

Part 1 General

1.1 Work covered by contract documents

- .1 Work of this Contract comprises the replacement of the existing chiller and pumps that serve the Morden Research and Development Centre and the replacement of controls in the panels of the mechanical room.
- .2 Perform all work indicated on the drawings including, but not limited to the following:
 - .1 Supply and install two new chillers to replace the existing one chiller.
 - .2 Supply and install new cooling tower.
 - .1 Existing cooling tower stand to be modified and reused. All paint to be stripped and all rust to be cleaned off. Apply rust inhibitor and paint the stand prior to installing new cooling tower.
 - .3 Supply and install new supply and return chilled water piping in the crawlspace.
 - .1 Connect to existing pipes using mechanical grooved couplings.
 - .4 Supply and install new chilled water and condensing water pumps.
 - .5 Supply and install new controllers for the systems in the mechanical room.
 - .6 Supply and install new chemical feeder system.
 - .7 AHU-1 piping to be reconfigured. Refer to sealed drawings.
 - .8 All existing Innotech controls are to be replaced by Johnson controls. Existing panels are to be reused. Existing system shown in Appendix.
 - .9 Work includes demolition of all existing systems that are to be replaced in the above work. Any areas damaged during the demolition and renovation of the facility (cut-outs, patching, holes, etc.) must be repaired to its original state.
 - .10 Work also includes start-up, commissioning, and training of all systems installed.
 - .11 All materials and workmanship must be as per stamped plans and specifications within.
 - .12 No asbestos containing materials (ACMs) are expected to be abated as work of the identified work. ACM encountered in the vicinity of the area of work of this project. If the ACM will be disturbed as a result of the work outlined in this project the Contractor is to notify the Departmental Representative prior to proceeding.
 - .13 Chiller, cooling tower, chemical treatment and all controls as a part of this contract are to start construction on September 15, 2022, if required by the Departmental Representative.
 - .14 Chiller and cooling tower system as a part of this contract are to be ready for commission by May 1st, 2023, if required by the Departmental Representative.

1.2 Work by others

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.

1.3 Work sequence

- .1 Construct Work in stages to accommodate Departmental Representative's continued use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Departmental Representative during construction.
- .3 Construct Work in stages to provide for continuous public usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.
- .4 Maintain fire access/control.

1.4 Contractor use of premises

- .1 Unrestricted use of site until Substantial Performance.
- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.5 Agriculture and Agri-Food Canada occupancy

- .1 Agriculture and Agri-Food Canada will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Agriculture and Agri-Food Canada in scheduling operations to minimize conflict and to facilitate Agriculture and Agri-Food Canada usage.

1.6 Alterations, additions or repairs to existing building

- .1 Execute work with least possible interference or disturbance to building operations, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.7 Documents required

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.

- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 System Components List.
- .12 Commissioning Verification Forms.
- .13 Commissioning Check Sheets.
- .14 Commissioning Issues/Resolution Log.
- .15 Other documents as specified.

1.8 Request for information

- .1 Maintain a Request for Information (RFI) system for questions regarding clarifications. A RFI must be a written document submitted in electronic form which as a minimum includes the following details:
 - .1 Date.
 - .2 Project name and number.
 - .3 Contractor's contact information.
 - .4 Reference to the drawings and/or specifications (when applicable).
 - .5 Location of the work in question.
 - .6 A complete description of the question.
 - .7 Affects this item will have on other work.
 - .8 Affects this item will have on the cost of the project.
 - .9 Affects this item will have on the construction schedule.
 - .10 Suggested solution to resolve the question(s).
 - .11 Date that the response to the RFI is required by.
 - .12 An area for a response to the RFI to be provided.
- .2 A RFI form is to be prepared with headings and spaces for the above mentioned information to be filled into. Hand-written RFIs will not be accepted.
- .3 The Contractor is to allow a minimum of 3 days for the Departmental Representative to provide a response.
- .4 The Departmental Representative's response does not authorize changes to the contract scope, price, of schedule.
- .5 RFIs are intended for clarification of site conditions, drawings, or specifications. RFIs shall not be used be used by the Contractor to identify potential errors or omissions in the Contract Documents. In the case of potential errors or omissions in the Contract Documents, communicate directly with the Departmental Representative for clarifications.

Part 2 Products

2.1 Not used

- .1 Not used.

Part 3 Execution

3.1 Not used

- .1 Not used.

Ω End of Section

Part 1 General

1.1 Access and egress

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 Use of site and facilities

- .1 Execute work with the least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Contractor to provide sanitary facilities for use.
- .5 Closures: protect work temporarily until permanent enclosures are completed.

1.3 Alterations, additions or repairs to existing building

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 All cutting or penetrations through a structural member must be reviewed and approved by a Structural Engineer prior to proceeding with the work.

1.4 Existing services

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 Security

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

1.6 Building smoking environment

- .1 Comply with smoking restrictions. Smoking is not permitted.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 **Execution**

3.1 **Not used**

.1 Not Used.

Ω End of Section

Part 1 General

1.1 Administrative

- .1 Schedule and administer project meetings throughout the progress of the work
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting two days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 Preconstruction meeting

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .3 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .4 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .5 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .6 Departmental Representative provided products.
 - .7 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .8 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .9 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
 - .10 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .11 Appointment of inspection and testing agencies or firms.
 - .12 Insurances, transcript of policies.

1.3 Progress meetings

- .1 During course of Work and 2 weeks prior to project completion, schedule progress meetings monthly.
- .2 Contractor, major Subcontractors involved in Work Departmental Representative are to be in attendance.
- .3 Notify parties minimum 2 days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 2 days after meeting.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Other business.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 Definitions

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

1.2 Requirements

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within 10 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 Project schedule

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Mobilization.
 - .4 Controls.
 - .5 Heating, Ventilating, and Air Conditioning.
 - .6 Testing and Commissioning.
 - .7 Supplied equipment long delivery items.

1.5 Project schedule reporting

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.6 Project meetings

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 Not used

- .1 Not used.

Part 3 Execution

3.1 Not used

- .1 Not used.

Ω End of Section

Part 1 General

1.1 Administrative

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that the necessary requirements have been determined and verified, or will be, and that each submittal has 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.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.2 Shop drawings and product data

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow 3 days for Departmental Representative review of each submission.
- .4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .6 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.

- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.
- .7 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 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 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 Relationship to adjacent work.
- .8 After Departmental Representative review, distribute copies.
- .9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .10 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .12 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.

