

PART 1 - GENERAL

- 1.1 Section Includes
- .1 Work covered by Contract Documents.
 - .2 Contract Method.
 - .3 Work by others.
 - .4 Future work.
 - .5 Work sequence.
 - .6 Contractor use of premises.
 - .7 Owner occupancy.
- 1.2 Related Sections
- .1 Section 013300: Submittal Procedures.
 - .2 Appendix: Safe Working Procedures for Contractors when working at a AAFC Laboratory.
 - .3 Section 013500: Special Procedures
- 1.3 Work Covered by Contract Documents
- .1 Work of this Contract comprises renovation of ventilation system, located at the Summerland Research Centre;
Pacific Agri-Food Research Centre at Summerland is further identified as PARC.
The project includes but is not limited to:
 - .1 Upgrade of lab exhaust system and addition of new exhaust fans LEF-4/5 & 6.
This upgrade includes separating the existing combined exhaust system into fume hood exhaust system (LEF-1/2 & 3) and general exhaust / return (LEF-4/5 & 6).
 - .2 Addition of control points, the necessary upgrade of the existing controls system, addition and revision of the controls programming, to support the operation of the new established exhaust systems.
 - .3 Electrical work upgrade to accommodate mechanical system upgrade.
 - .4 Structural work upgrade for the roof top

mechanical equipment and new access stair.

- .5 Architectural work upgrade to supplement mechanical system upgrade.
- .6 Phased construction.
- .7 Supply and installation of a complete, fully functional, tested and commissioned mechanical system, with ancillaries.

The new mechanical system upgrade includes, but not limited to:

- .1 Labs exhaust fan system upgrade / addition.
 - .2 Fume hood exhaust valves and control modules (re-commissioning).
 - .3 EMCS (DDC) controls upgrade.
- .2 All materials and equipment supplied and installed shall be new except the relocated equipment specified in the drawings.
- .3 Commissioning works includes mechanical, electrical, architectural and structural components and systems.
- .4 Return all reusable removed equipment (such as existing EMCS (DDC) control panels, controllers; exhaust fan motor starters in the motor control centers, fan motors for air handling units and general exhaust fans, etc.) to PARC as directed by the Departmental Representatives.
Coordinate and confirm with PARC for all the reusable equipment.
Move and store in a location on the premises, designated and coordinated with PARC.

1.4 Contract Method

- .1 Construct Work under single, stipulated price contract.

1.5 Work by Others

- .1 N/A

1.6 Work Sequence

- .1 Construct Work in stages to accommodate Owner's continued use of premises during

construction.

- .2 Coordinate Progress Schedule and coordinate with Owner's Occupancy during construction.
- .3 Maintain fire access/control.
- .4 Required stages: The project is to be carried out and completed in stages. Provide building operator with shut down notice at each phase, which shall include the anticipated shut down duration. The work sequence is driven primarily by the mechanical systems alteration. Refer to Drawings M-101 and M-102. Refer also to phasing on electrical, structural and architectural drawings. The work will include, but shall not be limited to, the following minimum construction stages:
 - .1 Prepare areas to receive the new high plume dilution (general exhaust) fan, including relocations and demolition. Interconnect the general exhaust and general return duct mains in the penthouse.
 - .2 Finalize preparatory work, including structural, roofing, etc.) to receive the new high plume dilution (general exhaust) fan and new exhaust ductwork. Rough in electrical feeders and control panels.
 - .3 Install the new high plume dilution (general exhaust) fan and a section of the new general exhaust plenum complete with bypass damper, connect power and controls; make functional and fully controlled.
 - .4 Extend the new general exhaust plenum, and re-connect the existing general return riser complete with new riser damper. Coordinate the shutdowns with PARC to occur outside normal operation of the labs. Building operator will turn on fume hoods to reduce load on the general return main to facilitate connection of the general return main to the new fans. Make both exhaust systems functional and fully controlled.
 - .5 Extend the new general exhaust plenum to the final extent, and re-connect the existing general exhaust riser. Cap temporary duct connections in the Penthouse. Coordinate the shutdowns with PARC to occur outside normal operation of the labs). Make both exhaust systems functional and fully controlled.

- .5 Contractor shall coordinate with the Departmental Representatives and PARC, and allow adequate construction stages in the tender prices to meet the site condition.
- .6 Staged testing, balancing and commissioning shall be provided such that the equipment and the systems are fully functional, tested, balanced and controlled after each phase of work, before proceeding with the next phase.

1.7 Site Meetings

- .1 Construction meetings with Departmental Representatives to be held on site bi-weekly.
- .2 All contractors shall also attend bi-weekly site meetings.
- .3 Contractors shall attend commissioning meetings.

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 Coordinate use of premises under direction of Departmental Representatives. See section 013500 for contractor entry/exit of primary staging area, entry log and contractor parking locations.
- .3 Contractor shall coordinate all work during normal hours of operation, 8:00 a.m.-5:00 p.m. All work to be performed after hours shall be coordinated with the Departmental Representatives.
- .4 Any work performed by the contractor outside of normal working hours requires notification of on-site security commissionaires.
- .5 A temporary storage area for removed equipment is to be located in a designated storage area adjacent to the Pesticide Storage Spray Building. Contractor to supply fencing. See section 013500.
- .6 Contractor shall abide by all on-site security

provisions and regulations.

- .7 Contractor entrance shall be at the loading dock for loading and unloading equipment.

1.9 Owner Occupancy

- .1 PARC will occupy premises, and carry out normal operation of the facility, during entire construction period.
- .2 Cooperate with Departmental Representatives in scheduling operations to minimize interruption or conflict and to facilitate Owner usage of the facility.

1.10 Contractor
Furnished Items

- .1 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to Departmental Representatives notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
 - .3 Receive and unload products at site.
 - .4 Handle products at site, including uncrating and storage.
 - .5 Protect products from damage, and from exposure to elements.
 - .6 Assemble, install, connect, adjust, and finish products.
 - .7 Provide installation inspections required by local authorities.
 - .8 Repair or replace and make good items damaged by contractor on site during construction.
 - .9 The word "make good" used in the contract documents means "to restore new or existing work after being damaged, cut, patched or rejected by the Departmental Representatives" and also means "using materials identical to the original materials with visible surfaces matching the appearance of the original surfaces in all details and with no apparent junctions between new and original surfaces. Where original materials are no longer available, the Contractor may submit a proposal of materials for review by the Departmental Representatives".

<u>1.11 Mock-Up</u>	.1	N/A
<u>1.12 Safety Working Procedure</u>	.1	Working process shall follow the "Safe Working Procedures for Contractors when working at an AAFC Laboratory" is provided in the Appendix.
<u>1.13 Construction Period</u>	.1	Allowable time for construction completion after contract is awarded is 36 weeks.

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| <u>1.1 Section Includes</u> | .1 Connecting to existing services.
.2 Special scheduling requirements. |
| <u>1.2 Related Sections</u> | .1 Section 015600 - Temporary Barriers and Enclosures. |
| <u>1.3 Existing Services</u> | .1 Notify, Departmental Representatives and utility companies of intended interruption of services and obtain required permission.
.2 Where Work involves breaking into or connecting to existing services, give Departmental Representatives 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
.3 Provide for unobstructed pedestrian and vehicular traffic.
.4 Construct barriers in accordance with Section 015600 - Temporary Barriers and Enclosures. |
| <u>1.4 Special Requirements</u> | .1 Paint public or Staff occupied areas Monday to Friday from 18:00 to 07:00 hours only and on Saturdays, Sundays, and statutory holidays.
.2 Carry out noise generating Work (such as drilling and coring building structures or similar noise level generating work) Monday to Friday from 18:00 to 07:00 hours and on Saturdays, Sundays and statutory holidays.
.3 Contractor shall only work on the areas for which the construction works are scheduled, and the testing and commissioning are required to perform before occupancy. Refer to sections 01111 and 018100 for the stages and phases of construction.
.4 Contractor and sub-contractors shall undergo |

security screening.

- .5 Maintain an acceptable indoor environmental quality during construction.
Apply measures such as:
 - Prevention of the construction dust from spreading into the laboratory or other spaces. Pressure differential is to be maintained between the construction and the occupied zones.
 - Fire protection
 - Prevention of fumes from welding or cutting.
- When working on laboratories, the dual duct box shall be at minimum flow while general exhaust be kept at normal flow to maintain negative pressure within the laboratory area.

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| <u>1.1 Section Includes</u> | .1 | Coordination Work with other contractors under administration of Departmental Representatives. |
| | .2 | Scheduled construction meetings. |
| <u>1.2 Precedence</u> | .1 | Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual. |
| <u>1.3 Related Sections</u> | .1 | Section 011100 - Summary of Work. |
| | .2 | Section 018100 - Commissioning. |
| <u>1.4 Description</u> | .1 | Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction work, with progress of Work of other contractors, as directed by the Departmental Representatives. |
| <u>1.5 Project Meetings</u> | .1 | Schedule and administer bi-weekly project construction and commissioning meetings throughout progress of Work as determined by Departmental Representatives. Commissioning meetings shall be separate from progress site meetings. |
| | .2 | Prepare agenda for meetings. Issue agenda for both progress and commissioning meetings minimum 72 hours in advance of the meetings. |
| | .3 | Distribute written notice of each meeting four days in advance of meeting date to Departmental Representatives and Owner. |
| | .4 | Provide physical space and make arrangements for meetings. |
| | .5 | Preside at meetings. |

- .6 Departmental Representatives will take meeting minutes, including significant proceedings and decisions and identifying action by parties.
 - .7 Departmental Representatives will reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants and affected parties not in attendance.
- 1.6 Construction Organization and Start-up
- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
 - .2 Representatives of the PARC, Departmental Representatives, Owner's commissioning agent, clerk of work, Contractor, major Subcontractors, including controls contractor, contractor's commissioning agent, 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 but after contract award.
 - .5 Agenda to include the following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work (include construction phases and sequences), progress scheduling, commissioning schedule.
 - .3 Schedule of submission of shop drawings and samples in accordance with Section 013300 - Submittal Procedures.
 - .4 Delivery schedule of specified equipment.
 - .5 Site security in accordance with Section 015200 - Construction Facilities.
 - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
 - .7 Owner provided Products.

- .8 Record drawings in accordance with Section 017800 - Closeout Submittals.
- .9 Maintenance in accordance with Section 017800 - Closeout Submittals.
- .10 Take-over procedures, acceptance, and warranties in accordance with Section 017700 - Closeout Procedures and 017800 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, and holdbacks.
- .12 Appointment of inspection and testing agencies or firms in accordance with Section 014500 - Quality Control.
- .13 Insurances and transcript of policies.
- .14 Commissioning process and test contactor fit into overall construction organization. Construction and commissioning meetings schedule. Various parties participating in commissioning.
- .6 Comply with Departmental Representatives' allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- .7 During construction, coordinate use of site and facilities through Departmental Representatives' procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .8 Coordinate field engineering and layout work with Departmental Representatives.

1.7 On-Site Documents

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings.
 - .5 Change orders.
 - .6 Other modifications to Contract.
 - .7 Field test reports.
 - .8 Copy of approved Work schedule.
 - .9 Manufacturers' installation and application instructions.
 - .10 Labour conditions and wage schedules.

.11 Commissioning reports.

