

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Description of work.
- .2 Scope of work.
- .3 Alterations to existing.
- .4 Existing services.
- .5 Contractor use of premises.
- .6 Owner occupancy.

1.2 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 WORK COVERED BY
CONTRACT DOCUMENTS

- .1 Work of this Contract comprises labour, tools and equipment required for the replacement of roof mounted exhaust fans and modifications of other HVAC systems serving laboratory spaces located at Canadian Food Inspection Agency (CFIA) Charlottetown on 93 Mount Edward Road, Charlottetown, PEI.

1.4 SCOPE OF WORK

- .1 Remove and dispose of 28 roof mounted, fume hood type exhaust fans.
- .2 Install 24 new roof mounted, fume hood type exhaust fans and tie into existing duct mains and electrical power sources. Tie fans into existing building control system.
- .3 Modify air supply and exhaust systems serving 5 laboratory spaces including:
 - .1 Modification of bio safety cabinets (BSC's) and canopy exhaust ductwork.
 - .2 Capping unused duct mains and branches in place.
 - .3 Replacement of air flow terminal units (VAV, CAV boxes) c/w tie into building control system.
 - .4 Modification of two centrifugal exhaust fan systems located in penthouse.
- .4 Perform an existing conditions air balancing survey of 30 exhaust fan systems, and 5 laboratory spaces, before any equipment modifications have started.

- .5 Commissioning of all exhaust fan systems.
Commissioning of the 5 laboratory spaces (with equipment modifications) including commissioning of replacement equipment. Overall laboratory commissioning procedures including verification of inward/outward air flows.

1.5 ALTERATIONS,
ADDITIONS OR
REPAIRS TO EXISTING
BUILDING

- .1 Execute work with least possible interference or disturbance to building operations occupants, and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Use only elevators in building for moving workers and material.
 - .1 Protect walls of passenger elevators, to approval of Departmental Representative prior to use.
 - .2 Accept liability for damage, safety of equipment and overloading of existing equipment.

1.6 EXISTING
SERVICES

- .1 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions.
- .2 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power, essential power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .3 Provide temporary services when directed by Owner to maintain critical building and user systems.
- .4 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .5 Provide plan for movement of equipment and lifting of heavy equipment into and out of building and mechanical rooms.

1.7 WORK SEQUENCE

- .1 Construct Work to accommodate Owner's continued use of premises during construction.
- .2 Coordinate Progress Schedule and coordinate with Owner Occupancy during construction.

.3 Maintain fire access/control.

1.8 CONTRACTOR USE
OF PREMISES

- .1 Contractor shall limit use of premises for Work, for storage, and for access, to allow:
- .1 Owner occupancy.
 - .2 Co-ordinate use of premises under direction of Owner.
 - .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.9 OWNER
OCCUPANCY

- .1 Building will be occupied during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.10 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 Other documents as specified.

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 ADMINISTRATIVE

- .1 Submit to Consultant 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 Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated 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 Consultant, 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 co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow 10 working days for Consultant's review of each submission.
- .4 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .5 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant 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 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .8 After Consultant's review, distribute copies.

- .9 Submit 1 electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.
 - .10 Submit 1 electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.
 - .11 Submit 1 electronic copy of test reports for requirements requested in specification Sections and as requested by Consultant.
 - .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 1 electronic copy of certificates for requirements requested in specification Sections and as requested by Consultant.
 - .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 1 electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant.
 - .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 1 electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .15 Submit 1 electronic copy and 1 printed copy in binders of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.
 - .16 Delete information not applicable to project.
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- .17 Supplement standard information to provide details applicable to project.
- .18 If upon review by Consultant, 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.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Consultant's business address.
- .3 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .6 Make changes in samples which Consultant may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 CERTIFICATES
AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.

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 PRECEDENCE .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 RELATED SECTIONS .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Material Safety Data Sheets (MSDS).
.3 Province of Prince Edward Island
.1 Occupational Health and Safety Act.

1.4 SUBMITTALS .1 Make submittals 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 - Ref. CFIA Occupational Health and Safety.
.2 Results of safety and health risk or hazard analysis for site tasks and operations.
.3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
.5 Submit copies of incident and accident reports.
.6 Submit WHMIS MSDS - Material Safety Data Sheets.

- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 7 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's 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.
- .9 Submit signed copy of Safe Working Procedures for Contractors (at CFIA Laboratory) document. Included at end of this specification section.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work. Project/site conditions will be outlined by Departmental Representative.

1.7 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.

1.8 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.
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1.9 COMPLIANCE REQUIREMENTS .1 Comply with Occupational Health and Safety Act, Occupational Safety General Regulations, RSPEI Reg.

1.10 UNFORSEEN 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.

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 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
.3 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.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Administrative procedures preceding preliminary and final inspections of Work.
- 1.2 RELATED SECTIONS
- .1 Section 01 78 00 - Closeout Submittals.
- 1.3 INSPECTION AND DECLARATION
- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
- .1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
- .2 Request Consultant's Inspection.
- .2 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
- .1 Work has been completed and inspected for compliance with Contract Documents.
- .2 Defects have been corrected and deficiencies have been completed.
- .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
- .4 Operation of systems have been demonstrated to Owner's personnel.
- .5 Work is complete and ready for Final Inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Consultant, and Contractor. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request reinspection.
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- .5 Declaration of Substantial Performance: when Owner and Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.
- .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .7 Final Payment: When Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request reinspection.
- .8 Payment of Holdback: After issuance of certificate of Substantial Performance of Work.

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 SECTION
INCLUDES

- .1 As-built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.
- .7 Final site survey.

1.2 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 RELATED
SECTIONS

- .1 Section 01 77 00 - Closeout Procedures.

1.4 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Consultant's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, 1 electronic copy and 1 hard copy of operating and maintenance manuals in English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.5 FORMAT

- .1 Organize data in the form of an 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. 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. Bind in with text; fold larger drawings to size of text pages.

1.6 CONTENTS - EACH
VOLUME

- .1 Table of Contents: provide title of project;
 - .1 date of submission; names,
 - .2 addresses, and telephone numbers of Consultant 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 clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

.6 Training: Refer to Section 01 79 00 - Demonstration and Training.

1.7 AS-BUILTS AND
SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Consultant one record copy of:
- .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Keep record documents and samples available for inspection by Consultant.

1.8 RECORDING
ACTUAL SITE
CONDITIONS

- .1 Record information on set of drawings.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly 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 References to related shop drawings and modifications.

- .4 Specifications: legibly 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.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.9 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.

- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .13 Include test and balancing reports.
- .14 Additional requirements: As specified in individual specification sections.

1.10 WARRANTIES AND BONDS

- .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 the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

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|-----------------------------|----|---|
| <u>1.1 SECTION INCLUDES</u> | .1 | Procedures for demonstration and instruction of equipment and systems to Owner's personnel. |
| <u>1.2 PRECEDENCE</u> | .1 | For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual. |
| <u>1.3 RELATED SECTIONS</u> | .1 | Section 01 78 00 - Closeout Submittals. |
| | .2 | Section 01 91 13 - Commissioning. |
| <u>1.4 DESCRIPTION</u> | .1 | Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of final inspection. |
| | .2 | Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times. |
| <u>1.5 QUALITY CONTROL</u> | .1 | When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed. |
| <u>1.6 SUBMITTALS</u> | .1 | Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Consultant's approval. |
| | .2 | Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed. |
| | .3 | Give time and date of each demonstration, with list of persons present. |
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1.7 CONDITIONS FOR
DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with Section.
- .2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - Commissioning and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.8 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated personnel are present.

1.9 DEMONSTRATION
AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting,, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

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 SUMMARY
- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
 - .2 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O&M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.
- 1.2 GENERAL
- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
 - .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 interactive 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.
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- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

- .1 Cx to be a line item of Contractor's cost breakdown.
- .2 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .3 Cx activities includes transfer of critical knowledge to facility operational personnel.
- .4 Engineer will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Engineer.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.4 COMPOSITION ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Cx Team to consist of the following members:
 - .1 Consultant: responsible for:
 - .1 Monitoring operations Cx activities.
 - .2 Witnessing, certifying accuracy of reported results.
 - .3 Witnessing and certifying TAB and other tests.
 - .4 Witnessing verification of performance of installed systems and equipment.
 - .2 Construction Team: contractor, sub-contractors, 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 Preparing O & M documentation.
 - .3 Facility Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Day-to-day operation and maintenance of facility.