- .13 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .14 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 Reference standards

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Manitoba
 - .1 The Workers Compensation Act RSM 1987 - Updated 2013.
- .3 Manitoba Workplace safety and Health Act and Regulation. 2020

1.2 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site-specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit 1 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
- .4 Submit copies of incident and accident reports.
- .5 Submit WHMIS Safety Data Sheets (SDS) in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials.
- .6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.
- .7 Departmental Representative review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .8 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 Safety assessment

- .1 Perform site specific safety hazard assessment related to project.

1.4 Meetings

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.5 Regulatory requirements

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.6 General requirements

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.7 Responsibility

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.8 Compliance requirements

- .1 Comply with the Occupational Health and Safety Acts and Regulations of the Province Having Jurisdiction
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.
- .3 Comply with all Federal and Provincial COVID-19 RESTRICTONS AND GUIDELINES.

1.9 Unforeseen hazards

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety coordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.10 Health and safety coordinator

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have working knowledge of occupational safety and health regulations.
 - .2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .4 Be on site during execution of Work and report directly to the Departmental Representative.

1.11 Correction of non-compliance

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.12 Work stoppage

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 Not used

- .1 Not used.

Part 3 Execution

3.1 Not used

- .1 Not used.

Ω End of Section

Part 1 General

1.1 References to regulatory requirements

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code
 - .1 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 Hazardous material discovery

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work.
- .2 Mould: stop work immediately when material resembling mould is encountered during demolition work.

1.3 Building smoking environment

- .1 Comply with smoking restrictions and municipal by-laws.

1.4 Quality assurance

- .1 Regulatory Requirements: Except as otherwise specified, Contractor shall apply for, obtain, and pay fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements.

Part 2 Products

2.1 Not used

- .1 Not Used.

2.2 Permits

- .1 Permits:
 - .1 Constructor shall apply for, obtain, and pay for permits, including electrical and trade permits where required by authority having jurisdiction.
 - .2 AHJ will issue appropriate instructions to Constructor for correction to Work where Contract Document deficiencies are required to be corrected in order to obtain occupancy permits, including partial occupancy permits.
 - .3 Constructor shall correct deficiencies in accordance with AHJ's instructions. Where deficiency is not corrected, Departmental Representative reserves the right to make correction and charge Constructor for costs incurred.

Part 3 **Execution**

3.1 **Not used**

.1 Not Used.

Ω End of Section

Part 1 General

1.1 Inspection

- .1 Allow Departmental Representative access to Work. If part of 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 Departmental Representative 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.

1.2 Independent inspection agencies

- .1 Provide equipment required for executing inspection and testing by appointed agencies.
- .2 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .3 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 Departmental Representative at no cost to Agriculture and Agri-Food Canada. Pay costs for retesting and reinspection.

1.3 Access to work

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.4 Procedures

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 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 Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Contractor to repair any damages as a result of contractor outside of scope by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative 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 Departmental Representative.

1.6 Reports

- .1 Submit 2 copies of inspection and test reports to Departmental Representative.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.2 Installation and removal

- .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 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.3 Scaffolding

- .1 Scaffolding in accordance with CAN/CSA-S269.2.

1.4 Hoisting

- .1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists cranes to be operated by qualified operator.

1.5 Site storage/loading

- .1 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.6 Construction parking

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

1.7 Security

- .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.8 Equipment, tool and materials storage

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.9 Sanitary facilities

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.10 Clean-up

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Store materials resulting from demolition activities that are salvageable.
- .3 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution - Not Used

Ω End of Section

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 Access to site

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.3 Fire routes

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.4 Protection for off-site and public property

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.5 Protection of building finishes

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 5 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.6 Waste management and disposal

- .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 Reference standards

- .1 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 Quality

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 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 Departmental Representative 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 Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 Storage, handling and protection

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

- .5 Touch-up damaged factory finished surfaces to Departmental Representative, satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 Transportation

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

1.6 Manufacturer's instructions

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 Quality of work

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.8 Co-ordination

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.9 Remedial work

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 Location of fixtures

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

1.11 Fastenings

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.12 Fastenings - equipment

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.13 Protection of work in progress

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.14 Existing utilities

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Part 1 General

1.1 Action and informational submittals

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Departmental Representative or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Departmental Representative or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.2 Materials

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.3 Preparation

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 Execution

- .1 Execute cutting, fitting, and patching, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.

- .5 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .6 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .7 Restore work with new products in accordance with requirements of Contract Documents.
- .8 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .9 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

1.5 Waste management and disposal

- .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 Project cleanliness

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Agriculture and Agri-Food Canada or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.
- .5 Dispose of waste materials and debris off site.
- .6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 Final cleaning

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Agriculture and Agri-Food Canada or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and sweep roofs, gutters, areaways, and sunken wells.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 **Execution**

3.1 **Not used**

.1 Not Used.

Ω End of Section

Part 1 General

1.1 Definitions

- .1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.
- .2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, re modeling operations, repair and demolition
- .3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity or reactivity.
- .4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.
- .5 Nontoxic: Not poisonous to humans either immediately or after a long period of exposure.
- .6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- .7 Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- .8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.
- .9 Return: To give back reusable items or unused products to vendors for credit.
- .10 Reuse: To reuse a construction waste material in some manner on the project site.
- .11 Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- .12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.
- .13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- .14 Toxic: Poisonous to humans either immediately or after a long period of exposure.
- .15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- .16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:
 - .1 Solvents in paints and other coatings;
 - .2 Wood preservatives; strippers and household cleaners;
 - .3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.
 - .4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.
- .17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- .18 Construction Waste Management Plan: A project related plan for the collection, transportation, and disposal of the waste generated at the construction site; the purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.2 Administrative requirements

- .1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the project, and ensure that requirements of the Construction Waste Management Plan are followed.
- .2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 – Project Meetings before starting any Work of the Contract attended by the Contractor, affected Subcontractor 's and Departmental Representative to discuss the Contractor 's Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.3 Submittals

- .1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Draft Construction Waste Management Plan (Draft CWM Plan): Submit to Departmental Representative a preliminary analysis of anticipated site generated waste by listing a minimum of five (5) construction or demolition waste streams that have potential to generate the most volume of material indicating methods that will be used to divert construction waste from landfill and source reduction strategies; Departmental Representative will provide commentary before development of Contractor 's Construction Waste Management Plan.
 - .2 Construction Waste Management Plan (CWM Plan): Submit a CWM Plan for this project prior to any waste removal from site and that includes the following information:

1.4 Delivery, storage and handling

- .1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the project waste and the available recycling and reuse programs in the project area.
- .2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:
 - .1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
 - .2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.
- .3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 (CWN plan) implementation

- .1 Manager: Contractor is responsible for designating an on-site party or parties responsible for instructing workers and overseeing and documenting results of the CWM Plan for the project.
- .2 Distribution: Distribute copies of the CWM Plan to the job site foreman, each Subcontractor, the Departmental Representative and other site personnel as required to maintain CWM Plan.
- .3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the project to Subcontractor 's at appropriate stages of the project.