1.8 Schedules

- .1 Submit preliminary construction progress schedule in accordance with Section 013200 - Construction Progress Documents to Departmental Representatives coordinated with Departmental Representatives' project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by Departmental Representatives.
- .4 Provide separate training and commissioning schedule.
- .5 Provide a construction schedule in conjunction with commissioning activities.

1.9 Construction Progress Meetings

- .1 During course of Work and two weeks prior to project completion, schedule progress meetings bi-weekly.
- .2 Contractor, major subcontractors, including controls contractor, contractor's commissioning agent, involved in Work and Departmental Representatives and Owner are to be in attendance.
- .3 Notify parties and issue agenda minimum seven days prior to each meeting.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three days after meeting.
- .5 Agenda to include 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 effect on construction schedule and on completion date.
- .12 Other business.

1.10 Commissioning
Progress Meetings

- .1 During the course of Work and six weeks prior to project completion, schedule commissioning progress meetings bi-weekly. Weekly meeting shall be conducted within the last six weeks of project completion.
- .2 Contractor, major subcontractors, including controls contractor, contractor's commissioning agent involved in Work as well as Departmental Representatives and Owner are to be in attendance.
- .3 Notify parties and issue agenda minimum seven days prior to each meeting.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three days after meeting.

1.11 Closeout
Procedures

- .1 Notify Departmental Representatives when Work is considered ready for Substantial Performance.
- .2 Accompany Departmental Representatives on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Departmental Representatives' instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Owner-occupied areas.
- .4 Notify Departmental Representatives of

instructions for completion of items of work
determined in Departmental Representatives'
final inspection.

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1.1 Administrative

- .1 Submit to Departmental Representatives submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed 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 Representatives. This review represents that 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 shall be considered rejected.
- .6 Notify Departmental Representatives, 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 Representatives' review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract

Documents is not relieved by Departmental Representatives review.

- .10 Keep one reviewed copy of each submission on site.

1.2 Shop Drawings
and Product Data

- .1 Submit shop drawings to Departmental Representatives for review. Shop drawings include but not limited to all major equipment, structural steel fabrication, architectural and electrical items as specified, and equipment shop drawings as requested by the Departmental Representatives. Major equipment such as fans, VFD, EMCS controls, etc.
- .2 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.
- .3 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.
- .4 Allow 7 days for Departmental Representatives' review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representatives are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representatives prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representatives may require, consistent with Contract Documents. When resubmitting, notify Departmental Representatives in writing of any

revisions other than those requested.

- .7 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.
- .8 Submissions shall 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 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Departmental Representatives' review, distribute copies.
- .10 Submit 6 prints of shop drawings for each requirement requested in specification Sections and as requested by Departmental Representatives.
- .11 Submit 6 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representatives where shop

drawings will not be prepared due to standardized manufacture of product. In addition, submit one copy in electronic PDF file or CADD file.

- .12 Identify project relevant and applicable data. Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .14 If upon review by Departmental Representatives, 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.
- .15 The review of shop drawings by Departmental Representatives is for sole purpose of ascertaining conformance with general concept. This review shall not mean that Departmental Representatives 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 all requirements of construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

1.3 Samples

- .1 Submit for review samples in as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representatives' business address.

- .3 Notify Departmental Representatives 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 Departmental Representatives are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representatives prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representatives 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.

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SPECIAL PROCEDURES

All procedures listed in the following section are designed as a minimum standard that the Contractor must achieve, and all work procedures submitted to the Departmental Representatives will be reviewed against the following.

PART 2 - PRODUCTS

- .1 Not used.

PART 3 - EXECUTION

3.1 - FUME HOOD EXHAUST
SYSTEM DISASSEMBLY

3.1.1 Staging Areas

- .1 Prior to the commencement of fume hood exhaust system disassembly staging areas will be established.
- .2 A Staging Area will be established for the temporary storage of the demolished material and equipment (including those that are to be treated as hazardous waste). Coordinate location with PARC.
- .3 Signage and markers will identify staging areas so that they are clearly identifiable by all personnel.

3.1.2 Workplace Entry
and Exit for Personnel

- .1 Signage and markers will identify staging areas, including those designated including those that for materials treated as hazardous waste, so that they are clearly identifiable by all personnel.
- .2 All personnel who enter the work area must be listed in the entry log, located in the decontamination area where applicable. Entry log for general areas will be in the contractor's office designated location.

- .3 All personnel who enter the work area, shall read and be familiar with all posted regulations, personal protective equipment requirements (including work place entry and exit procedures) and emergency procedures. A sign-off sheet shall be used for personnel to acknowledge that all documentation has been read and understood.
- .4 For any work inside labs, as directed by the PARC, all personnel must put on the assigned respiratory protection and disposable coveralls, head covering, gloves and foot covering. Hard hats, eye protection and gloves shall also be utilized if required. Clean respirators shall be provided and utilized by each person for each separate entry into the work area.
- While wearing designated personal protective equipment all personnel shall proceed from the decontamination area to the primary work area. Before leaving the work area all personnel must remove gross contamination from the outside of respirators, protective clothing and footwear by wet wiping.
- All personnel must proceed to the decontamination area, which will consist of a series of three clean up stations.
- At the first clean up station personnel will wet wipe and remove all gross contamination.
- At the second clean up station all personnel will then remove their outer gloves, chemical coveralls and boots. This wash station will be used to wash down their respirators, inner gloves and boots and followed by the removal of their inner gloves.
- At the third and final clean up station all personnel will wash their hands, remove their respirators and then wash their face.
- Wash station water must be kept clean and changed on a frequent basis.
- Reusable contaminated footwear and chemical-resistant coveralls shall be stored in the work area when not in use. Upon completion of disassembly work all rubber boots may be decontaminated for reuse and all chemical-resistant coveralls will be disposed of as contaminated waste.

After drying off, all personnel will inspect the assembly of their respirators to ensure that they are free of residual debris before storing the respirator in a cool dry place. A copy of these procedures shall be posted in a clean area.

3.2 - WASTE REMOVAL

3.2.1 Waste transfer Procedure

- .1 All metal items (lab exhaust sheet metal ductwork) considered medium hazard, and shall be treated as hazardous waste. Upon removal on site, they shall be double-bagged, and moved to the Staging Area established for the temporary storage of the demolished material. This material shall be securely stored within a sealed, locking container provided by the contractor within the fenced area. The container contents will then need to be disposed of at a licensed hazardous waste landfill. The contractor shall supply to the Departmental Representatives a copy of the landfill's invoice and/or waybill proving that the contents were delivered and disposed of.

3.3 - COMMUNICATION

- .1 When working in the areas with contamination hazard, workers within the work area will communicate in a fashion that does not require the removal of respiratory protection.
- .2 Written communication using wipe sheets will be permitted, however these sheets are to be disposed of as contaminated waste upon completion of the project.

3.4 - PERSONAL PROTECTIVE EQUIPMENT (FUME HOOD EXHAUST SYSTEM DISASSEMBLY)

3.4.1 Training

- .1 Prior to the commencement of disassembly activities all personnel who will be required to enter the work area or handle waste materials must have received adequate

documented training approved by the Departmental Representatives. This training must include information identifying the potential risks associated with the dismantling of chemical fume hood ductwork.

- .2 Special on site training on equipment and procedures unique to this project site shall be performed as required.
- .3 Training in emergency response shall be provided to strategic personnel.
- .4 Training in emergency evacuation procedures shall be provided to all personnel.

3.4.2 Respiratory Protection

- .1 When working in the areas with high contamination hazard, all respiratory protection shall be provided to workers in accordance with the submitted written respiratory protection program, which will include, as a minimum, the following:
 - .1 Cleaning, care and maintenance of respirator,
 - .2 Fit testing.
 - .3 Respiratory protection factors, types of respirators, selection and limitations.
 - .4 NIOSH & MSHA certification of respirators.
 - .5 Organic vapor/ acid gas cartridges.This program shall be posted in the clean room of the worker decontamination enclosure system.
- .2 Workers shall be provided with personally issued, individually identified (marked with waterproof designation) PAPR Full Face respirators.
- .3 Respirators will only be issued to, and used by, workers that are clean-shaven.
- .4 Training in emergency evacuation procedures shall be provided to all personnel.

3.4.3 Fit Testing

- .1 Workers must perform positive and negative pressure field fit tests each time a

respirator is put on, whenever the respirator design so permits.

- .2 Powered air-purifying respirators shall be tested for adequate flow as specified by the manufacturer, and the Contractor will retain a flow meter in a clean area throughout the duration of the hazardous material removal process.
- .3 Workers shall be given a qualitative fit test for all respirators to be used on this project in accordance with procedures detailed in the CSA fit testing protocol.
- .4 Documentation of adequate respirator fit (for each person using a respirator) must be available for inspection by the Departmental Representatives.
- .5 Additional respirators and training on their use must be available at the work site for authorized visitors, sub-contractors, and any Departmental Representatives who may be required to enter the work area.

3.4.4 Protective Clothing

- .1 Chemically resistant coveralls with integral head coverings up to sizes XXXXL shall be provided in sufficient quantities and adequate sizes for all workers and authorized visitors.
- .2 Workers shall use snug fitting neoprene gloves beneath outer rubber gloves. The rubber gloves shall be of a sufficient length so as to cover the first three inches of the sleeves of the chemical resistant coveralls.
- .3 Hard hats, protective eyewear, gloves, steel toed rubber boots and/or other footwear shall be provided as required for workers and authorized visitors. Safety shoes may be required for some activities.

3.4.5 - Intervention and Dismantling Precaution

- .1 Provide training to the participants by a qualified individual. Instruction will alert workers to the danger, indicate methods of mitigation, and describe activities, equipment, protective gear, and procedures to be followed.
- .2 Insist on a planning exercise that clearly delineates the steps required, roles and

responsibilities specific to the task at hand.

- .3 Perform maintenance or de-commissioning on weekends or silent hours only, when the laboratory facility is empty of personnel.
- .4 Provide suitable isolation, barricades, and protective clothing for personnel.
- .5 Work does not involve perchloric exhaust.

3.4.6 Clean-up Procedure

- .1 Lab exhaust ductwork that is to be removed will be disassembled, double-bagged, and moved to the Staging Area established for the temporary storage of the demolished material, and disposed of in accordance with those procedures identified in the waste removal procedure of this section.
- .2 Decontaminate all tools and equipment and remove them at the appropriate time in the cleaning sequence.
- .3 The work area shall be cleaned until it is in compliance with regulatory requirements and any more stringent criteria agreed upon by the Contractor and Departmental Representatives prior to initiation of cleaning activities. Criteria for cleanliness will be in the form of visual inspections.
- .4 Following the satisfactory completion of a visual inspection the remaining barriers may be removed and properly disposed of in accordance with the requirements of the specification. A final visual tear down inspection by the Departmental Representatives shall insure that no contamination remains in the work area. Unsatisfactory conditions may require additional cleaning at no additional cost to the Owner.

3.6 - WASTE DISPOSAL
PROCEDURE

3.6.1 Requirements

- .1 All non-metal and non-glass waste will be transported and disposed of in accordance with the requirements of the Transportation of

Dangerous Goods Act, the BC Ministry of Water Lands and Air Protection, and all other applicable regulations.

- .2 Any materials stored on site will be stored in an isolated and secure area. The secure area shall be restored to the condition it was before. This area shall be adjacent to the pesticide storage area at the secondary staging area. Contractor shall provide fencing and devices to secure this area.