1.5 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 Consultant, 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.

1.6 PRE-CX REVIEW .1 Before Construction:
.1 Review contract documents, confirm by writing to Engineer.
.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 Ensure installation of related components, equipment, sub-systems, systems is complete.
.2 Fully understand Cx requirements and procedures.
.3 Have Cx documentation shelf-ready.
.4 Understand completely design criteria and intent and special features.
.5 Submit complete start-up documentation to Engineer.
.6 Ensure systems have been cleaned thoroughly.
.7 Complete TAB procedures on systems, submit TAB reports to Engineer for review and approval.
.8 Ensure "As-Built" system schematics are available.

.4 Inform Engineer in writing of discrepancies and deficiencies on finished works.

1.7 CONFLICTS .1 Report conflicts between requirements of this section and other sections to Engineer before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

- 1.8 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.

- 1.9 COMMISSIONING SCHEDULE .1 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
- .1 Approval of Cx reports.
- .2 Verification of reported results.
- .3 Repairs, retesting, re-commissioning, re-verification.
- .4 Training.

- 1.10 COMMISSIONING DOCUMENTATION .1 Refer to CX Check Sheets and System PV Checks, in Appendix 2 - Commissioning (CX) Forms.
- .2 Forms to be completed fully and submitted to Consultant for review. Final approval to be obtained from Consultant before commissioning is complete.

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

- 1.12 WITNESSING OF STARTING AND TESTING .1 Provide 14 days notice prior to commencement.
- .2 Consultant to witness of start-up and testing.

- 1.13 MANUFACTURER'S INVOLVEMENT .1 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Engineer.
- .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.
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- .2 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.
- .3 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, 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 System PV: include repetition of tests after correcting deficiencies.
 - .4 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Engineer after distinct phases have been completed and before commencing next phase.
- .4 Document required 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 Engineer. 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 Engineer.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Engineer.

.3 If evaluation report concludes that major damage has occurred, Engineer shall reject equipment.

.1 Rejected equipment to be removed from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP
DOCUMENTATION

- .1 Assemble start-up documentation and submit to Engineer 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 Engineer to repeat start-up at any time.

1.16 OPERATION AND
MAINTENANCE OF
EQUIPMENT AND
SYSTEMS

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

1.17 TEST RESULTS

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

- 1.18 START OF COMMISSIONING
- .1 Notify Engineer at least 14 business days prior to start of Cx.
 - .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.
- 1.19 INSTRUMENTS / EQUIPMENT
- .1 Submit to Engineer for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
 - .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.
- 1.20 COMMISSIONING PERFORMANCE VERIFICATION
- .1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
 - .2 Cx procedures to be repeatable and reported results are to be verifiable.
 - .3 Follow equipment manufacturer's operating instructions.
- 1.21 WITNESSING COMMISSIONING
- .1 Engineer to witness activities and verify results.
- 1.22 AUTHORITIES HAVING JURISDICTION
- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
 - .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
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- .3 Provide copies to Engineer within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

- .1 All laboratory spaces will be occupied during the Cx process. To avoid disturbing tenants, coordinate times with facility manager.

1.24 EXTRAPOLATION OF RESULTS

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

1.25 EXTENT OF VERIFICATION

- .1 Laboratory areas:
 - .1 Provide manpower and instrumentation to verify up to 100 % of reported results.
- .2 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .3 Review and repeat commissioning of systems if inconsistencies found in more than 20 % of reported results.
- .4 Perform additional commissioning until results are acceptable to Consultant.

1.26 REPEAT VERIFICATIONS

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

1.27 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.

- .2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES,
FAULTS, DEFECTS

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

1.29 COMPLETION OF
COMMISSIONING

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

1.30 ACTIVITIES
UPON COMPLETION OF
COMMISSIONING

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

1.31 TRAINING

- .1 In accordance with Section 01 79 00 - Demostration and Training.

1.32 MAINTENANCE
MATERIALS, SPARE
PARTS, SPECIAL

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

1.33 INSTALLED
INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Engineer.
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- 1.34 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.

- 1.35 OWNER'S PERFORMANCE TESTING
- .1 Performance testing of equipment or system by Engineer 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.