Ω End of Section

Part 1 General

1.1 Administrative requirements

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Departmental Representative Inspection:
 - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
 - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.
 - .5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

1.2 Final cleaning

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 Administrative requirements

- .1 Pre-warranty Meeting:
 - .1 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .2 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .3 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, two final copies of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 Format

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.

1.4 Contents - project record documents

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses and telephone numbers of Departmental Representative and Contractor with name of responsible parties.

- .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Typewritten Text: as required to supplement product data.

1.5 As -built documents and samples

- .1 Maintain one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field Test Report, Commissioning Verification Testing and Verification Documentation such as Forms and Check Sheets and Commissioning Issues/Resolution Log.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 Recording information on project record documents

- .1 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .2 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Field changes of dimension and detail.
 - .2 Changes made by change orders.
 - .3 Details not on original Contract Drawings.
 - .4 Referenced Standards to related shop drawings and modifications.
- .3 Specifications: mark each item to record actual construction, including:

- .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
- .2 Changes made by Addenda and change orders.
- .4 Provide digital photos, if requested, for site records.

1.7 Materials and finishes

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

1.8 Delivery, storage and handling

- .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 components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.9 Warranties and bonds

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 12 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .3 Contractor's plans for attendance at 12 month post-construction warranty inspections.
 - .4 Procedure and status of tagging of equipment covered by extended warranties.
 - .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

Part 2 **Products**

2.1 **Not used**

.1 Not Used.

Part 3 **Execution**

3.1 **Not used**

.1 Not Used.

Ω End of Section

Part 1 General

1.1 Administrative requirements

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Agriculture and Agri-Food Canada's personnel two weeks prior to date of final inspection.
- .2 Agriculture and Agri-Food Canada: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
- .4 Demonstration and Instructions:
 - .1 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .2 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .3 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

1.2 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 Quality assurance

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
 - .1 Instruct Agriculture and Agri-Food Canada's personnel.
 - .2 Provide written report that demonstration and instructions have been completed.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 Trainees

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes the Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.2 Instructors

- .1 The Departmental Representative will provide:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down of equipment, components and systems.
 - .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .3 Contractor and equipment manufacturer to provide instruction on:
 - .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.3 Training objectives

- .1 Training to be detailed and duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis and trouble-shooting.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.4 Training materials

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Management Manual.

- .3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.5 Scheduling

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be 3 hours in length.
- .3 Training to be completed prior to acceptance of facility.

1.6 Responsibilities

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Departmental Representative will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by the Departmental Representative.

1.7 Training content

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
 - .7 Maintenance and servicing.
 - .8 Trouble-shooting diagnosis.
 - .9 Inter-Action among systems during integrated operation.
 - .10 Review of O&M documentation.

- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 General

- .1 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 Operations and Maintenance Manual
 - .3 Effectively train O&M staff.
- .2 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.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional, operational requirements and construction document.

1.2 Commissioning overview

- .1 Section 01 91 13.13 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Section 01 91 13.13 - Commissioning (Cx) Plan.
- .3 Cx to be a line item of Contractor's cost breakdown.
- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 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 built 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.
- .6 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components, systems and integrated systems have been fully commissioned and functional as per design intent to meet contract specification and project functional and operational requirements.
 - .3 Completion of two O&M Training session to Operational and Maintenance staffs. One training session at commissioning and one at season change.
 - .4 Final O&M and training manual to be received, reviewed and approved by Departmental Representative for suitability.

- .5 Successful completion of integrated system tests, and after meeting all requirements of the authority having jurisdiction.

1.3 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 Departmental Representative, 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.

1.4 Pre-cx review

- .1 Before Construction:
 - .1 Review Contract Documents, confirm by writing to Departmental Representative.
 - .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 are 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 Departmental Representative.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.5 Conflicts

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

1.6 Action and informational submittals

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .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 Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
- .3 Cx procedures are to be created by the Departmental Representative, and provided to the contractor for execution, including Departmental witness of commissioning activities.
- .4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.7 Commissioning documentation

- .1 Refer to Section 01 91 13.16 - Commissioning (Cx) Forms.
- .2 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.8 Commissioning schedule

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.19 - Construction Progress Schedules - Bar (GANTT) Chart.
- .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.

1.9 Commissioning meetings

- .1 Commissioning meetings to be convened by the Departmental Representative, who will also records minutes and distribute to all parties within 28 hours, contractor(s) are responsible for attending and participating in commissioning meetings, as well as executing commissioning plan (prepared by the Departmental Representative) and completing the commissioning inspections and testing (which is created by the Departmental Representative)
- .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. Section 01 32 16.19 - Construction Progress Schedules - Bar (GANTT) Chart. Departmental Representative 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 Departmental Representative, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60 % and subsequent Cx meetings and as required.

1.10 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.

1.11 Witnessing of starting and testing

- .1 Provide 14 days notice prior to commencement.
- .2 Departmental Representative to witness 100% 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.

1.12 Manufacturer's involvement

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative 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 Departmental Representative
 - .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.

1.13 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, approved shop drawings and completion of PI report forms.
 - .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 Departmental Representative 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 Departmental Representative. 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 Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative 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.

1.14 Start-up documentation

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of 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 Departmental Representative to repeat start-up at any time.

1.15 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 Departmental Representative 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.

1.16 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.

1.17 Start of commissioning

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.

1.18 Instruments/equipment

- .1 Submit to Departmental Representative 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.

1.19 Commissioning performance verification

- .1 Carry out Cx:
 - .1 Under accepted simulated 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.

1.20 Witnessing commissioning

- .1 Departmental Representative to witness activities and verify results.

1.21 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 Departmental Representative within 5 days of test and with Cx report.

1.22 Extent of verification

- .1 100% verification of all equipment installed is required on this project.
- .2 Number and location to be at discretion of Departmental Representative.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20 % of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.23 Repeat verifications

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

1.24 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.

1.25 Deficiencies, faults, defects

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

1.26 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 Departmental Representative.

1.27 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.

1.28 Training

- .1 In accordance with Section 01 79 00 - Commissioning (Cx) - Training and 01 79 00.13 Demonstration and Training for Building Commissioning.

1.29 Maintenance materials, spare parts, special tools

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

1.30 Occupancy

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.31 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.
- 1.32 Departmental Representative's performance testing**
- .1 Performance testing of equipment or system by Departmental Representative 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.