3.7 - ALTERNATIVE PROCEDURES

3.7.1 General Requirements

- .1 Procedures described in this specification are to be utilized at all times.
- .2 If the specified procedures cannot be utilized, a request must be made in writing to the Departmental Representatives providing details of the problems encountered and recommended alternatives.
- .3 Alternative procedures shall provide equivalent or greater protection than procedures they replace.
- .4 Any alternative procedure must be approved in writing by the Departmental Representatives prior to its implementation.

PART 1 - GENERAL

1.1 Section Includes

- .1 Generic types of products, work, or requirements specified.
- .2 Waste Audit, Waste Reduction Workplan, Materials Source Separation Program, and Cost/Revenue Analysis Workplan.

1.2 Precedence

- .1 Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 Definitions

- .1 Waste Audit (WA): Relates to projected waste generation. Involves measuring and estimating quantity and composition of waste, reasons for waste generation, and operational factors which contribute to waste.
- .2 Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA (Schedule A).
- .3 Demolition Waste Audit (DWA): Relates to actual waste generated from project.
- .4 Materials Source Separation Program (MSS P): Consists of a series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .5 Cost/Revenue Analysis Workplan (CRAW): Based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.
- .6 Waste Management Coordinator (WMC): Designate individual who is in attendance on-site, full-time. Designate, or have designated, individuals from each Subcontractor to be responsible for waste management related to

their trade and for coordinating activities with WMC.

- .7 Separate Condition: Refers to waste sorted into individual types.

1.4 Site Visit .1 Refer to Instructions to Tenders.

1.5 Documents .1 Maintain at job site, one copy of following documents:
 .1 Waste Audit
 .2 Waste Reduction Workplan
 .3 Material Source Separation Plan
 .4 Schedules A B C D E completed for project.

1.6 Use of Site and Facilities .1 Execute work with least possible interference or disturbance to normal use of premises.
 .2 Maintain security measures established by existing facility provide temporary security measures approved by Departmental Representatives.

1.7 Submittal .1 Submit requested submittals in accordance with Section 013300 - Submittal Procedures.
 .2 Prepare and submit the following submittals prior to project start-up:
 .1 Submit 2 copies of completed Waste Audit (WA): Schedule A.
 .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
 .3 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule C.
 .4 Submit 2 copies of Cost/Revenue Analysis Workplan (CRAW): Schedule D.
 .5 Submit 2 copies of Materials Source Separation Program description.

1.8 Waste Audit .1 Conduct WA prior to project start-up.
 .2 Prepare Waste Audit: Schedule A.
 .3 Record, on Waste Audit - Schedule A, extent to

which materials or products used consist of recycled or reused materials or products.

1.9 Waste Reduction
Workplan

- .1 Prepare WRW prior to project start-up.
- .2 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .3 Describes management of waste.
- .4 Identify opportunities for reduction, reuse, and/or recycling (3Rs) of materials. Based on information acquired from WA.
- .5 Post workplan or summary where workers at site are able to review its content.

1.10 Demolition
Waste Audit

- .1 Prepare Demolition Waste Audit (DWA) prior to project start-up.
- .2 Complete Demolition Waste Audit (DWA): Schedule C.

1.11 Cost/Revenue
Analysis Workplan

- .1 Prepare CRAW: Schedule D.

1.12 Materials Source
Separation Program

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as approved by Engineer.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
- .4 Provide containers to deposit reusable and/or recyclable materials.
- .5 Locate containers in locations, to facilitate

deposit of materials without hindering daily operations.

- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition. Transport to approved and authorized recycling facility to users of material for recycling.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition. Ship materials to site operating under Certificate of Approval premises of Departmental Representatives. Materials must be immediately separated into required categories for reuse or recycling.

1.13 Disposal of
Wastes

- .1 Burying of rubbish and waste materials is prohibited unless approved by Departmental Representatives.
- .2 Disposal of waste volatile materials mineral spirits oil paint thinner into waterways, storm, or sanitary sewers is prohibited.

1.14 Storage, Handling
and Protection

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representatives.
- .2 Unless specified otherwise, materials for removal do not become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.

- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representatives.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.

1.15 Scheduling

- .1 Coordinate work with other activities at site to ensure timely and orderly progress of the work.

PART 2 - PRODUCTS

- .1 Not used.

PART 3 - EXECUTION

3.1 Application

- .1 Do work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- .3 Recycling bins shall be located in the Greenhouse parking lot, on the side opposite the greenhouse where the contractors storage site.

3.2 Cleaning

- .1 Remove tools and waste materials on completion of work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

3.3 Diversion of Materials

- .1 From following list, separate materials from general waste stream and stockpile in separate

piles or containers, to approval of Departmental Representatives, and consistent with applicable fire regulations. Mark containers or stockpile areas. Provide instruction on disposal practices.

- .2 On-site sale of salvaged recovered reusable recyclable materials is permitted is not permitted.

.3 Demolition Waste

Material Type	Recommended Diversion %	Actual Diversion %
Acoustical Insulation	100	
Electrical Equipment	80	
Mechanical Equipment	100	
Metals	100	
<u>Other</u>		

.4 Construction Waste

Material Type	Recommended Diversion %	Actual Diversion %
Carboard	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
<u>Other</u>		

3.5 Waste Reduction .1 Schedule B
Workplan

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount Projected (unit)	(5) Actual Recycled Amount Projected (unit)	(6) Actual Material(s) Destination
Wood and Plastics					
Material Descrip.					
Chutes Warped Pallet					
Forms					
Plastic Packaging					
Cardboard Packaging					
Other					
Doors and Windows					
material Descrip.					
Painted Frames					
Glass					
Wood					
Metal					
Other					

PART 1 - GENERAL

- 1.1 Related Sections .1 Section 013300 - Submittal Procedures.
- .2 Section 013500 - Special Procedures.
- 1.2 References .1 Export and Import of Hazardous Waste and
Hazardous Recyclable Material Regulations -
SOR /2005-149 (EIHWS Regulations).
- .2 National Fire Code of Canada 2010.
- .3 Transportation of Dangerous Goods Act (TDG
Act) 1992, (T-19.01).
- .4 Transportation of Dangerous Goods Regulations
(TDGR), consolidated to include SOR/2011-210
(Amendment 10) and SOR/2011-239 (Amendment 8).
- 1.3 Definitions .1 Dangerous Goods: Product, substance, or
organism that is specifically listed or meets
the hazard criteria established in
Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: Product, substance, or
organism that is used for its original
purpose; and that is either dangerous goods or
a material that may cause adverse impact to
the environment or adversely affect health of
persons, animals, or plant life when released
into the environment.
- .3 Hazardous Waste: Any hazardous material that
is no longer used for its original purpose and
that is intended for recycling, treatment or
disposal.
- .4 Workplace Hazardous Materials Information
System (WHMIS): A Canada-wide system designed
to give employers and workers information
about hazardous materials used in the
workplace. Under WHMIS, information on
hazardous materials is to be provided on

container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by a combination of federal and provincial laws.

- 1.4 Submittals
- .1 Submit product data in accordance with Section 013300 - Submittal Procedures.
 - .2 Submit to Departmental Representatives current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.
- 1.5 Storage and Handling
- .1 Coordinate storage of hazardous materials with Departmental Representatives and abide by internal requirements for labeling and storage of materials and wastes.
 - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.
 - .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use. Store all flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representatives.
 - .5 Transfer of flammable and combustible liquids is prohibited within buildings.
 - .6 Transfer of flammable and combustible liquids will not be carried out in the vicinity of open flames or any type of heat-producing devices.

- .7 Flammable liquids having a flash point below .
38° C, such as naptha or gasoline, will not be
used as solvents or cleaning agents.
- .8 Store flammable and combustibile waste liquids
for disposal in approved containers located in
a safe, ventilated area. Keep quantities to a
minimum.
- .9 Observe smoking regulations at all times.
Smoking is prohibited in any area where
hazardous materials are stored, used, or
handled.
- .10 Abide by the following storage requirements
for quantities of hazardous materials and
wastes in excess of 5 kg for solids, and 5
litres for liquids:
 - .1 Store hazardous materials and wastes in
closed and sealed containers which are in
good condition.
 - .2 Label containers of hazardous materials
and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in
containers compatible with that material
or waste.
 - .4 Segregate incompatible materials and
wastes.
 - .5 Ensure that different hazardous materials
or hazardous wastes are not mixed.
 - .6 Store hazardous materials and wastes in a
secure storage area with controlled
access.
 - .7 Maintain a clear egress from storage
area.
 - .8 Store hazardous materials and wastes in a
manner and location which will prevent
them from spilling into the environment.
 - .9 Have appropriate emergency spill response
equipment available near the storage
area, including personal protective
equipment.
 - .10 Maintain an inventory of hazardous
materials and wastes, including product
name, quantity, and date when storage
began.
- .11 Ensure personnel have been trained in
accordance with Workplace Hazardous Materials
Information System (WHMIS) requirements.

- .12 Report spills or accidents immediately to Departmental Representatives. Submit a written spill report to Departmental Representatives within 24 hours of incident.

1.6 Transportation

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If hazardous waste is generated on site:
 - .1 Coordinate transportation and disposal with Departmental Representatives.
 - .2 Ensure compliance with applicable provincial laws and regulations for generators of hazardous waste.
 - .3 Use only a licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Prior to shipping material, obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Ensure that only trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide a photocopy of all shipping documents and waste manifests to Departmental Representatives.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Departmental Representatives.
 - .9 Report any discharge, emission, or escape of hazardous materials immediately to Departmental Representatives and appropriate provincial authority. Take reasonable measures to control release.

PART 2 - PRODUCTS

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| <u>2.1 Materials</u> | .1 | Only bring on site the quantity of hazardous materials required to perform work. |
| | .2 | Maintain MSDSs in proximity to where the materials are being used. Communicate this location to personnel who may have contact with hazardous materials. |

PART 3 - EXECUTION

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| <u>3.1 Disposal</u> | .1 | Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines. |
| | .2 | Recycle hazardous wastes for which there is an approved, cost effective recycling process available. |
| | .3 | Send hazardous wastes only to authorized hazardous waste disposal or treatment facilities. |
| | .4 | Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited. |
| | .5 | Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited. |
| | .6 | Dispose of hazardous wastes in a timely fashion in accordance with applicable provincial regulations. |
|
<u>3.2 Disposal of
Decommissioned Fans and
Ductwork</u> | .1 | Refer to Section 013500 Special Procedures for disposal of decommissioned fans and ductwork. |
| | .2 | Fume hood fans and ductwork to be removed by non-sparking method. |

- .3 Fan inlet and exhaust outlets to be bagged and sealed in preparation for disposal. Care to be taken to ensure no material escapes from the decommissioned fans.
- .4 Ductwork inlet and outlets to be bagged and sealed in preparation for disposal. Care to be taken to ensure no material escapes from the decommissioned fan.
- .5 Material to be collected and prepared for transportation by a certified hazardous waste contractor to an approved hazardous waste location.

