplemented with professionally produced graphics to provide a permanent record for the City's use.
- .8 General Requirements
- .1 Conduct training in conjunction with the equipment testing 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 four hours of classes scheduled for any one shift.
 - .2 Provide final Operations and Maintenance (O&M) Manuals, for the specific equipment to the City at least four weeks prior to the start of any training. (Video recording may take place concurrently with all training session).
- .9 Operator Classroom Training
- .1 As a minimum, classroom equipment training for operations personnel will include:
 - .1 The equipment's specific location and an operational overview. Use slides and drawings to aid discussion.
 - .2 Purpose and plant 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.
 - .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.
 - .10 Exam.

.10 Operator Hands-On Training

- .1 As a minimum, hands-on equipment training for operations personnel will 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 daily visual inspection of system operation.
 - .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.

.11 Maintenance Classroom Training

- .1 Classroom equipment training for the maintenance and repair personnel will include:
- .1 Basic theory of operation.
 - .2 Description and function of equipment.
 - .3 Routine start-up and shutdown procedures.
 - .4 Normal and major repair procedures.
 - .5 Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
 - .6 Routine and long-term calibration procedures.
 - .7 Safety procedures.
 - .8 Preventive maintenance and up to and including major repairs such as replacement of major equipment part(s) with the use of special tools.

.12 Maintenance Hands-on Training

- .1 Hands-on equipment training for maintenance and repair personnel will 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 Contractor's manuals in the hands-on training.
- .13 Equipment and Systems for Training
- .1 Provide training during the equipment testing period for the following equipment and systems:
 - .1 Sampler
 - .2 Magmeter
 - .3 Heating/ventilation system
 - .4 Control system
 - .5 Electrical system
 - .2 Coordinate and finalize with the Contract Administrator on training schedules and duration of each training session.
- .14 Training Completion Forms and Payment
- .1 Training for the Contract supplied equipment shall be conducted before the operation period.
 - .2 The Contract shall not be considered complete, for the purpose of issuing a Certificate of Substantial Performance, until the training has been provided.

1.31 Commissioning

- .1 General
 - .1 Perform commissioning as specified in the Commissioning Plan attached in Appendix B, and as supplemented below and in individual equipment specification sections.
- .2 Intent
 - .1 This Section describes the Contractor's responsibilities in commissioning and handover of the process, electrical, and other systems to be installed as part of this Work.

.3 Definitions

- .1 System: for the purpose of this Specification 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 Commissioning: for the purpose of this Specification Section, commissioning shall be defined as the successful operation of a system in accordance with its design requirements for a period of 7 Calendar Days, unless otherwise specified or authorized by the Contract Administrator
- .3 Acceptance: for the purpose of this Specification Section, acceptance shall be defined as the formal turnover of a system to the City for their operation and maintenance. This shall occur after the successful end of commissioning of each system through a formal agreement between the Contract Administrator, the City, and the Contractor. Success of the commissioning period is determined by the Contract Administrator.

.4 Commissioning Team

- .1 The Work of commissioning will be conducted by the Contractor, the City, and the Contract Administrator.
- .2 The City's appointed staff shall represent process personnel and operating staff.
- .3 The Contractor shall provide personnel representing the appropriate trades, including I&C personnel during the commissioning. These personnel shall be skilled workmen, able to expedite any minor repairs, adjustments, etc., as required to complete commissioning with as few delays as possible.

.5 Commissioning Plan

- .1 Develop a detailed methodology for the commissioning of each system at least 30 Calendar Days prior to planned start of commissioning. The plan shall be drafted by the Contractor and reviewed by the Contract Administrator and 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.
 - .2 Method for introducing process flow.
 - .3 Planned attendance schedule for manufacturer's representatives.
 - .4 Contingency plans in the event of a process malfunction.
 - .5 Drawings and sketches as required to illustrate the planned sequence of events.
 - .6 List and details for any temporary equipment required to facilitate Commissioning.