Ω End of Section

Part 1 General

1.1 Reference standards

- .1 Underwriters' Laboratories of Canada (ULC)
- .2 ASHRAE 202-2013 - Commissioning Process for Building and Systems
- .3 CSA Z320-11 - Building commissioning Standard.

1.2 General

- .1 Provide a fully functional facility:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
 - .3 Optimized life cycle costs.
 - .4 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".
- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O&M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
- .4 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 WHMIS Safety Data Sheets (SDS).
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 WHMIS - Workplace Hazardous Materials Information System.
- .5 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.3 Development of 100% cx plan

- .1 Cx Plan to be 95% completed before added into Project Specifications.
- .2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Cx schedule.
 - .5 Contractor's, sub-contractor's, suppliers' requirements.
 - .6 Project construction team's and Cx team's requirements.
- .3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.4 Refinement of cx plan

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update at every weekly meeting during the construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.5 Composition, roles and responsibilities of cx team

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 Departmental Representative Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress
 - .2 Departmental Representative Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O&M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.
 - .3 Departmental Representative is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Witnessing, certifying accuracy of reported results.

- .4 Developing BMM.
- .5 Ensuring implementation of final Cx Plan.
- .6 Performing verification of performance of installed systems and equipment.
- .7 Implementation of Training Plan.
- .4 Construction Team: Contractor, subcontractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
- .5 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
- .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-To-Day operation and maintenance of facility.

1.6 Cx participants

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
- .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
- .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
- .4 Specialist Cx agency:
 - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
- .5 Client: responsible for intrusion and access security systems.
- .6 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
- .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.7 Extent of cx

- .1 Commission mechanical systems and associated equipment:
 - .1 HVAC and exhaust systems:
 - .1 Chiller
 - .2 Hydronic Pumps
 - .3 Cooling Tower
- .2 Commission electrical systems and equipment
- .3 Commission control systems and equipment

1.8 Deliverables relating to O&M perspectives

- .1 General requirements:
 - .1 Compile English documentation.
 - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 WHMIS Safety Data Sheets (SDS).
 - .7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.
 - .8 Contractor's and sub-contractors' as built drawings.
 - .9 Standard Operating Procedures (SOP)
 - .10 Preventive Maintenance Program

1.9 Deliverables relating to the cx process

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.

- .5 Completed performance verification (PV) report forms.
- .6 Results of Performance Verification Tests and Inspections.
- .7 Description of Cx activities and documentation.
- .8 Description of Cx of integrated systems and documentation.
- .9 Preventive maintenance program
- .10 Tests performed by Contractor.
- .11 Training Plans.
- .12 Cx Reports.
- .13 Prescribed activities during warranty period.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

1.10 Pre-cx activities and related documentation

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor all of these pre-start-up inspections.
 - .4 Include completed documentation with Cx report.
 - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
 - .6 Departmental Representative will monitor some of these inspections and tests.
 - .7 Include completed documentation in Cx report.
- .2 Pre-Cx activities - MECHANICAL:
 - .1 Plumbing systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 Complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

1.11 Start-up

- .1 Start up components, equipment and systems.
- .2 Departmental Representative to monitor all of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .3 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary, until results are acceptable to Departmental Representative.

- .2 Departmental Representative to witness and certify reported results using approved PI and PV forms.
- .3 Departmental Representative to approve completed PV reports and provide to Departmental Representative.

1.12 Cx activities and related documentation

- .1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.
- .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.13 Installation check lists (icl)

- .1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.14 Product information (pi) report forms

- .1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.15 Performance verification (pv) report

- .1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.16 Cx schedules

- .1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Cx agents' credentials: 60 days before start of Cx.
 - .3 Cx procedures: 3 months after award of contract.
 - .4 Cx Report format: 3 months after contract award.
 - .5 Discussion of heating/cooling loads for Cx: 3 months before start-up.
 - .6 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
 - .7 Notification of intention to start Cx: 14 days before start of Cx.
 - .8 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
 - .9 Identification of deferred Cx.

- .10 Implementation of training plans.
- .11 Cx reports: immediately upon successful completion of Cx.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.
- .3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.

1.17 Cx reports

- .1 Submit reports of tests, witnessed and certified by contractor to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.18 Training plans

- .1 Refer to Section 01 79 00 - Demonstration and Training.

1.19 Final settings

- .1 Upon completion of Cx to satisfaction of Departmental Representative lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

Part 2 Products

2.1 Not used

- .1 Not Used.

Part 3 Execution

3.1 Not used

- .1 Not Used.

Ω End of Section

Part 1 General

1.1 Installation/start-up check lists

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.2 Product information (pi) report forms

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.3 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 Departmental Representative's approval.

1.4 Samples of commissioning forms

- .1 Departmental Representative's will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.5 Changes and development of new report forms

- .1 When additional forms are required, but are not available from Departmental Representative's develop appropriate verification forms and submit to Departmental Representative's for approval prior to use.
 - .1 Additional commissioning forms to be in same format as provided by Departmental Representative's

1.6 Commissioning forms

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Departmental Representative's provides Contractor project-specific 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 Departmental Representative's.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative's with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.

1.7 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.

CHILLED WATER SYSTEM

Static Verification

REVISION #: 01

NAME:

COMPANY:

ADDRESS:

FILE NUMBER: R111908

DATE:

NAMEPLATE

EQUIPMENT NO.

LOCATION

CHILLER

SPECIFIED

SHOP DRAWINGS

INSTALLED

MANUFACTURER

-

MODEL NO.

-

SERIAL NO.