PART 1 - GENERAL

- 1.1 Section Includes .1 References and Codes.
- .2 Discovery of Asbestos (if any).
- 1.2 Precedence .1 Refer to General Conditions clauses.
- 1.3 References and Codes .1 Perform Work in accordance with National Building Code of Canada (NBC) including all 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 New construction works shall meet or exceed requirements of:
- .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.
 - .3 MD15128 Minimum Guidelines for Laboratory Fume Hoods
 - .4 BCBC
 - .5 National Building Code of Canada 2010
 - .6 National Plumbing Code of Canada 2010
 - .7 Labour Canada Code Part II
 - .8 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - .9 Industrial Ventilation: A Manual of Recommended Practice: American Conference of Government Industrial Hygienists
 - .10 Occupational Safety and Health Standards
 - .11 Treasury Board Guidelines
 - .12 Health Canada Laboratory Biosafety Guidelines - 2004
 - .13 ANSI/AIHA Z9.5-1992 - American National Standard for Laboratory Ventilation
 - .14 CSA Z3-16.5-94 - Fume Hoods and Associated Exhaust Systems - Health Care Technology
 - .15 ASHRAE 110 - Method of Testing

- Performance of Laboratory Fume Hoods
- .16 SMACNA - HVAC Air Duct Leakage Test Manual
- .17 ANSI /AWS D9.1-2006 - Sheet Metal Welding Code
- .18 NFPA 30 - 2012 - Use, handling and storage of flammable and combustible liquids
- .19 NFPA 45 - 2011 - Standard on Fire Protection for Laboratories Using Chemicals

1.4 Building
Smoking Environment

- .1 Comply with smoking restrictions.

PART 1 - GENERAL

- 1.1 Section Includes
- .1 Inspection and testing, administrative and enforcement requirements.
 - .2 Tests and mix designs.
 - .3 Mill tests.
 - .4 Equipment and system adjust and balance.
- 1.2 Related Sections
- .1 Section 013300 - Submittal Procedures.
 - .2 Section 014200 - References.
 - .3 Section 017800 - Closeout Submittals.
- 1.3 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 Engineer, 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.
 - .4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

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| <u>1.4 Access to Work</u> | .1 | Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants. |
| | .2 | Co-operate to provide reasonable facilities for such access. |
|
 | | |
| <u>1.5 Procedures</u> | .1 | Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made. |
|
 | | |
| <u>1.6 Rejected Work</u> | .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 | Make good other Contractor's work damaged 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 may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative. |
|
 | | |
| <u>1.7 Reports</u> | .1 | Submit 4 copies of inspection and test reports to Departmental Representative. |
| | .2 | Provide copies to Subcontractor of work being inspected or tested. |
|
 | | |
| <u>1.8 Equipment and Systems</u> | .1 | Submit adjustment and balancing reports and commissioning reports for mechanical, electrical and building equipment systems. |

- .2 Refer to Section 230593 for definitive requirements.
- .3 Refer to Sections 018100, 230800, 230801, 230802 and 230900 for definitive requirements.

PART 1 - GENERAL

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| <u>1.1 Section Includes</u> | .1 | Construction aids. |
| | .2 | Office and sheds. |
| | .3 | Parking. |
| | .4 | Project identification. |
| | .5 | Temporary power |
| <u>1.2 Related Sections</u> | .1 | Section 015600 - Temporary Barriers and Enclosures. |
| <u>1.3 Installation and Removal</u> | .1 | Provide construction facilities in order to execute work expeditiously. |
| | .2 | Remove from site all such work after use. |
| <u>1.4 Scaffolding</u> | .1 | Provide and maintain scaffolding, ladders and platforms. |
| <u>1.5 Hoisting</u> | .1 | Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof. |
| | .2 | Hoists cranes shall be operated by qualified operator. |
| <u>1.6 Elevators</u> | .1 | Designated existing elevators may be used by construction personnel and transporting of materials. Designated elevator for use by the contractor shall be the freight elevator. |
| | .2 | Provide protective coverings for finish surfaces of cars and entrances. |
| | .3 | Upon completion of work, clean used designated |

existing elevators thoroughly and restore to original condition.

1.7 Site Storage/
Loading

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.
- .3 Storage and trailers for use by the contractor during construction may be placed at the primary staging area, coordinated with PARC.

1.8 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 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .4 Parking area for contractor's private vehicles and those vehicles not required for use during construction shall be at the Upper Parking Lot only.

1.9 Offices

- .1 Site offices will not be provided in the building.
- .2 Contractors shall provide their own offices as necessary in mobile trailers. Location of mobile trailers shall be coordinated with PARC.

1.10 Equipment, Tool
and Materials Storage

- .1 Provisions will be made on site for parking of one construction trailer for storage of tools, equipment and materials. Location of this trailer shall be coordinated with PARC.

- .2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.11 Sanitary
Facilities

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Location of the sanitary facilities shall be coordinated with PARC

1.12 Temporary Power

- .1 Temporary electrical power will be provided by AAFC along side of the Greenhouse parking lot.

PART 1 - GENERAL

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| <u>1.1 Section Includes</u> | .1 | Barriers. |
| | .2 | Environmental Controls. |
| | .3 | Traffic Controls. |
| | .4 | Fire Routes. |
|
<u>1.2 Related Sections</u> | .1 | Section 015200 - Construction Facilites. |
|
<u>1.3 Installation and Removal</u> | .1 | Provide temporary controls in order to execute Work expeditiously. |
| | .2 | Remove from site all such work after use. |
|
<u>1.4 Guard Rails and Barricades</u> | .1 | Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and around lifting/hoisting areas. |
| | .2 | Provide as required by governing authorities. |
|
<u>1.5 Weather Enclosures</u> | .1 | Provide weather tight closures to openings, in floors and roofs. |
| | .2 | Design enclosures to withstand wind pressure and snow loading. |
|
<u>1.6 Addition Filtration</u> | .1 | Provide additional prefiltration at each AHU filter bank during construction to minimize dust deposits. |
| | .2 | Replace AHU filters once construction is |

complete with filters of matching size and performance.

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| <u>1.7 Access to Site</u> | .1 | Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work. |
| <u>1.8 Public Traffic Flow</u> | .1 | Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work, protect the public and maintain unobstructed access to the facility for staff and general public. |
| <u>1.9 Fire Routes</u> | .1 | Maintain access to property including overhead clearances for use by emergency response vehicles. |
| <u>1.10 Protection for Off-Site and Public Property</u> | .1 | Protect surrounding private and public property from damage during performance of Work. |
| | .2 | Be responsible for damage incurred. |
| <u>1.11 Protection of Building Finishes</u> | .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 3 days prior to installation. |
| | .4 | Be responsible for damage incurred due to lack of or improper protection. |

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| <u>1.12 Noise Issues</u> | .1 | Coordinate with Departmental Representative all construction work that may involve excessive noise. Make provisions for noise barriers to protect all occupants. |
| | | |
| <u>1.13 Signs and Notices</u> | .1 | Provide signs and notices in the renovated areas, public corridors and entrance. |
| | | |
| <u>1.14 Hoarding and Barriers</u> | .1 | Required where building security, protection of the Public and preservation of building finishes are concerned. |
| | .2 | Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13mm exterior grade fir plywood to CSA 0121 or other method approved by Departmental Representative. |
| | .3 | Rolled plastic construction type fencing is acceptable where approved by Departmental Representative. Provide metal posts at 1800 mm centres minimum. |
| | .4 | Apply plywood panels vertically flush and butt jointed. |
| | .5 | Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law. |

PART 1 - GENERAL

- 1.1 Section Includes
- .1 Product quality, availability, storage, handling, protection, and transportation.
 - .2 Manufacturer's instructions.
 - .3 Quality of Work, coordination and fastenings.
 - .4 Existing facilities.
- 1.2 Related Sections
- .1 Section 017300 - Execution.
- 1.3 Reference Standards
- .1 If there is a question as to whether any product or system is in conformance with applicable standards, it is a responsibility of the contractor to prove compliance.
 - .2 In case of dispute, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
 - .3 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
 - .4 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.
- 1.4 Quality
- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) 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 any dispute 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.

1.5 Availability

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any 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 the 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.

1.6 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 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 Transportation

- .1 Pay costs of transportation of products required in performance of Work.

1.8 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 may 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.

1.9 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.

1.10 Co-Ordination

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

1.11 Concealment

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

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| <u>1.12 Remedial Work</u> | <ul style="list-style-type: none">.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate 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. |
| <u>1.13 Location of Fixtures</u> | <ul style="list-style-type: none">.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate..2 Inform Departmental Representative of conflicting installation. Install as directed. |
| <u>1.14 Fastenings</u> | <ul style="list-style-type: none">.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. |

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| <u>1.15 Fastenings -
Equipment</u> | <ul style="list-style-type: none">.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. |
| <u>1.16 Protection of
Work in Progress</u> | <ul style="list-style-type: none">.1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative. |
| <u>1.17 Existing
Utilities</u> | <ul style="list-style-type: none">.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 and pedestrian and vehicular traffic..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

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| <u>2.1 Acceptable</u> | <ul style="list-style-type: none">.1 Products listed as acceptable products in various sections and on drawings are to be used as a guide and does not imply exclusion of unlisted manufacturers, models or materials..2 Acceptable products mean that item named and |
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specified by manufacturers reference meets the specification in all respects and is acceptable to the Departmental Representative.

- .3 Equipment or materials proposed shall meet the same standards.
- .4 During the tendering period, manufacturers or suppliers or products or equipment other than those listed as "acceptable products" in the various section throughout the specifications and where it is considered by manufacturers or suppliers that their products or equipment meets the specification requirements, may provide full descriptive data, proving compliance, in writing to the Departmental Representative for assessment at least fourteen (14) days before opening of the tender. The Departmental Representative will advise in the form of an addendum acceptance based on the review of the data submitted. Rejection of products or equipment will not be issued as an addendum item.

2.2 No Substitutions

- .1 All products listed as No Substitution in various sections are to be supplied as specified.

PART 1 - GENERAL

1.1 References

- .1 Canada Labour Code - Part II, Canada Occupational Safety and Health Regulations.
- .1 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations - Safety Requirements for Powder-Actuated Fastening Systems.
- .2 Canadian Standards Association (CSA):
 - .1 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
 - .2 CSA S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.
 - .3 CSA Z797-2009 Code of Practice for Access Scaffold.
 - .4 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .4 Fire Commissioner of Canada (FCC):
 - .1 FCC No. 301-1982, Standard for Construction Operations.
 - .2 FCC No. 302-1982, Standard for Welding and Cutting.
- .3 National Building Code of Canada (NBC):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .4 Province of British Columbia:
 - .1 Workers Compensation Act Part 3 Occupational Health & Safety
 - .2 Occupational Health and Safety Regulation.

1.2 Related Sections

- .1 Refer to the following sections as required:
 - .2 Section 011100 - Summary of Work
 - .2 Section 013300 - Submittal Procedures
 - .3 Section 013500 - Special Procedures
 - .4 Section 013570 - Hazardous Materials

1.3 Workers' Compensation Board Coverage

.1 Comply fully with the Worker's Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

- .2 Maintain Workers' Compensation Board coverage during the term of the contract, until and including the date that Certification of Final Completion is issued.
- 1.4 Compliance with Regulations
- .1 Comply fully with the Canada Labour Code, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.
 - .1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
 - .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- 1.5 Submittals
- .1 Perform submittals in accordance with Section 013300 - Submittal Procedures.
 - .2 Work affected by submittal shall not proceed until review is complete.
 - .3 Submit the following:
 - .1 Health and Safety Plan.
 - .2 Copies of reports or directions issued by federal and provincial health and safety inspectors.
 - .3 Copies of incident and accident reports.
 - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .5 Emergency procedures.
 - .4 Departmental Representative shall review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and

provide comments to the Contractor within 7 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative for review upon request.