- .10 Design Parameters
 - .1 Design parameters for the systems to be commissioned shall be as defined in the Specifications and/or the operating descriptions. The commissioning team will identify to the Contractor, which parameters shall be modified prior to commissioning and shall be responsible for any subsequent changes during the commissioning period.
- .11 Preparation
 - .1 Each item of equipment included in the system to be commissioned shall be satisfactorily tested.
 - .2 Piping, wiring, and other conduit systems shall be finished and tested.
 - .3 Electrical connections shall be completed and inspected to the satisfaction of the governing authorities.
 - .4 All other regulatory inspections shall be completed to the satisfaction of the governing authorities.
 - .5 Control systems shall be completed and the related control software debugged.
- .12 Sequence
 - .1 Systems shall be commissioned in a logical manner. Upstream components shall be commissioned first to the degree possible.
 - .2 The following sequence of events shall be followed:
 - .1 O&M Manuals shall be available at least 14 Calendar Days prior to the start of commissioning.
 - .2 Initial operator training shall be undertaken prior to commissioning.
 - .3 Equipment performance tests shall be conducted successfully.
 - .4 Start and run system in manual mode.
 - .5 Turn separate items of equipment to automatic in a planned and logical manner. 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.
 - .6 Commence commissioning period of 7 Calendar Days. The equipment shall operate continuously and successfully through the commissioning period. Minor failures shall not void the commissioning period. A minor failure is defined as one which does not present a safety hazard, does not impact overall process functioning and can be temporarily overcome by the use of available standby equipment. The commissioning period shall be re-started if a critical failure occurs. A critical failure shall be deemed as one, which prohibits the process from functioning successfully for an

eight hour period or one, which creates a safety hazard.

- .7 Upon completing the commissioning period, the system shall be granted formal acceptance by the Contract Administrator.

.13 Commissioning

- .1 Final effluent (non-potable water) will be introduced to the system in a manner which precludes the damage of any equipment or structures.
- .2 Twice during the commissioning period, plant component settings will be modified to ensure that the system is subjected to flows and loads as close to design conditions as possible. Where necessary to achieve this, flows to the area being commissioned will be augmented to exaggerate the naturally occurring flows and loads. Where it is necessary to modify settings outside the limits of this Contract area within the plant, coordinate the changes with plant staff.
- .3 All components and systems shall be operated in the automatic/manual and the remote/local modes as required to prove proper operation.
- .4 Ensure all bypasses and backup provisions function satisfactorily.
- .5 All minor and major alarm conditions will be induced to ensure that the process reacts as intended and the applicable alarms are annunciated.

.14 Acceptance

- .1 The commissioning of a system shall be considered acceptable when the process has operated in a stable manner, satisfying the design criteria for a period of 7 Calendar Days of continuous operation.
- .2 When a process system has been commissioned satisfactorily, the process system shall be formally accepted for operation and routine maintenance by the City's forces.
- .3 An acceptance meeting must be held at the end of the 7 Calendar Day test to confirm the status of each system.

Part 1 General

1.1 INSPECTION

- .1 Allow the Contract Administrator access to the Work. If part of the Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by the Contract Administrator instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 The Contract Administrator will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, the City shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies may be engaged by the City for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the City. Costs of additional tests required due to defective Work shall be paid by the Contractor.
- .2 All equipment required for executing inspection and testing will be provided by the respective agencies.
- .3 Employment of inspection/testing agencies does not relieve or relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Contract Administrator at no cost to the City. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

- .1 The City, the Contract Administrator, and other authorities having jurisdiction shall have access to the Work.

1.4 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.

- .3 If in opinion of the Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the City will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by the Contract Administrator.

1.5 REPORTS

- .1 Submit draft inspection and test reports to the Contract Administrator, prior to inclusion with the O&M manuals.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Approved: 2006-03-31

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.2 HOARDING

- .1 Erect temporary site enclosures using construction grade lumber framing and exterior grade fir plywood to CSA O121.

1.3 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide rigid guard rails constructed of dimensional lumber in the existing gate chamber structure as the existing rails are of insufficient height.
- .3 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to Pre-Commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Requirements
 - .1 Refer to Section 01 91 33 - Pre-Commissioning Forms.
- .3 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx – Pre-Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 The following documents shall be referenced for commissioning activities and plans.
 - .1 Project Commissioning Plan, document S0976-14DD-PLA-0001
- .2 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O M staff.
- .3 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

- .4 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 PRE-COMMISSIONING OVERVIEW

- .1 For Cx responsibilities refer to Project Commissioning Plan, document S0976-14DD-PLA-0001
- .2 Cx to be a line item of Contractor's cost breakdown.
- .3 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .4 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .5 Contract Administrator will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Contract Administrator.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Contract Administrator, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Contract Administrator.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.

- .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Contract Administrator.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Contract Administrator for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Contract Administrator in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Contract Administrator before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 00 00 General Provisions.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Contract Administrator for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Contract Administrator where not specified and obtain written approval at least 8 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Contract Administrator.

1.8 PRE-COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Pre-Commissioning (Cx) Forms.
- .2 Provide completed and approved Cx documentation to Contract Administrator.