-

CAPACITY

130 TONS

REFRIGERANT

R-410a

MAXIMUM FOOTPRINT

2500 MM x 1524 MM

MAXIMUM HEIGHT

2100 MM

COMBINED REFRIGERATION CAPACITY

703 KW

MINIMUM NO. OF CHILLERS

2

NO. OF COMPRESSORS

4

COMPRESSOR TYPE

SCROLL

NUMBER OF COOLING CIRCUITS

2

MAXIMUM SOUND LEVEL AT FULL LOAD

85 dB

TOTAL INPUT POWER

150 KW WHEN COOLING
39 L/S AT 29.4 deg C TO
34.6 deg C

PRESSURE DROP

NOT TO EXCEED 82 KPA

MINIMUM EFFICIENCY RATING

TO ASHRAE 90.1

CONDENSER FOULING RESISTANCE COEFFICIENT

0.000045

EVAPORATOR FOULING RESISTANCE COEFFICIENT

0.000018

VOLTAGE

575 V, 3 Phase

ENCLOSURE

SPRINKLER PROOF

COOLING FLUID

WATER

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

CHILLED WATER SYSTEM

Static Verification

REVISION #: 01

NAME:

COMPANY:

ADDRESS:

FILE NUMBER: R111908

DATE:

VERIFICATION ACTIVITIES	EQUIPMENT NUMBER	COMPLIANCE TO VERIFICATION ACTIVITY			COMMENTS
		YES	NO	N/A	
CONTROL INTERFACE VERIFIED					
CHILLER(S) STARTED BY MANUFACTURER					
CHILLER 1A					
CHILLER 1B					
PUMP P-3					
PUMP P-4					
PUMP P-5					
PUMP P-6					
COOLING TOWER					
CONTROL VALVES VERIFIED					
SENSORS VERIFIED					
FLOW MEASURING DEVICES VERIFIED					
CONTROL VALVES VERIFIED					
SENSORS VERIFIED					
FLOW MEASURING DEVICES VERIFIED					
CHEMICAL TREATMENT VERIFIED					
UNIT IS FREE FROM PHYSICAL DAMAGE					
FACTORY LEAK TEST REPORT PROVIDED					
GENERAL COMMENTS:					

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

CHILLED WATER SYSTEM

Start-Up

REVISION #: 01

NAME:

COMPANY:

ADDRESS:

FILE NUMBER: R111908

DATE:

NAMEPLATE

EQUIPMENT NO.

LOCATION

VERIFICATION ACTIVITIES	EQUIPMENT NUMBER	COMPLIANCE TO VERIFICATION ACTIVITY			COMMENTS
		YES	NO	N/A	
CHILLER 1A					
Chiller-1A installation meets foundation requirements					
Chiller-1A is fastened in place and piped.					
Manufacturer's recommended clearances provide for service access and air circulation around equipment					
Chiller vibration isolation devices functional					
Piping installed in accordance with design drawings					
Piping flushed, cleaned, and leak tested					
Piping labelled in accordance with building's standards					
Valves Properly Labeled					
Air circulation fan(s) for air cooled condenser installed and functional					
Airways and screens for air-cooled condenser installed and cleaned					
External surfaces of condenser heat exchanger clean					
External fins are undamaged					
Unit is free from physical damage					
The unit is secured as required by the manufacturer and specifications					
All valves are in operable					
All valves are installed in the correct orientation					
Electrical disconnects are accessible					
Manufacturer's startup procedure completed					

GENERAL COMMENTS:

CHILLED WATER SYSTEM

Start-Up

REVISION #: 01

NAME:

COMPANY:

ADDRESS:

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DATE:

NAMEPLATE

EQUIPMENT NO.

LOCATION

VERIFICATION ACTIVITIES	EQUIPMENT NUMBER	COMPLIANCE TO VERIFICATION ACTIVITY			COMMENTS
		YES	NO	N/A	
CHILLER 1B					
Chiller installation meets foundation requirements					
Chiller is fastened in place and piped.					
Manufacturer's recommended clearances provide for service access and air circulation around equipment					
Chiller vibration isolation devices functional					
Piping installed in accordance with design drawings					
Piping flushed, cleaned, and leak tested					
Piping labelled in accordance with building's standards					
Valves Properly Labeled					
Air circulation fan(s) for air cooled condenser installed and functional					
Airways and screens for air-cooled condenser installed and cleaned					
External surfaces of condenser heat exchanger clean					
Unit is free from physical damage					
The unit is secured as required by the manufacturer and specifications					
All valves are in operable					
All valves are installed in the correct orientation					
Electrical disconnects are accessible					
Manufacturer's startup procedure completed					

GENERAL COMMENTS:

COOLING TOWER

Static Verification

REVISION #: _____

NAME: _____

COMPANY: _____

ADDRESS: _____

FILE NUMBER: R111908

DATE: _____

NAMEPLATE

EQUIPMENT NO.

CT-1

COOLING TOWER	SPECIFIED	SHOP DRAWINGS	INSTALLED
MANUFACTURER	-		
MODEL NO.	-		
SERIAL NO.	-		
TYPE	OPEN CIRCUIT COOLING TOWER INDUCED DRAFT COUNTER		
COOLING CAPACITY	260 TONS		
VIBRATION ISOLATORS	NOT SPECIFIED		
WATER FLOW RATE	50.5 L/s		
ENTERING WATER TEMP (°C)	42 deg C		
LEAVING WATER TEMP (°C)	36 deg C		
AMBIENT WET BULB TEMP (°C)	24 deg C		
NUMBER OF FANS	1		
NO. MOTORS	1		
MOTOR HP	10		
VOLTAGE / PHASE / FREQUENCY	575 VAC, 3 Ph., 60 Hz.		
MOTOR RPM	1800		
COLD WATER BASIN	INTEGRAL		
TOWER FILL	PVC FORMED FILM TYPE		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

COOLING TOWER

Start-Up

REVISION #: _____

NAME: _____

COMPANY: _____

ADDRESS: _____

FILE NUMBER: R111908

DATE: _____

NAMEPLATE

EQUIPMENT NO.

CT-1

START-UP	STATUS	COMMENTS
NO PHYSICAL DAMAGE ON UNIT		
UNIT AND SUMP ARE CLEAN AND FREE OF DEBRIS		
ALL BOLTS AND SCREWS ARE TIGHT AND FIELD JOINTS SEALED		
BASIN HEATERS INSTALLED		
VIBRATION ISOLATORS INSTALLED		
TEMPERATURE SENSORS INSTALLED		
ISOLATING VALVES INSTALLED		
BALANCING VALVES INSTALLED		
WATER MAKE-UP & LEVEL CONTROL COMPLETE		
FANS ROTATE FREELY		
BELTS ALIGNED & ADJUSTED		
UNIT CONTROLS COMPLETE		
STARTED AS PER MANUFACTURER'S REQUIREMENTS		
FAN ROTATION CORRECT		
VIBRATION ISOLATION OPERATION		
ISOLATION SUPPLIER'S INSPECTION REPORTS ATTACHED		
OPERATION OF IMMERSION HEATER		
FLEXIBLE CONNECTIONS OPERATION		
OPERATION OF CHEMICAL TREATMENT SYSTEM		
NO SHORT CIRCULATION OF AIR FROM OUTLET TO INLET		
CHECK FIELD JOINTS FOR LEAKS		
SEQUENCE OF OPERATION VERIFIED		
SUMMER/WINTER CYCLE VERIFIED		
BELTS CHECKED FOR TENSION AND WEAR AFTER 24 HOURS OPERATION (REPLACE IF WORN)		
OVERFLOW AND EQUALIZER LINE		
PIPING CONNECTIONS CORRECT		
PIPING INSULATION COMPLETE		
MAKE-UP WATER & LEVEL CONTROL INSTALLED CORRECTLY		
WATER TREATMENT INSTALLED		
SUMP SCREEN INSTALLED		
HIGH/LOW LEVEL ALARM		
UNIT SAFETY REQUIREMENTS MEET		

COOLING TOWER

Start-Up

REVISION #: _____

NAME: _____

COMPANY: _____

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CAPACITY CONTROL INSTALLED		
SUMMER/WINTER OPERATION		
MANUAL/AUTO OPERATION		
SOUND ATTENUATORS INSTALLED AT TOWER DISCHARGE		
NOISE LEVELS		
SPRINGS ADJUSTED WITH TOWER FULL		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

COOLING TOWER

Functional Performance Testing

REVISION #: _____

NAME: _____

COMPANY: _____

ADDRESS: _____

FILE NUMBER: R111908

DATE: _____

NAMEPLATE

EQUIPMENT NO.

CT-1

TASK ITEM	STATUS	COMMENTS
THE SYSTEMS RECEIVES ENABLE SIGNAL FROM EMCS		
ONCE SET, ALARM DOES NOT RETURN TO NORMAL UNTIL THE ALARM CONDITIONS HAVE CEASED.		
OBSERVE FAN OPERATION AND CONFIRM SEQUENCE		
TURN OFF THE PUMPS MANUALLY AT PUMP DISCONNECT AND OBSERVE FOR SYSTEM ALARM FEEDBACK		
VIEW ALL GRAPHIC SCREENS AND TEST FUNCTION		
OPERATOR GUI ALLOWS OPERATOR TO VIEW ALARMS AN		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

CHILLED WATER SYSTEM

Start-Up

REVISION #: 01

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NAMEPLATE

EQUIPMENT NO.		LOCATION	
---------------	--	----------	--

VERIFICATION ACTIVITIES	EQUIPMENT NUMBER	COMPLIANCE TO VERIFICATION ACTIVITY			COMMENTS
		YES	NO	N/A	
CHILLER WATER SYSTEM					
All valves are in operable					
All valves are installed in the correct orientation					
Electrical disconnects are accessible					
Manufacturer's startup procedure completed					
Disconnect panels installed and labeled					
Fuse ratings correct for connected equipment					
Power available to equipment starters					
Power available to chilled water control panel					
Power available to chilled water disconnect					
Control system contactors functional					
Control system interlocks functional					
Shielded wiring used on electronic controls					
Full operating charge of refrigerant and oil					
Low chilled water temperature provided					
High refrigerant pressure provided					
Low oil flow protection provided					
Loss of chilled water flow protection provided					
Loss of condenser flow protection provided					
Loss of refrigerant protection					
Motor current overload					
Phase reversal/unbalanced/single phasing					
Over/under voltage					
Failure of water temperature sensor used by controller					
Full load test to verify load limiting					
System starts and runs without any unusual noise or vibration					

CHILLED WATER SYSTEM

Start-Up

REVISION #: 01

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NAMEPLATE

EQUIPMENT NO.		LOCATION	
---------------	--	----------	--

VERIFICATION ACTIVITIES	EQUIPMENT NUMBER	COMPLIANCE TO VERIFICATION ACTIVITY			COMMENTS
		YES	NO	N/A	
Factory start-up and check-out complete					
Chiller safety/protection devices tested					
Chilled water flow switch installed					
Chilled water flow switch tested					
Condenser water flow switch installed					
Condenser water flow switch tested					
Chemical water treatment complete					
Water flow rate checked					
Chilled water piping is connected to the Evaporator					
Chilled water piping connected to air handling units.					
Strainer is installed and cleaned					
Chilled water inlet vents and outlet drains are closed.					
Water supply is connected to the filling system					
System is filled					
Pumps run, and air has been bled from the system					
Gauges, thermometers, and air vents are installed on both sides of the evaporator					
Wiring sized and installed as per submittal and NEC 310-16.					
Unit is properly electrically grounded.					
Wiring connections are tight					
Full power is available and within the utilization range.					
External interlocks are connected.					
Compressor oil sump heaters are installed tightly around the compressor.					

Non Compliance and Corrections

The Following items did not comply with the plans and/or manufacturer's and/or contract specifications and require correction

CHILLED WATER SYSTEM

Start-Up

REVISION #: 01

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NAMEPLATE			
EQUIPMENT NO.		LOCATION	

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

CHILLED WATER SYSTEM

Functional Performance Testing

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NAMEPLATE

EQUIPMENT NO.

LOCATION

Modify control system setpoints, as required, to facilitate chiller's response to simulated building load. Modify the outdoor air temperature to simulate different outdoor air temperatures to verify sequencing.

Switch system to "warm-up" mode in order to open all supply ducts, where VAV boxes may be present, and set fan powered box coils to full heat.

Start the building air handling units in order to provide a cooling load for the chiller(s) and cooling tower.

Operate boilers or use outside air to provide cooling load in building depending upon the outside air temperature.

Start the building air handling units in order to provide a cooling load for the chiller(s).

Operate boilers or use outside air to provide cooling load in building depending upon the outside air temperature.

VERIFICATION ACTIVITIES	Yes	No	Not Applicable	Comments
Outdoor air temperate below 5C				
Air Cooled chilled water pump turns on and chilled water flow is established				Modulate the chilled water control valve to prevent a "slug" of hot water from entering the chiller
Determine that chilled water temperature is above setpoint				Setpoint Temperature: _____ Chilled Water Temperature: _____
Control system energizes chiller at start sequence				
Chiller "soft start" sequence is functional				
Verify that only chiller 1 is enabled when temperature is below 5 C				
Shutoff air handling equipment to remove load on chilled water system. Monitor chilled water temperature to determine when the temperature drops below setpoint.				Time to drop below setpoint: _____
Chiller shutdown sequence is initiated and accomplished after load is removed				
Restart air handling equipment one minute after shutdown. Monitor chilled water temepature to determine when temperature rises above				Time to rise above setpoint: _____
Chiller restart sequence is operational				
Outdoor air temperate below 10C and above 5C				
Air Cooled chilled water pump turns on and chilled water flow is established				Modulate the chilled water control valve to prevent a "slug" of hot water from entering the chiller
Determine that chilled water temperature is above setpoint				Setpoint Temperature: _____ Chilled Water Temperature: _____
Control system energizes chiller at start sequence				
Chiller "soft start" sequence is functional				
Verify that chiller 1 is enabled first when temperature is below 10C and above 5C				
Shutoff air handling equipment to remove load on chilled water system. Monitor chilled water temperature to determine when the temperature drops below setpoint.				Time to drop below setpoint: _____
Chiller shutdown sequence is initiated and accomplished after load is removed				

CHILLED WATER SYSTEM

Functional Performance Testing

REVISION #: 01

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NAMEPLATE

EQUIPMENT NO.

LOCATION

Restart air handling equipment one minute after shutdown. Monitor chilled water temperature to determine when temperature rises above setpoint

Time to rise above setpoint: _____

Chiller restart sequence is operational

Outdoor air temperature above 10C

Water cooled chilled water pump turns on and chilled water flow is established

Modulate the chilled water control valve to prevent a "slug" of hot water from entering the chiller

Determine that chilled water temperature is above setpoint

Setpoint Temperature: _____
Chilled Water Temperature: _____

Control system energizes chiller at start sequence

Chiller "soft start" sequence is functional

Verify that lead water cooled chiller is enabled first when temperature is below 10C .

Verify that chiller 1 is enabled only if water cooled chillers are operating above 95% capacity for 10 mins.

Verify that cooling tower is enabled when chillers are enabled

Determine that condenser water temperature is above setpoint

Setpoint Temperature: _____
Condenser Water Temperature: _____

Verify that condenser water pumps are enabled when condenser water exceeds setpoint

Verify that cooling tower fan is enabled and modulates to maintain the condenser water set point

Shutoff air handling equipment to remove load on chilled water system. Monitor chilled water temperature to determine when the temperature drops below setpoint.

Time to drop below setpoint: _____

Chiller shutdown sequence is initiated and accomplished after load is removed

Restart air handling equipment one minute after shutdown. Monitor chilled water temperature to determine when temperature rises above setpoint

Time to rise above setpoint: _____

Chiller and Cooling Tower restart sequence is operational

GENERAL COMMENTS:

CHILLED WATER SYSTEM
Functional Performance Testing

REVISION #: 01

NAME: _____

COMPANY: _____

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NAMEPLATE			
EQUIPMENT NO.		LOCATION	

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

CHILLED WATER SYSTEM

Functional Performance Testing

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NAMEPLATE

EQUIPMENT NO.

LOCATION

Contractors/Subcontractor

Establish stable, full-load operation of the chiller, then measure and record the following data:

Chilled water flow (L/s): _____

Record chiller inlet/outlet pressure readings and compare to chiller design conditions, Test and Balance Report and chiller manufacturer's performance data.

		Design	T&B	F.P.T.	Actual
Inlet Pressure (kPa)	Chiller 1				
	Chiller 2-A				
	Chiller 2-B				
Outlet Pressure (kPa)	Chiller 2				
	Chiller 2-A				
	Chiller 2-B				

Record chilled water supply and return temperature readings and compare to readout on chiller control panel

	Displayed	Actual
Chilled Water Supply Temperature (°C)		
Chilled water Return Temperature (°C)		

Record the flowing information

	Temperature
Ambient outside air DB temperature (°C)	
Entering chilled water temperature (°C)	
Leaving chilled water temperature (°C)	

GENERAL COMMENTS:

CHILLED WATER SYSTEM
Functional Performance Testing

REVISION #: 01

NAME: _____

COMPANY: _____

ADDRESS: _____

FILE NUMBER: R111908 _____

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NAMEPLATE			
EQUIPMENT NO.		LOCATION	

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		

CHILLED WATER SYSTEM

Functional Performance Testing

REVISION #: 01

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NAMEPLATE

EQUIPMENT NO.

LOCATION

Use the following equation to calculate kW with the electrical data collected above:

$$VA = \sqrt{3} V_L I_L$$

Where

V = Voltage phase to phase

I = amperage per phase

$$PF = \cos \theta$$

θ = Phase angle between V & I

$$KW = VA \times PF$$

Calculate chiller efficiency (kW/ton) at the specified load-levels tested above and plot the results as follows

Sort data into separate sets according to supply chilled water temperature ranges (for example, one set of data in the range of 10° to 12°C, a second set for 13° to 15°C, etc.). Select the smallest range that includes an adequate number of data points and proceed with plot preparation.

Plot chiller kW versus chiller tons for each sorted data set. Where outside air temperatures differed by more than 3°C (for example, 16° to 18°F, 24° to 26°F, etc.) during the test, identify the plotted points common to each range.

Curve fit each group (designated by outside temperature range) of plotted points.

Compare chiller calculated performance and plotted curves to manufacturer's rated efficiency, performance specifications and part-load curves:

Record Results

Prime Contractor shall record and submit results of the functional performance testing to CES Project Manager.

If specified equipment performance is not verified, Prime Contractor shall report remedial action required and reschedule functional performance tests

Verification of Safety Controls

VERIFICATION ACTIVITIES	YES	NO	COMMENTS
High pressure switch is operational			
Low pressure switch is operational			
Oil level safety switch is operational			
Anti-cycling logic is operational			

GENERAL COMMENTS:

CHILLED WATER SYSTEM
Functional Performance Testing

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NAMEPLATE			
EQUIPMENT NO.		LOCATION	

--

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		

PUMP

Static Verification

REVISION #: 01

NAME:

COMPANY:

ADDRESS:

FILE NUMBER: R111908

DATE:

NAMEPLATE

EQUIPMENT NO. P-3/P-4

PUMP	SPECIFIED	SHOP DRAWINGS	INSTALLED
MANUFACTURER	NOT SPECIFIED		
MODEL	NOT SPECIFIED		
TYPE	HYDRONIC PUMP		
PRESSURE	153 KPA		
PUMP CAPACITY (US GPM)	40 L/S		
ELECTRICAL REQUIREMENTS	575 V, 60 Hz., 3 Ph.		
STYLE	VERTICAL INLINE AND SINGLE SUCTION CENTRIFUGAL		
IMPELLER	BRASS OR BRONZE		
SHAFT	SS W/ BRONZE SLEEVE BEARING, INTEGRAL THRUST COLLAR		
SEAL ASSEMBLY	MECHANICAL FOR SERVICE TO 120 deg C		
COUPLING	RIGID SELF-ALIGNING		
MOTOR	SPECIFIED	SHOP DRAWINGS	INSTALLED
MANUFACTURER	NOT SPECIFIED		
MODEL	NOT SPECIFIED		
TYPE	NEMA MG 1 RESILIENT MOUNTED, DRIP PROOF, SLEEVE BEARING		
MOTOR HORSEPOWER	15 HP		
VOLTAGE / PHASE / FREQUENCY	575 V, 60 Hz., 3 Ph.		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

PUMP

Start-Up

REVISION #: 01

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NAMEPLATE

EQUIPMENT NO.

P-3/P-4

START-UP	STATUS	COMMENTS
IMPELLER & MOTOR ROTATION CORRECT		
ELECTRICAL DISCONNECTS ARE OPERATIONAL		
ALL CONNECTIONS ARE SECURE		
PUMPS WIRED CORRECTLY TO CONTROL PANEL		
VALVES & STRAINERS INSTALLED		
BEARINGS LUBRICATED		
NAMEPLATE IS VISIBLE		
VIBRATION ISOLATORS CORRECT		
PRESSURE GAUGES INSTALLED		
INSTALLATION CODE CAN/CSA-B214		
IN-LINE CIRCULATORS, INSTALL W.R.T. FLOW ARROWS		
INSTALL WITH BEARING LUBE POINTS ACCESSIBLE		
CHECK THAT COOLING WATER SYSTEM PROTECTIVE DEVICES ARE INSTALLED		
CHECK FOR PROPER AND SAFE OPERATION		
CHECK OPERATION OF MECHANICAL SEALS		
CHECK BASE FOR FREE FLOATING		
ELIMINATE AIR FROM SCROLLING		
VERIFY LUBRICATING OIL LEVELS		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

Functional Performance Testing

NAME: _____

COMPANY: _____

ADDRESS: _____

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DATE:

NAMEPLATE	
EQUIPMENT NO.	P-3/P-4

FUNCTIONAL PERFORMANCE TESTING	STATUS	COMMENTS
PUMP RESPONDS TO CALL FROM CONTROL PANEL		
PUMPING FLOW RATE		
HEAD PRESSURE RATE		
IMPELLER & MOTOR ROTATION CORRECT		
WORN PART & SEALS REPLACED IN PUMPS USED FOR CLEANING		
NO LEAKAGE FROM MECHANICAL SEALS.		
NET POSITIVE SUCTION HEAD CHECKED/CALCULATED		
AIR FLOW FOR MOTOR COOLING		
VERIFY MFC. PERFORMANCE CURVES		
ENSURE VALVES ON PUMP SUCTION AND DISCHARGE PROVIDE TIGHT SHUT-OFF		
MEASURE NET POSITIVE SUCTION HEAD		

GENERAL COMMENTS:	

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

PUMP

Static Verification

REVISION #: 01

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COMPANY:

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DATE:

NAMEPLATE

EQUIPMENT NO. P-5/P-6

PUMP	SPECIFIED	SHOP DRAWINGS	INSTALLED
MANUFACTURER	NOT SPECIFIED		
MODEL	NOT SPECIFIED		
TYPE	HYDRONIC PUMP		
PRESSURE	210 KPA		
PUMP CAPACITY (US GPM)	29 L/S		
ELECTRICAL REQUIREMENTS	575 V, 60 Hz., 3 Ph.		
STYLE	VERTICAL INLINE AND SINGLE SUCTION CENTRIFUGAL		
IMPELLER	BRASS OR BRONZE		
SHAFT	SS W/ BRONZE SLEEVE BEARING, INTEGRAL THRUST COLLAR		
SEAL ASSEMBLY	MECHANICAL FOR SERVICE TO 120 deg C		
COUPLING	RIGID SELF-ALIGNING		
MOTOR	SPECIFIED	SHOP DRAWINGS	INSTALLED
MANUFACTURER	NOT SPECIFIED		
MODEL	NOT SPECIFIED		
TYPE	NEMA MG 1 RESILIENT MOUNTED, DRIP PROOF, SLEEVE BEARING		
MOTOR HORSEPOWER	15 HP		
VOLTAGE / PHASE / FREQUENCY	575 V, 60 Hz., 3 Ph.		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

PUMP

Start-Up

REVISION #: 01

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DATE:

NAMEPLATE

EQUIPMENT NO.

P-5/P-6

START-UP	STATUS	COMMENTS
IMPELLER & MOTOR ROTATION CORRECT		
ELECTRICAL DISCONNECTS ARE OPERATIONAL		
ALL CONNECTIONS ARE SECURE		
PUMPS WIRED CORRECTLY TO CONTROL PANEL		
VALVES & STRAINERS INSTALLED		
BEARINGS LUBRICATED		
NAMEPLATE IS VISIBLE		
VIBRATION ISOLATORS CORRECT		
PRESSURE GAUGES INSTALLED		
INSTALLATION CODE CAN/CSA-B214		
IN-LINE CIRCULATORS, INSTALL W.R.T. FLOW ARROWS		
INSTALL WITH BEARING LUBE POINTS ACCESSIBLE		
CHECK THAT COOLING WATER SYSTEM PROTECTIVE DEVICES ARE INSTALLED		
CHECK FOR PROPER AND SAFE OPERATION		
CHECK OPERATION OF MECHANICAL SEALS		
CHECK BASE FOR FREE FLOATING		
ELIMINATE AIR FROM SCROLLING		
VERIFY LUBRICATING OIL LEVELS		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

Functional Performance Testing

NAME: _____

COMPANY: _____

ADDRESS: _____

FILE NUMBER: R111908

DATE:

NAMEPLATE	
EQUIPMENT NO.	P-5/P-6

FUNCTIONAL PERFORMANCE TESTING	STATUS	COMMENTS
PUMP RESPONDS TO CALL FROM CONTROL PANEL		
PUMPING FLOW RATE		
HEAD PRESSURE RATE		
IMPELLER & MOTOR ROTATION CORRECT		
WORN PART & SEALS REPLACED IN PUMPS USED FOR CLEANING		
NO LEAKAGE FROM MECHANICAL SEALS.		
NET POSITIVE SUCTION HEAD CHECKED/CALCULATED		
AIR FLOW FOR MOTOR COOLING		
VERIFY MFC. PERFORMANCE CURVES		
ENSURE VALVES ON PUMP SUCTION AND DISCHARGE PROVIDE TIGHT SHUT-OFF		
MEASURE NET POSITIVE SUCTION HEAD		

GENERAL COMMENTS:	

POSITION/TITLE	SIGNATURE	DATE
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

Commissioning Log

REVISION #: 00

NAME: _____
COMPANY: _____
ADDRESS: _____



CUSTOMER: PSPC
PROJECT: Morden Chiller Replacement
FILE NUMBER: R.111908
DATE: _____

Issue No.	Issue Description	Date Identified	Contractor Responsibility	Date Contractor Notified	Action Taken	Issue Status