- .5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.
- .5 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
 - .1 Be construed to imply approval by the Departmental Representative.
 - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
 - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 Responsibility

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .2 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 the extent that they may be affected by the conduct of the Work.
- .3 Comply with and enforce compliance by employees with safety requirement of contract documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 General Protection

- 1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection

for pedestrian and vehicular traffic.

- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
- .3 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
- .4 Secure site at night time or provide security guard as deemed necessary to protect site against entry.

1.8 Project Site
Conditions

- .1 Coordination will be required for access crews, refit contractors and delivery of supplies.
- .2 Temporary closure of any access point or shutdown of utilities will require two weeks' advance notice in writing to Departmental Representative.
- .3 Liaise with Coordinator appointed by Departmental Representative.

1.9 Regulatory
Requirements

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.10 Work Permits

- .1 Obtain building permit[s] related to project before start of work.

1.11 Filing Notice

- .1 Complete and submit a Notice of Project as

required by provincial authorities.

- .2 Provide copies of all notices to the Departmental Representative.

1.12 Health & Safety Plan

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary requirements:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.
 - .4 General safety rules for project.
 - .5 Job-specific safe work, procedures.
 - .6 Inspection policy and procedures.
 - .7 Incident reporting and investigation policy and procedures.
 - .8 Occupational Health and Safety Committee/Representative procedures.
 - .9 Occupational Health and Safety meetings.
 - .10 Occupational Health and Safety communications and recordkeeping procedures.
 - .11 Incorporate existing site Health & Safety requirements.
 - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
 - .3 List hazardous materials to be brought on site as required by work.
 - .4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and

- hazards.
- .5 Identify personal protective equipment (PPE) to be used by workers.
- .6 Identify personnel and alternates responsible for site safety and health.
- .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review of Health and Safety Plan is for the sole purpose of ascertaining conformance with Occupational Health and Safety regulations. Departmental Representatives review will not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.
- 1.13 Emergency Procedures.
 - .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
 - .1 Designated personnel from own company.
 - .2 Regulatory agencies applicable to work and as per legislated regulations.
 - .3 Local emergency resources.
 - .4 Departmental Representative site staff.
 - .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.

- .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
- .6 Notify Departmental Representative.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
 - .1 Work at high angles.
 - .2 Work in confined spaces or where there is a risk of entrapment.
 - .3 Work with hazardous substances.
 - .4 Underground work.
 - .5 Work on, over, under and adjacent to water.
 - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit. .
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.14 Meetings

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.15 Hazardous Products

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents.
 - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours".

- .3 Provide adequate means of ventilation.
- .4 An example of a product that shall be treated as hazardous is the demolished exhaust and return air system ductwork. Refer to Section 013500 - Special Procedures.

1.16 Electrical Safety Requirement

- .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
 - .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with the Departmental Representative.
- .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.17 Electrical Lockout

- 1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have the procedures available for review upon request by Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a logbook for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.18 Overloading

- .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause

permanent deformation.

1.19 Falsework

- .1 Design and construct falsework in accordance with CSA S269.1-1975 (R2003).

1.20 Scaffolding

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA-Z797-2009 and BC Occupational Health and Safety Regulations.

1.21 Confined Spaces

- .1 Comply with Occupational Health and Safety Regulation, Part 9. Carry out work in confined spaces in compliance with regulations.

1.22 Powder-Actuated Devices

- .1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

1.23 Fire Safety and Hot Work

- .1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.24 Fire Safety Requirements

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

- 1.25 Fire Protection and Alarm Systems .1 Fire protection and alarm systems shall not be:
- .1 Obstructed.
 - .2 Shut off.
 - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department and the building owner and tenants, resulting from false alarms.
- 1.26 Unforeseen Hazards .1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.
- 1.27 Posted Documents .1 Post legible versions of the following documents on site:
- .1 Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 All "Notices of Project" to be posted.
 - .6 Floor plans and site plans.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
 - .9 Material Safety Data Sheets (MSDS).
 - .10 Names of Joint Health and Safety Committee members, or Health and

Safety Representative, as applicable,
and the Departmental Representative's
Health and Safety Coordinator.

- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be a minimum 600 mm x 600 mm piece of plywood staked into the ground, protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.28 Correction of Non-Compliance

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The Contractor will be responsible for any costs arising from such a "stop work order".

PART 1 - GENERAL

- 1.1 Section Includes .1 Requirements and limitations for cutting and patching the Work.
- 1.2 Related Sections .1 Section 011100 - Summary of Work.
.2 Section 013300 - Submittal Procedures.
.3 Individual product Sections: cutting and patching incidental to work of section. Advance notification to other sections required.
- 1.3 Submittals .1 Submit written request in advance of cutting or alteration which affects:
.1 Structural integrity of any element of Project.
.2 Integrity of weather-exposed or moisture-resistant elements.
.3 Efficiency, maintenance, or safety of any operational element.
.4 Visual qualities of sight-exposed elements.
.5 Work of Departmental Representative or separate contractor.
.2 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 Engineer or separate contractor.
.7 Written permission of affected separate contractor.
.8 Date and time work will be executed.
- 1.4 Materials .1 Required for original installation.

- .2 Change in Materials: Submit request for substitution in accordance with Section 01330 - Submittal Procedures.

1.5 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 may be exposed by uncovering work; maintain excavations free of water.

1.6 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 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core

drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
- .13 Conceal pipes, ducts and wiring in wall and ceiling construction of finished areas except where indicated otherwise.

PART 1 - GENERAL

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| <u>1.1 Section Includes</u> | .1 | Progressive cleaning. |
| | .2 | Final cleaning. |
|
<u>1.2 Related Section</u> | .1 | Section 013550 - Waste Management and Disposal. |
| | .2 | Section 017700 - Closeout Procedures. |
|
<u>1.3 Project Cleanliness</u> | .1 | Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors not working as part of this contract. |
| | .2 | 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 Engineer. |
| | .3 | Clear snow and ice from access to building, bank/pile snow in designated areas only. |
| | .4 | Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris. |
| | .5 | Provide on-site containers for collection of waste materials and debris. |
| | .6 | Provide and use clearly marked separate bins for recycling. Refer to Section 013550 - Waste Management and Disposal. |
| | .7 | Remove waste material and debris from site and deposit in waste container at end of each working day. |
| | .8 | Dispose of waste materials and debris off site. |

- .9 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .10 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .11 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .12 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .13 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- .14 Provide protection of all system components i.e. coils, filters, etc., during construction and clean up.

1.4 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 the Departmental Representative or other Contractors not working as part of this contract.

- .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 polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.

PART 1 - GENERAL

1.1 Section Includes

- .1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 Related Sections

- .1 Section 017800 - Closeout Submittals.
- .2 Section 018100 - Commissioning.
- .3 Section 017800 - 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 Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Engineer's Review.
- .2 Departmental Representative's Review: Departmental Representative and Contractor will perform a review 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 Certificates required by Boiler Inspection Branch, Fire Commissioner and Utility companies have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 Work is complete and ready for Final Inspection.

- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Departmental Representative, and Contractor. If the work is deemed incomplete by Owner and Departmental Representative, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when Owner and Departmental Representative each 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 Departmental Representative each 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 Departmental Representative, complete outstanding items and request reinspection.
- .8 Payment of Holdback: after issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback.

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 Related Sections

- .1 Section 014500 - Quality Control.
- .2 Section 017700 - Closeout Procedures.
- .3 Section 018100 - Commissioning.
- .4 Section 018200 - Demonstration and Training.

1.3 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 Departmental Representative'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 Departmental Representative, four final copies of operating and maintenance manuals in English. Upon review, provide a copy of the manual in an electronic, searchable, PDF format.
- .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.

1.4 Format

- .1 Add data into the existing maintenance manuals in PARC Summerland.
- .2 Existing binders: vinyl, hard covered, to match with existing maintenance manuals in PARC Summerland.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .5 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .6 Text: Manufacturer's printed data, or typewritten data.
- .7 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .8 Upon review, provide a copy of the manual and record drawings in an electronic, searchable, PDF format.

1.5 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 specified in Section 014500 - Quality Control.
- .6 Training: Refer to Section 018200 - Demonstration and Training.

1.6 As-builts and Samples

- .1 In addition to requirements in General Conditions, maintain at the site for Owner 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 Store record documents and samples in field office apart from documents used for construction. 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. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.7 Recording Actual
Site Conditions

- .1 Record information on set of blue line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 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.
- .5 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.

- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Transfer all site record information to AutoCAD drawings. Provide an electronic AutoCAD file with all the record drawings for mechanical, electrical, structural and architectural works. Submit one hard copy of the record drawings prior to substantial completion.

1.8 Final Survey

- .1 Submit final site survey certificate in certifying that locations of completed Work are in conformance, or non-conformance with Contract Documents.

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 charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01450 - Quality Control and 01810 - Commissioning.
- .15 Additional requirements: As specified in individual specification sections.

1.10 Materials and
Finishes

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .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.

1.11 Spare Parts

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.12 Maintenance Materials

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.13 Special Tools

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.14 Storage, Handling and Protection

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store 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 to satisfaction of Departmental Representative.

1.15 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 1 - GENERAL

- 1.1 Definitions .1 "Commissioning" is a designed process of ensuring that systems are designed, installed, functionally tested and capable of being operated and maintained to perform in conformity with the design intent.
- .2 Commissioning begins with planning and includes design, construction, start-up, acceptance and training and can be applied throughout the life of the building.
- .3 This contract includes construction, start-up, acceptance, training and limited post-occupancy commissioning activities.
- .4 "Sections 018000" means all Sections included in commissioning. Sections 018100, 230800, 230801, 230802 and 230900.
- 1.2 Precedence .1 Refer to General Conditions clauses.
- 1.3 Summary .1 Purpose
- .1 The purpose of the commissioning process is to provide the Departmental Representative assurance that the systems have been installed in the prescribed manner and will operate in conformity with the design intent.
- .2 Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems to beneficial use by the occupants.
- .3 The Contractor verifies installation, provides scheduling and coordination and commissioning activities, performs training, starts up equipment, conducts functional performance testing, corrects deficiencies, performs retests and provides documentation of the process.
- .4 Commissioning procedures and results will be observed by the Departmental Representative.
- .5 The contractor is expected to verify the functional readiness of systems to be tested prior to performing the tests in the presence of the Departmental

Representative.

- .7 Test failure will indicate that the contractor has not adequately verified the readiness of the systems.

.2 General

- .1 Furnish labour and material to accomplish building commissioning as specified in Sections 018000.
 - .2 Requirements of Sections 018000 shall be accomplished by a qualified Test Contractor, as specified herein.
 - .3 The requirement for and responsibilities of the Test Contractor are indicated herein.
 - .4 Unless otherwise noted, verification tests and functional performance tests (FPTs) specified elsewhere in Sections 018000 apply to all equipment and systems identified under Systems/Equipment To Be Tested.
- .3 Provide the services of a qualified Test Contractor with commissioning expertise as described in this section.
- .4 Commissioning activities are described in detail in other sections of the work.
- .5 Acceptance of the Work requires successful completion of various acceptance procedures including but not limited to verification procedures and functional performance tests.
- .1 Verification procedures include a full range of checks and tests to determine that all components, equipment, systems and interfaces between systems operate in accordance with contract documents. This includes all operating modes, all interlocks, all control responses and all specified responses to abnormal or emergency conditions.
 - .2 Functional performance testing verifies that systems, as installed, are capable of producing the required effect in accordance with the design intent. Functional performance testing shall progress from tests of individual components of the central equipment and systems, including but not limited to: the new and existing lab exhaust systems, the relocated penthouse exhaust fan, and power switching,

to tests of the systems that distribute the services throughout the building. During functional performance testing, failures in performance may be revealed. Performance deficiencies will be evaluated to determine the cause and whether they are part of the contractual obligations.

- .6 As each acceptance procedure is accomplished physical responses of the system shall be observed and compared to the specified requirements in order to verify the test results. The actual physical responses of system components must be observed. Reliance on control signals or other indirect indicators is not adequate. The input and output signals for each control component also need to be observed to confirm that they are correct for each physical condition.

1.4 Related Sections

- .1 Section 014500 - Quality Control.
- .2 Section 230900- EMCS: Commissioning.
- .3 Section 230800- Commissioning Testing Requirements.
- .4 Section 230801- Commissioning Component Testing.
- .5 Section 230802- Commissioning System Testing
- .6 Section 233400- Fans
- .7 Section 230593- Testing, Adjusting and Balancing

1.5 Test Contractor

- .1 Responsibilities: The Test Contractor shall execute Sections 018000. Responsibilities of the Test Contractor are specified in Sections 018000 and include, but are not limited to:
 - .1 Coordinate and manage the Contractor's commissioning activities.
 - .2 Coordinate directly with each subcontractor with respect to their responsibilities and contractual obligations for commissioning.
 - .3 Obtain, assemble and submit commissioning documentation.

- .4 Attend periodic on-site commissioning meetings.
- .5 Develop the commissioning plan and schedule. Integrate commissioning schedule into the master construction activity schedule. Update schedule at specified intervals.
- .6 Develop detailed commissioning test procedures and forms.
- .7 Conduct installation verification inspections.
- .8 Review controls documentation and interface with other systems.
- .9 Obtain, review and assemble operation and maintenance information and as-built drawings provided by the various subcontractors and vendors.
- .10 Note any inconsistencies or deficiencies in system operations. Enforce system compliance or recommend to the Departmental Representative modifications to system design that will correct or enhance system performance.
- .11 Coordinate Departmental Representative test witnessing, after verifying that pre-tests have been satisfactorily conducted and final tests are ready to be performed.
- .12 Be present during training sessions to direct video recording, present training and direct the presentations of others.
- .13 Be present during start-up activities to direct and witness execution of start-up.
- .14 Monitor performance of testing, adjusting and balancing (TAB) activities to ensure acceptable results, and use of approved methods and instrumentation.
- .15 Ensure that necessary test instrumentation is available during verification and functional performance testing, and that

instruments meet quality and calibration requirements and are in good working order.

- .16 Be present during verification and functional performance testing and retesting to direct and witness execution of tests.
 - .17 In the event that a commissioning test fails, determine the cause of failure. Direct timely correction of deficiency and then retest. If more than two commissioning tests of the same systems are required, reimburse the Departmental Representative for billed costs for the extraordinary participation of the Departmental Representative, and consultant.
 - .18 Prepare and submit commissioning reports.
 - .19 Track commissioning deficiencies until correction and retesting is successfully completed.
 - .20 Assemble and submit Verification Report and Commissioning Report to the Departmental Representative for approval.
- .2 Qualifications: The Test Contractor shall meet the following minimum qualifications:
- .1 Extensive experience in startup and troubleshooting Laboratory ventilation and exhaust, fume hood exhaust, HVAC, hot water heating, chilled water, steam, plumbing, fire suppression, electrical, emergency power, fire alarm, life safety, energy monitoring and control system (EMCS) and telecommunications systems of similar complexity to those contained in these documents.
 - .2 Excellent working knowledge of complex environmental, fire alarm, and electric power control and facility management systems; be capable of understanding control vendor's operating system and control code; be capable of troubleshooting control code and recommending necessary modifications.

- .3 Competency in system design and intent.
 - .4 Knowledge of the test and balance of air and hydronic systems.
 - .5 Excellent communication and writing skills, organizational skills and ability to work well with management and trades contractors.
 - .6 A bachelors degree in mechanical engineering and P.Eng certification, with extensive practical field experience is preferred; however, other technical training such as ASCT and experience with extensive practical field experience will be considered.
 - .6 Staff performing work shall have specific experience with the mechanical systems at the PARC Summerland site.
- .3 Qualifications Submittal: Submit the Test Contractor resume and statement of qualifications to the Departmental Representative for approval. Document preceding qualifications and include the following:
- .1 Present employment, including company name and address; present title and job description; and history of employment (include dates and positions held).
 - .2 Relevant work experience (job name, position held and work history).
 - .3 Education and technical training.
 - .4 Interview: The Departmental Representative reserves the right to personally interview the Test Contractor candidate prior to accepting placement in the position. Final approval of the Test Contractor will be by the Departmental Representative.
 - .5 Conflict of interest: The Test contractor shall not be financially associated with any of the Division 1 through Division 26

contractors or vendors prior to engaging in this contract, to avoid potential conflicts of interest.

- .6 Authority: Provide a letter of authority to the Test Contractor signed by a principal of the General Contractor's firm. Submit copy of letter to Departmental Representative. Letter shall authorize the Test Contractor to:

- .1 Make inspections required for commissioning.
- .2 Coordinate, schedule and manage commissioning activities of the Contractor, subcontractors and suppliers.
- .3 Obtain documentation required for commissioning from the Contractor, subcontractors and vendors.
- .4 Report directly to the principal regarding deficiencies, delayed resolution of deficiencies, schedule conflicts, and lack of cooperation or expertise on the part of subcontractors or suppliers.

1.6 Coordination

- .1 Coordination and management: Provide overall coordination and management of the commissioning program as specified herein. The commissioning process will require cooperation of the Contractor, subcontractors, vendors, and Departmental Representative. The commissioning team shall include the following:
 - .1 Contractor: Project manager and Test Contractor.
 - .2 Subcontractors: As required by the prime contractor.
 - .3 Manufacturers' factory engineers: As specified elsewhere.
 - .4 Engineer: Mechanical Engineer and electrical Engineer.

1.8 Submittals

- .1 General: Submit the following in accordance with general and supplemental conditions of the contract and Division I specification sections.
- .2 Commissioning plan: Submit commissioning plan to the Departmental Representative for review and approval by the Engineer within 30 calendar days of notice to proceed.
- .3 Commissioning schedule: Submit commissioning schedule to the Departmental Representative for review and approval by the Engineer within 30 calendar days of notice to proceed.
- .4 Design intent documentation: Submit edited and updated design intent narratives to the Departmental Representative for review and approval by the Engineer.
- .5 Critical flow chart diagrams: Submit edited and updated critical flow chart diagrams to the Departmental Representative for review and approval by the Engineer.
- .6 Start-up plan: For each piece of equipment or system for which formal start-up is specified elsewhere in Sections 018000, submit the following to the Departmental Representative for review and approval by the Engineer. Obtain approval of the start-up plan prior to beginning start-up activities.
 - .1 Start-up schedule.
 - .2 Names of firms/individuals required to participate.
 - .3 Detailed start-up procedures.
 - .4 Start-up data forms.
- .7 Test equipment identification list: For each instrument, sorted according to intended use, submit to the Departmental Representative for review and approval by the Engineer: Manufacturer; model number; serial number; calibration certification; range; accuracy; resolution; and intended use.
- .8 Operations manuals and maintenance manuals: Submit to the Departmental Representative prior to the start of training.

- .9 Start-up procedures: Submit start-up procedures for equipment for which formal start-up is specified in Sections 018000 to the Departmental Representative for review and approval by the Engineer. These procedures will be reviewed for technical depth, clarity of documentation, and completeness.
- .10 Start-up data forms: Submit start-up data forms for equipment for which formal start-up is specified elsewhere to the Departmental Representative for review and approval by the Engineer.
- .11 Testing, adjusting and balancing (TAB) report: Submit written TAB report to the Departmental Representative for review and approval by the Engineer. Refer to section 230593 for details.
- .12 Verification test and functional performance test procedures: Submit test procedures for verification tests and functional performance tests specified elsewhere to the Departmental Representative for review and approval by the Engineer.
 - .1 Each procedure shall have a unique alphanumeric designator.
 - .2 The same procedure may be applied to multiple identical pieces of equipment or systems.
 - .3 Procedures shall reference the applicable specification section upon which the procedure is based.
 - .4 These procedures will be reviewed for technical depth, clarity of documentation, compliance with acceptance criteria specified elsewhere and completeness.
 - .5 Identify the value for all set points and inputs, positions of adjustable devices, valves, dampers and switches.
 - .6 Identify the range of acceptable results for each condition tested.
 - .7 Procedures shall be detailed, stand-alone test instructions, written with sufficient step-by-step information to allow a test to be repeated under identical conditions with

repeatable results. Other documents referenced by a procedure must be included, at minimum those portions applicable to the procedure.

- .13 Test data forms: Submit verification test and functional performance test data forms or equipment for which tests are specified in Sections 018000, to the Departmental representative for review and approval by the Engineer.
 - .1 Identify each functional performance test data form by a unique designator consisting of the applicable functional performance test procedure designator followed by a dash digit suffix to distinguish multiple uses of the same procedure.
 - .2 Include space to record: Description of the procedure; whether the form is for a retest of a failed procedure; identification and location of the equipment being tested; identification of instrumentation used by serial number; observed conditions at each step of the procedure; acceptable results as specified elsewhere; date of the test; names of technicians performing the procedure; name and signature of the Test Contractor; name and signature of the Departmental Representative-designated witness (signature of witness shall only indicate concurrence with reported results and observations; acceptance of the results will be reported separately by the Departmental Representative after review of the data forms).
- .14 Test deficiency report forms: Submit verification test and functional performance test deficiency report forms to the Departmental representative for review and approval by the Engineer. Include space to record:
 - .1 Associated test data form number;
 - .2 Date of test;
 - .3 Name of person reporting the deficiency;
 - .4 Description of the observations associated with the failure of the test;
 - .5 Cause of the failure, if apparent at the time of the test;
 - .6 Date and description of corrective action

- taken;
- .7 Name and signature of person taking corrective action; and
- .8 Schedule for retest.

1.9 Commissioning Plan

- .1 Develop a commissioning plan to identify how commissioning activities will be integrated into general construction and trade activities. The plan is the key means for the Test Contractor to inform all parties as to how each system functions, independently and with respect to other systems. The plan shall be updated regularly and redistributed to the commissioning team for review and comment. The intent of this plan is to evoke questions, expose issues and resolve them with input from the entire commissioning team early in construction. The commissioning plan shall identify how commissioning responsibilities are distributed.
- .2 Include an organizational chart showing lines of communication and authority of the Test Contractor relative to key general contractor positions and to key subcontractors.
- .3 Identify who will be responsible for producing the various procedures, reports, Departmental Representative notifications and forms required in this division.
- .4 Include the commissioning schedule integrated with the construction schedule.
- .5 Describe the test/acceptance procedure.
- .6 Identify which subcontractors will participate in each of the tests.
- .7 Identify instrumentation required for each test.
- .8 Identify who will provide instrumentation for each test.
- .9 Operational description: This shall include, for example, the design criteria, design intent, code requirements, specifics of the equipment to be provided, sequences of operation, operating priorities, protocols, etc.

1.10 Schedule

- .1 Commissioning schedule: Integrate functional performance testing and commissioning requirements into the Critical Path Method (CPM) master construction schedule. Commissioning scheduling is the responsibility of the

contractor.

- .1 Prior to the beginning of start-up or verification testing activities, update the schedule of commissioning activities monthly.
- .2 Two weeks prior to the beginning of start-up or verification testing activities, provide a detailed two-week look-ahead schedule. Thereafter, update the two week look-ahead schedule weekly for the duration of commissioning. The two-week look-ahead schedule shall identify the date, time, beginning location, contractor personnel required, and anticipated duration for each start-up or test activity.

1.11 Commissioning Staging

- .1 The exhaust systems shall be commissioned in several stages. Refer to the phasing of the project. Each phase shall be fully functional, commissioned and reviewed by the Departmental Representative before proceeding to the next stage.
- .2 The general exhaust system and the lab exhaust system shall be re-balanced and made operational to facilitate operation of the facility at completion of each phase.
- .3 After all final phase is commissioned, a final integrated commissioning of labs shall be performed.
- .4 Test contractor shall review the commissioning staging and schedule with the Departmental Representative at the beginning of the construction, and modify as required to suit the site condition, laboratory operation and project requirements.
- .5 Test existing fume hoods to provide face velocities as stipulated by Engineer after the replacement of associated exhaust fans and ductwork with new control devices and ductwork.

1.12 Coordination with Departmental Representative

- .1 The Departmental Representative will witness all start-up and test activities specified in this division. The Departmental Representative will designate witnesses and alternates for each

activity.

- .2 Notify the Departmental Representative in writing of the date, time, location and anticipated duration of start-up and test activities as required in schedule above.
- .3 Provide written timely notice to Departmental Representative of any changes in date, time, location or anticipated duration of start-up and test activities. For the purpose of this paragraph, written notice shall be received by Departmental Representative a minimum of 72 hours in advance is to be considered timely notice.
- .4 Contractor shall reimburse Departmental Representative for actual costs incurred by the Departmental Representative as the result of failure to provide timely notice per preceding paragraph of changes in date, time, location or anticipated duration of start-up and test activities.
- .5 Obtain the signature of designated witness on all data forms. If the witness is unavailable at the scheduled time and location of the activity, so note, and proceed per schedule without the witness.

1.13 Commissioning Meetings

- .1 Attend periodic commissioning meetings.
 - .1 Prior to the beginning of start-up or functional performance testing activities, the Departmental Representative will hold commissioning meetings at least monthly.
 - .2 Beginning two weeks prior to the commencement of start-up or verification testing activities, whichever is earlier, the Departmental Representative will hold commissioning meetings at least weekly. Thereafter, and for the duration of commissioning, commissioning meetings will continue to be held at least weekly.
 - .3 The Departmental Representative may require additional meetings if the commissioning process appears to be behind schedule or if there are coordination problems. The Test Contractor may also request in writing additional meetings.
 - .4 Commissioning meetings shall carry through

all phases of the work.

PART 2 - PRODUCTS

2.1 Test Equipment

- .1 Provide industry standard test equipment required for performing the tests specified herein.
- .2 Instrumentation shall meet the following standards:
 - .1 Be of sufficient quality and accuracy to test and measure system performance within the tolerances required to determine adequate performance.
 - .2 Be calibrated on the manufacturers' recommended intervals with calibration tags permanently affixed to the instrument being used.
 - .3 Be maintained in good repair and operating condition throughout the duration of use on this project.
 - .4 Be recalibrated/repaired if dropped or damaged in any way since last calibrated.
- .3 Immersion temperature measuring instruments, liquids:
 - .1 Range, -40°F to 120°F; type, glass partial stem immersion; minimum accuracy, within 1/2 of scale division; resolution, 1°C
 - .2 Range, 0°F to 220°F; type, glass partial stem immersion; minimum accuracy, within 1/2 of scale division; resolution, 1°C
- .4 Air temperature measuring instruments:
 - .1 Range, -40°F to 120°F; type, glass partial stem immersion; minimum accuracy, within 1/2 of scale division; resolution, 1°C
 - .2 Range, 0°F to 220°F; type, glass partial stem immersion; minimum accuracy, within 1/2 of scale division; resolution, 1°C
- .5 Hydronic pressure measuring instruments:
 - .1 Range, indicated pressure shall be in the middle half of the instrument range; type,

minimum Grade A gauge with stainless steel, alloy steel, monel or bronze Bourdon tube; minimum accuracy, within $\pm 0.25\%$ of full scale; resolution, 0.5 PSI subdivisions on a 4.5 inch dial with a mirrored scale and knife-edge pointer.

- .6 Hydronic differential pressure measuring instruments:
 - .1 Range, indicated pressure shall be in the middle half of the instrument range; type, dual inlet, minimum Grade A gauge with dual stainless steel, alloy steel, monel or bronze Bourdon tubes and a single pointer; minimum accuracy, within $\pm 0.25\%$ of full scale; resolution, 0.5 PSI subdivisions on a 4.5 inch dial with a mirrored scale and knife-edge pointer.
- .7 Air pressure measuring instruments:
 - .1 Range, indicated pressure shall be in the inclined portion of the scale; type, inclined/vertical manometer; resolution: if air velocity less than 1,000 fpm, then 0.005 inch graduations; if air velocity between 1,000 and 4,000 fpm, then 0.01 inch graduations; if air velocity greater than 4,000 fpm, then 0.1 inch graduations.

2.2 Reports

- .1 Testing, adjusting and balancing (TAB) progress reports: After TAB activities have begun, submit weekly TAB progress reports to the Departmental Representative.
Identify:
 - .1 Systems or subsystems for which preliminary balancing is complete.
 - .2 Systems or subsystems for which final balancing is complete.
 - .3 Status of deficiencies and balancing problems encountered, including corrective actions taken.
 - .4 Updated schedule of remaining TAB activities.
- .2 Installation verification audit: Prior to start-up, submit a report of installation verification audit activities to the Departmental Representative for review and approval by the Engineer. Identify equipment and components verified, deficiencies noted, corrective action taken and the dates and initials of the persons making the entries.

- .3 Start-up deficiency report: Within five days following start-up of each system or equipment, submit start-up deficiency report forms to the Departmental Representative. Identify systems and/or equipment started-up, deficiencies noted, corrective action taken and the dates and initials of the persons making the entries.
- .4 Test deficiency reports: At the end of each day in which verification tests or functional performance tests are conducted, submit test deficiency report forms to the Departmental Representative for tests for which acceptable results were not achieved during the day.
 - .1 Identify tests for which acceptable results were not obtained by test number and description, equipment identification and location. Briefly describe observations about the performance that were associated with failure to achieve acceptable results. Identify the cause of failure if such is apparent.
 - .2 When corrections have been completed, update the functional performance test deficiency report forms. Identify corrective action taken and the dates and initials of the persons making the entries.
 - .3 Identify the schedule for retesting.
- .5 Commissioning test data report: At the conclusion of acceptance phase commissioning activities, submit a report of all test data forms.
 - .1 Submit signed start-up, balancing, verification test, and functional performance test data forms and deficiency report forms. Include forms for failed tests and for acceptable tests.
 - .2 Bind data forms in three ring binders. Imprint covers with project name, date, and the words, "Commissioning Test Data."
 - .3 Separate data with index tab dividers.
 - .4 Provide a table of contents.

- .5 Group all data forms for a single test together. Place the data form with final, acceptable results in front of data forms with failed results. Locate deficiency report forms behind the test data form on which the deficiency was originally noted.

PART 3 - EXECUTION

3.1 Design Intent Documentation

- .1 Edit and update design intent narratives provided by the Departmental Representative. Incorporate the effect of approved substitution requests, change orders and responses to requests for clarifications that change the information in the Engineer's design intent narratives.

3.2 One-Line Diagrams

- .1 Edit and update one-line diagrams provided by the Departmental Representative. Incorporate the effect of approved substitution requests, change orders and responses to requests for clarifications that change the information in the Engineer's one-line diagrams.
- .2 Provide one-line diagrams for the systems identified in 3.2.3.
- .3 One-line diagrams are intended to support narrative system descriptions and the overall commissioning process. Depending on the system in question, the following procedures for developing the one-line diagrams are to be employed:
 - .1 Update the existing AutoCAD-based one-line diagrams provided by the Departmental Representative for the following systems: laboratory fume hood exhaust, electrical power; emergency power; supply air systems; return air systems; and exhaust air systems.
 - .2 Update and revise vendor supplied AutoCAD-based shop drawings; revise as required to match the format for commissioning documents. This method shall be employed for the following systems:
 - .1 energy management control;
 - .2 fire alarm/smoke evacuation/life

safety graphics.

3.3 Commissioning
Procedures

- .1 Sequence of testing: Commissioning shall proceed from lower to higher levels of complexity. For each discrete subsystem or system, testing at the lower level shall be completed prior to starting the next higher level of tests. Verification tests shall precede functional performance tests. In general, the order of testing from lowest to highest is:
 - .1 Static tests (such as pipe and duct leakage tests).
 - .2 Flushing and cleaning.
 - .3 Start-up.
 - .4 Component verification tests (motors, actuators, sensors, etc.).
 - .5 Balancing.
 - .6 Subsystem verification tests.
 - .7 System verification tests.
 - .8 Central equipment functional performance tests.
 - .9 System functional performance tests.
 - .10 Intersystem functional performance tests.
- .2 Retesting: Repeat, at no additional cost to the Departmental Representative, the complete verification test procedure for each test for which acceptable results are not achieved. Repeat tests until acceptable results are achieved. Compensate the Departmental Representative for direct costs incurred as the result of tests repeated to achieve acceptable results. Fill out a new test data form for each retest.
- .3 Correction of deficiencies:
 - .1 Correct functional performance test deficiencies promptly and schedule retest.
 - .2 Corrections during verification or functional performance tests are generally prohibited to avoid consuming the time of personnel waiting for the test, but not involved in making the correction. Exceptions will be allowed if the cause of the failure is obvious and corrective action can be completed in less than five

minutes. If corrections are made under this exception, the failure shall be noted on the test data form. A new test data form, marked retest, shall be initiated after the correction has been made. The entire test procedure shall be repeated.

- .4 Witnesses: Witnesses will be designated by the Departmental Representative to observe the commissioning process. Departmental Representative shall provide no labour or materials in the commissioning process. The only function of the Departmental Representative shall be to observe and comment on the progress and results of commissioning.

- .1 Provide access to permit the Departmental Representative to directly observe the performance of the equipment being tested.
- .2 Provide ladders, scaffolding, and staging as required to permit the Departmental Representative to directly observe the performance of the equipment being tested.
- .3 Notify the Departmental Representative of commissioning schedule changes at least 48 hours in advance if a Departmental Representative will be involved.

3.4 Operations Manuals and Maintenance Manuals

- .1 Review operations manuals and maintenance manuals prepared by other divisions of the work related to commissioning for compliance with the requirements of Division I.
- .2 Incorporate the standard technical literature into a systems-specific document: concise; to the point; and above all, tailored specifically to this facility.
- .3 Obtain the equipment manufacturer's standard technical literature relevant to the operation and maintenance of the provided equipment. The literature shall be specifically oriented to the equipment provided, indicating all operation and maintenance procedures, parts lists, assembly/disassembly diagrams, and related information. Wiring diagrams must be complete and specific to the equipment provided.
- .4 Submit the draft document for review by the Departmental Representative and Engineer to

ensure completeness, proper written communications, and compliance with each reviewer's knowledge of the significant requirements.

- .5 Refer to the required submissions for format, number of copies, etc.

3.5 Installation Verification

- .1 During construction, periodically observe the work of the prime contractor and subcontractors to ensure that all installations are being made in accordance with the intent of the contract documents, insofar as the installation impacts the goals of commissioning.
- .2 Before system start-up begins, conduct an installation verification audit. The audit shall include, but not be limited to, a check of:
 - .1 Piping specialties including balance, control and isolation valves.
 - .2 Ductwork specialty items including turning devices; balance, fire, smoke and control dampers; and access doors.
 - .3 Control sensor types and locations.
 - .4 Identification of piping, valves, starters, gauges, thermometers, etc.
 - .5 Documentation of prestart-up tests performed, including manufacturers' factory tests.
 - .6 Accessibility to equipment in 1-3 above.
- .3 If any work is found to be incomplete, inaccessible for safe operation and maintenance, incorrect or non-functional, record deficiencies and correct the deficiencies before system start-up work proceeds.

3.6 System Start-up

- .1 Develop a start-up plan. Commence with system start-up after approval has been given to the start-up plan and the prestart-up inspection has been completed by the Test Contractor. The Test Contractor shall witness system start-up and list all system and equipment deficiencies noted during start-up.
The Contractor shall take corrective action on all system deficiencies noted and demonstrate suitable system operation to the Test Contractor. Notify Engineer of start-up activities schedule at least five working days in advance. Departmental Representative will witness start-up procedures. Test Contractor shall obtain signature of the Departmental Representative indicating successful start-up.

3.7 Start-up
Deficiency Lists

- .1 Prepare start-up deficiency list forms to report deficiencies discovered in conjunction with system start-up. Start-up deficiency forms shall indicate the system being started-up; the location and identification of the deficient equipment/material; date of observation; initials of the observer; observed deficiency; date of correction; initials of person making the correction; and corrective action taken.
- .2 Issue start-up deficiency report forms to the Contractor for corrective action, and to the Departmental Representative for tracking. The Contractor shall advise the Test Contractor and Departmental Representative when all start-up deficiency list items have been corrected.

3.8 Testing Adjusting
and Balancing (TAB)

- .1 Coordinate demonstration of the accuracy of the air and hydronic TAB report as required in Section 230593. Advise the TAB firm when systems are complete and ready for balancing. TAB shall not commence until after systems start-ups and component verification tests, and shall be essentially complete prior to system verification tests.
- .2 Verify the accuracy of the TAB work prior to commencing any verification test activities that may be adversely affected by improper balancing.

3.9 Test Procedures

- .1 Develop start-up procedures, verification test procedures and functional performance test procedures documentation. Personnel experienced in the technical aspects of each system to be commissioned shall be engaged if necessary to augment the expertise of the Test Contractor. Include test procedures and test data sheets for each system based upon actual system configuration. Emphasis shall be placed on testing procedures that will conclusively determine actual system performance and compliance with the Contract and design intent.
- .2 Test procedures shall fully describe system configuration and steps required for each test; appropriately documented so that another party can repeat the tests with virtually identical results.
- .3 The majority of mechanical equipment requires integral safety devices to stop/prevent equipment operation unless minimum safety standards or conditions are met. This could include adequate

oil pressure, proof-of-flow, non-freezing conditions, maximum head pressure, etc. Functional performance test procedures shall demonstrate the actual performance of safety shutoffs in real or closely simulated conditions of failure.

- .4 Systems may include safety devices and components that control a variety of equipment operating as a system. Interlocks may be hard-wired or installed via software. Test procedures shall demonstrate these interlocks.
- .5 Inform appropriate subcontractors and vendors before commissioning is started as to what the tests and expected results will be. Whereas some test results and interpretations may not become evident until the actual tests are performed, all participants should have a reasonable understanding of the requirements.

3.10 Review Software
Documentation

- .1 Review vendor/contractor-provided detailed EMCS/BAS software documentation. This includes obtaining EMCS/BAS program documentation, a review of the programming approach, interface with other systems (such as lighting, fire alarm, security, clock, emergency generator monitoring, and utility metering), and a review of the specific software routines as applied to this project. Discrepancies in programming approaches shall be resolved to provide the Departmental Representative with the most appropriate, simple and straightforward approach to software routines.
- .2 Provide copies of all of the preceding material, including electronic copies of all control system software, to the Departmental Representative so that the Departmental Representative can simulate system operation and troubleshoot the software.

3.11 Training

- .1 Prepare and submit a training plan for approval. The training plan shall include for each training session:
 - .1 Dates, start and finish times, and locations.
 - .2 Outline of the information to be presented.
 - .3 Names and qualifications of presenters.
 - .4 List of texts and other materials required to support training.
- .2 Obtain assistance from appropriate subcontractors and vendors to provide training for the

Departmental Representative as specified in Divisions 23 and 26.

- .3 Provide videotape documentation of training of the Departmental Representative for each system. Training will be in a classroom setting on site with the appropriate schematics, handouts and audio/visual training aids.
- .4 Catalogue training videotapes and deliver to the Departmental Representative with the OPERATIONS MANUALS AND MAINTENANCE manuals in accordance with Divisions 23, 26 and Sections 018000.
- .5 Host each training session:
 - .1 Provide program overview and curriculum guidance.
 - .2 Obtain signatures of attendees on a sign-in list.
- .6 Equipment vendors provide training on the specifics of each system and philosophy, troubleshooting, and repair techniques as specified in the relevant sections of this specification.
- .7 Installation subcontractors provide training on peculiarities specific to this project and job specific experience in the relevant sections of this specification.

3.12 Record Drawings

- .1 Review record drawings to verify accuracy.

3.13 Exclusions

- .1 The Departmental Representative is not responsible for construction means, methods, job safety or any management function related to commissioning on the job site.
- .2 The contractor shall provide all technical services requiring tools or the use of tools to test, adjust or otherwise bring equipment into a full operational state.

PART 1 - GENERAL

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|--|----|---|
| <u>1.1 Section Includes</u> | .1 | Procedures for demonstration and instruction of equipment and systems to Departmental Representative. |
| <u>1.2 Related Sections</u> | .1 | Section 017800 - Closeout Submittals. |
| | .2 | Section 018100 - Commissioning. |
| <u>1.3 Description</u> | .1 | Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative two weeks prior to date of final inspection. |
| | .2 | Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times. |
| <u>1.4 Quality Control</u> | .1 | When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Departmental Representative, and provide written report that demonstration and instructions have been completed. |
| <u>1.5 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 Departmental Representative'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. |
| <u>1.6 Conditions for Demonstrations</u> | .1 | Equipment has been inspected and put into operation in accordance with Section 017700 - Closeout Procedures. |
| | .2 | Testing, adjusting, and balancing has been performed in accordance with Section 018100 - Commissioning - General Requirements and equipment and systems are fully operational. |
| | .3 | Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions. |

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|--|----|--|
| <u>1.7 Preparation</u> | .1 | Verify that conditions for demonstration and instructions comply with requirements. |
| | .2 | Verify that designated personnel are present. |
| <u>1.8 Demonstration and Instructions</u> | .1 | Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled 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. |
| <u>1.9 Time Allocated for Instructions</u> | .1 | Ensure amount of time required for instruction of each item of equipment or system as follows:
.1 Ventilation System: 8 hours of instruction.
.2 Control System: 24 hours of instruction.
.3 Electrical System: 4 hours of instruction. |
| | .2 | Confirm with Departmental Representative that time allotted is sufficient and can be scheduled for proper instruction |
| <u>PART 2 - PRODUCTS</u> | .1 | NOT USED |
| <u>PART 3 - EXECUTION</u> | .1 | NOT USED |

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

1.2 REFERENCES

- .1 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-[03].
- .2 Underwriters' Laboratories of Canada (ULC)

1.3 GENERAL

- .1 Related Works:
 - .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 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.
- .3 Term "Cx" in this section means "Commissioning".
- .4 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 Owner, and design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.

- .6 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.
- .5 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 MSDS - Material Safety Data Sheets.
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.
 - .8 WHMIS - Workplace Hazardous Materials Information System.
- .6 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.

1.4 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.

1.5 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 every 6weeks during 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.

1.6 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 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 PWGSC 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 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 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.
 - .4 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Testing.

- .3 Preparation, submission of test reports.
- .5 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.

1.7 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 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
- .3 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
 - .1 Modify ventilation rates to meet changes in off-gassing.
 - .2 Changes to heating or cooling loads beyond scope of EMCS.
 - .3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.
 - .4 Redistribution of electrical services.
 - .5 Modifications of fire alarm systems.
 - .6 Modifications to voice communications systems.
- .4 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.

1.8 EXTENT OF CX

- .1 Commission mechanical systems and associated equipment:
 - .1 HVAC and exhaust systems:
 - .1 HVAC systems.
 - .2 General exhaust and general return systems.
 - .3 Laboratory fume hoods and related systems.
 - .2 Noise and vibration control systems for mechanical systems.
 - .3 Seismic restraint and control measures.
 - .4 IAQ environmental control systems:
 - .5 EMCS:

1.9 DELIVERABLES RELATING TO O&M PERSPECTIVES

- .1 General requirements:
 - .1 Compile English documentation.
 - .1 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 MSDS data sheets.
 - .7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.10 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:
 - .2 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .3 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 Cx Reports.
 - .10 Prescribed activities during warranty period.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 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.
- .2 Pre-Cx activities - MECHANICAL:
 - .1 HVAC equipment and systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 At this time, 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.
 - .4 Perform TAB on systems. TAB reports to be approved by Departmental Representative.
 - .2 EMCS:
 - .5 EMCS trending to be available as supporting documentation for performance verification.
 - .6 Perform point-by-point testing in parallel with start-up.
 - .7 Carry out point-by-point verification.
 - .8 Perform final Cx and operational tests during demonstration period and 30 day test period.
 - .9 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

1.12 START-UP

- .1 Start up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction.
- .3 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable.
 - .2 Use procedures modified generic procedures to suit project requirements.
 - .3 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

□

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

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

- .1 Cx to be performed by specified Cx specialist, using procedures approved by Departmental.
- .2 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Departmental Representative and submitted to Departmental Representative for review.
- .3 Departmental Representative reserves right to verify percentage of reported results.
- .4 Integrated systems to include:
 - .1 HVAC and associated systems forming part of integrated HVAC systems.
- .5 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, and systems.

1.15 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.17 PERFORMANCE VERIFICATION (PV) REPORT

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.18 DELIVERABLES RELATING TO ADMINISTRATION OF CX

.1 General:

- .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.19 CX SCHEDULES

- .1 Prepare detailed 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: 2 months after award of contract.
 - .4 Cx Report format: 2 months after contract award.
 - .5 Discussion of heating/cooling loads for Cx: 1 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 6 months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Department Representative, Contractor, Contractor's Cx agent will monitor progress of Cx against this schedule.

1.20 CX REPORTS

- .1 Submit reports of tests to Departmental Representative.
- .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

1.21 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.

1.22 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.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORKS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 INSTALLATION/START- UP CHECK LISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .1 Special procedures as specified in relevant technical sections.
 - .2 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.
- .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.

1.3 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.

1.4 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.

1.5 SAMPLES OF COMMISSIONING FORMS

- .1 Departmental Representative will 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.

1.6 COMMISSIONING FORMS

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

END OF SECTION