1.9 PRE-COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.

- .3 Repairs, retesting, re-commissioning, re-verification.
- .4 Training.

1.10 PRE-COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage, Contract Administrator to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Cx Agent, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days notice prior to commencement.
- .2 Contract Administrator to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Contract Administrator.
 - .3 Arrange for Contract Administrator to witness tests.
 - .4 Obtain written approval of test results and documentation from Contract Administrator before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Contract Administrator.

- .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
- .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, and approved shop drawings.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Contract Administrator after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Contract Administrator. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Contract Administrator.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Contract Administrator.
 - .3 If evaluation report concludes that major damage has occurred, Contract Administrator shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Contract Administrator for approval before commencement of Pre-Commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Contract Administrator to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit to Contract Administrator for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF PRE-COMMISSIONING

- .1 Notify Contract Administrator at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

- .1 Submit to Contract Administrator for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.20 PRE-COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 Facility shall be operational for minimum 2 weeks with no incidents requiring correction to any deficiency before start of final commissioning. If a deficiency is discovered during the 2 week period, an additional 2 weeks will be required starting from when deficiency is corrected.

1.21 WITNESSING PRE-COMMISSIONING

- .1 Contract Administrator to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Contract Administrator within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

- .1 It is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Contract Administrator in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

- .1 Provide manpower and instrumentation to verify up to 100% of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Contract Administrator.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat Pre-Commissioning of systems if inconsistencies found in more than 20% of reported results.

- .5 Perform additional commissioning until results are acceptable to Contract Administrator.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Contract Administrator for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Contract Administrator's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Contract Administrator deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Contract Administrator.
- .2 Report problems, faults or defects affecting Cx to Contract Administrator in writing. Stop Cx until problems are rectified. Proceed with written approval from Contract Administrator.

1.29 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Contract Administrator.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.31 TRAINING

- .1 In accordance with Section 01 00 00 General Provisions.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 OCCUPANCY

- .1 Cooperate fully with Contract Administrator during stages of acceptance and occupancy of facility.

1.34 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Contract Administrator.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.36 OWNER'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Contract Administrator will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system and integrated system.
- .2 Related Requirements
 - .1 Section 01 91 13 General Pre-Commissioning (Cx) Requirements.

1.2 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Contract Administrator's approval.

1.3 SAMPLES OF PRE-COMMISSIONING FORMS

- .1 Contract Administrator will develop and provide to Contractor required project-specific Pre-Commissioning forms in electronic format complete with specification data.

Document	Description
F-A-CONTROL.DOC	Automation – Control Conductors
F-A-TSP.DOC	Automation – Twisted Shielded Pairs
F-CBL-4160V.doc	Power Cable, 4160V
F-CBL-LV.doc	Power Cable < 1000V
F-EMERG-LTG.doc	Emergency Lighting
F-GND_CONN_RES_L.doc	Grounding/Bonding Connection Resistance
F-GROUNDING.doc	Grounding System
F-INST-SW-CHECKLIST.DOC	Instrumentation Switch Checklist
F-INST-TRANS-CHECKLIST.DOC	Instrumentation Transmitter Loop Checklist
F-INTEL-OL.doc	Intelligent Overload
F-MOD-CTRL-DEV-CHECKLIST.DOC	Modulating Control Device Checklist
F-MS-FVNR-BASIC.doc	Motor Starter, FVNR, Basic
F-MTR-LV.doc	AC Motor, Low Voltage
F-PID-CTRLR-CHECKLIST.DOC	PID Controller Checklist
F-PLC-DI-CHECKLIST.DOC	PLC Discrete Input Checklist
F-PLC-DO-CHECKLIST.DOC	PLC Discrete Output Checklist
F-PNL-LV.doc	Panel board, Low Voltage
F-XFMR-LIQ-MV.doc	Transformer, Liquid Filled, Medium Voltage

- .2 Revise items on Commissioning forms to suit project requirements.

- .3 Samples of Pre-Commissioning forms and a complete index of produced to date will be attached to this section.

1.4 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

- .1 When additional forms are required, but are not available from Contract Administrator develop appropriate verification forms and submit to Contract Administrator for approval prior to use.
 - .1 Additional Pre-Commissioning forms to be in same format as provided by Contract Administrator.

1.5 PRE-COMMISSIONING FORMS

- .1 Use Pre-Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Contract Administrator provides Contractor project-specific Pre-Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician and reviewed and signed off by Contract Administrator.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Contract Administrator with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.
 - .13 Forms to be both hard copy and electronic format with typed written results.

1.6 LANGUAGE

- .1 To suit the language profile of the awarded contract.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION