PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)
- .1 CAN/CSA Z321-96 (R2006), Signs and Symbols for the Workplace.

.2 National Research Council Canada
- .1 NRCC NBCC-2015, National Building Code of Canada.
- .2 NRC Canadian Fire Code, National Fire Code of Canada 2015.

1.2 MINIMUM STANDARDS

.1 Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the NRCC NBCC-2015 and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirement shall apply.

.2 Refer to Section 01 14 00 - Work Restrictions.

1.3 TAXES

.1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

1.4 FEES, PERMITS, PERMITS AND CERTIFICATES

.1 Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.5 FIRE SAFETY REQUIREMENTS

.1 Comply with both the NRCC NBCC-2015 (NBC) and the NRC Canadian Fire Code (NFC) for safety of persons in buildings in the event of a fire and the protection of buildings from the effects of fire, as follows:
- .1 The NBC: for fire safety and fire protection features that are required to be incorporated in a building during construction.
- .2 The NFC:
  - .1 The on-going maintenance and use of the fire safety and fire protection features incorporated in buildings.
  - .2 The conduct of activities that might cause fire hazards in and around buildings.
  - .3 The establishment of fire safety plans.
  - .4 Fire safety at construction and demolition sites.

.2 Welding and cutting:
- .1 Before welding, soldering, grinding and/or cutting work, obtain a hot work permit in compliance with IVFC 2015, and obtain approval by the Departmental Representative before usage. Store flammable liquids in approved CSA containers.
- .2 At least one week prior to commencing cutting, welding or soldering procedure, provide to Departmental Representative:
  - .1 Notice of intent, indicating devices affected, time and duration of isolation or bypass.

.2 Completed welding permit as defined in NFC.
.3 Return welding permit to Departmental Representative immediately upon completion of procedures for which permit was issued.

.3 "Fire Watchers" as described in NFC shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 15 m may be ignited by conduction or radiation.

.4 Where work requires interruption or cause activation of fire alarms or fire suppression, extinguishing or protection systems:
.1 Provide "Watchman Service" as described in NFC; In general, watchman service is defined as an individual conversant with "Fire Emergency Procedures", performing fire picket duty within an unprotected and unoccupied (no workers) area once per hour.
.2 Retain services of manufacturer for fire protection systems on daily basis or as approved by Departmental Representative, to isolate and protect all devices relating to:
.1 Modification of fire alarms, fire suppression, extinguishing or protection systems; and/or
.2 Cutting, welding, soldering or other construction activities that might activate fire protection systems.
.3 Immediately upon completion of work, restore fire protection systems to normal operation and verify that all devices are fully operational.
.4 Inform fire alarm system monitoring agency and local Fire Department immediately prior to isolation and immediately upon restoration of normal operation.

1.6 FIELD QUALITY CONTROL

.1 Carry out Work using qualified licenced workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.

.2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licenced workers.

.3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

1.7 HAZARDOUS MATERIALS

.1 Comply with the requirements of the Ontario Regulation 860, Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Material Safety Data Sheets (MSDS).

.2 For work in occupied buildings give the Departmental Representative 1 week notice for work involving designated substances (Ontario Bill 208) and before painting.

1.8 REMOVED MATERIALS

.1 Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from site.

1.9 PROTECTION

.1 Protect finished work against damage until take-over.

.2 Protect adjacent work against the spread of dust and dirt beyond the work areas.

.3 Protect operatives of site from all hazards.

1.10 USE OF SITE AND FACILITIES

.1 Refer to Section 01 14 00 - Work Restrictions.

1.11 SITE STORAGE

.1 Do not unreasonably encumber site with materials or equipment.

.2 Move stored products or equipment which interfere with operations of occupants.

1.12 CUT, PATCH AND MAKE GOOD

.1 Cut existing surfaces as required to accommodate new work.

.2 Remove all items so shown or specified.

.3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval.

.4 Prior to trenching/excavation/cutting of floor slabs or coring into floor slabs, provide Departmental Representative with written proof that the area has been scanned for any type of buried service.

.5 Refer to Section 01 14 00 - Work Restrictions.

1.13 EXAMINATION

.1 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions.

.2 Provide photographs of surrounding properties excluding aircrafts and security components, objects and structures liable to be damaged or be the subject of subsequent claims.

1.14 SIGNS

.1 Provide common-use signs related to traffic control, information, instruction, use of equipment, public safety devices, etcetera, in both official languages or by the use of commonly-understood graphic symbols to the Departmental Representative's approval.

.2 Signs must comply with CAN/CSA Z321. Symbols size to be 200 mm for a viewing distance of 24 to 30 metres.

.3 No advertising will be permitted on this project.

1.15 ACCESS AND EGRESS

.1 Refer to Section 01 14 00 - Work Restrictions.

1.16 SCAFFOLDS AND WORK PLATFORMS

.1 Design, install, and inspect scaffolds and work platforms required for work in accordance with relevant municipal, provincial and other regulations.

.2 Provide design drawings, signed and sealed by qualified Professional Engineer licensed in the province of Ontario.

.3 Additions or modifications to scaffolding must be approved by Professional Engineer in writing.

1.17 WASTE MANAGEMENT

.1 Comply with the Environmental Protection Act, Ontario Regulations O.Reg. 102/94 and O. Reg. 103/94 for waste management program on construction and demolition projects.

.2 Facility waste bins shall not be used by contractors. Waste shall be disposed of off site.

1.18 RECORDS

.1 As work progresses, maintain accurate records to show deviations from contract drawings. Just prior to Departmental Representative's inspection for issuance of final certificate of completion, supply to the Departmental Representative one (1) set of white prints with all deviations neatly inked in. The Departmental Representative will provide two sets of clean white prints for this purpose.

1.19 GUARANTEES AND WARRANTIES

.1 Before completion of work collect all manufacturer's guarantees and warranties and deposit with Departmental Representative.

1.20 CLEAN UP

.1 Clean up work area as work progresses. At the end of each work period, and more often if ordered by the Departmental Representative, remove debris from site, neatly stack material for use, and clean up generally.

.2 Upon completion remove scaffolding, temporary protection and surplus materials. Make good defects noted at this stage.

.3 Clean areas under contract to a condition at least equal to that previously existing and to approval of Departmental Representative.

1.21 SECURITY

.1 Departmental Representative shall initially provide Contractor with security badges and escorts. Contractor must have all personnelcleared with reliability level security, anticipated 60-90 days to clear an individual to reliability level.

.2 Personnel will be checked daily at start of work shift and given a pass which must be worn at all times. Pass must be returned atend of work shift and personnel checked out.

1.22 BUILDING SMOKING ENVIRONMENT

.1 Smoking is not permitted in the Building. Obey smoking restrictions on building property.

1.23 DUST CONTROL

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work and public.

.2 Maintain and relocate protection until such work is complete.

.3 All temporary enclosures/dust protection shall be installed meeting National Fire Code of Canada, 5.6.1.2.

1.24 SCHEDULING

.1 Refer to section 01 32 16.19 - Construction Progress Schedule - Barr.

.2 Carry out work as indicated in work restrictions.

1.25 PRECEDENCE

.1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Divisions 03, 05, 06, 07, 08, 09, 21, 22, 23, 25, 26, 28 & 33.

1.2 SPECIAL REQUIREMENTS

.1 Construction shall adhere to project phasing plan. Draft project phasing plan provided as guideline, contractor's final phasing plan shall be coordinated with Construction schedule and approved by Departmental Representative.

.2 Submit schedule in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.

.3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.4 Keep within limits of work and avenues of ingress and egress.

.5 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative.

.6 No work shall be carried out above or around aircraft without having installed adequate physical barriers, or alternatively, until arrangements have been made to move aircraft.

.7 Regular Hours of work shall be 7 AM to 11:30 PM, Monday to Friday. Loud or dust generating work shall be after hours,11:30 PM to 7 AM, Monday to Friday, or after hours weekends, 4 PM to 7 AM, Saturday and Sunday. Fire alarm replacement work shall be after hours Monday to Friday, 11:30 PM to 7 AM, and after hours weekends, 4 PM to 7 AM, Saturday and Sunday.

.8 Refer to tender bid forms for construction start and end dates, and total weeks of construction.

1.3 SECURITY

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

.2 Security clearances:
- .1 Personnel employed on this project will be subject to security check. Obtain clearance for each individual who will require to enter premises.
- .2 Obtain requisite clearance for each individual required to enter premises.
- .3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

.3 Security escort:
- .1 Personnel employed on this project must be escorted when executing work in non-public areas during normal working hours. Personnel must be escorted in all areas after normal working hours.
- .2 Submit an escort request to Departmental Representative at least 14 days before service is needed. For requests submitted within time noted above, costs of security escort will be paid for by Departmental Representative. Cost incurred by late request will be Contractor's responsibility.

.3 Any escort request may be cancelled free of charge if notification of cancellation is given at least 4 hours before scheduled time of escort. Cost incurred by late request will be Contractor's responsibility.

.4 Calculation of costs will be based on average hourly rate of security officer for minimum of 8 hours per day for late service request and of 4 hours for late cancellations.

1.4 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions.

1.5 ACCESS AND EGRESS

.1 Refer to section 01 32 16.19 - Construction Progress Schedule for access to site notice requirements.

.2 Design, construct and maintain temporary construction fencing work areas, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

.3 The contractor shall agree to install proper site separation and identification in order to maintain "Time and Space" at all times throughout the life of the project. When building operations staff, building staff or private sector maintenance personal require access to operational equipment located in the construction area in order to operate the building, access shall be granted and proper coordination and communication must exist between all parties involved.

1.6 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to the normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Sanitary facilities will not be provided for Contractors personnel due to COVID-19 restrictions. Provide separate outdoor sanitary facilities for use by contractor personnel.

.4 Use of building electricity is permitted. Contractor shall provide temporary panels, breakers, wiring, connections,Inspections, permits, and all coordination with Departmental Representative for connection to existing building electricity.

.5 Use of existing building water is permitted. Contractor shall provide temporary connections, protection of supply,and all coordination with Departmental Representative for connection to existing building water supply.

1.7 EQUIPMENT REQUIREMENTS FOR WORK INSIDE OF BUILDING (HANGAR)

.1 No equipment with combustion engine shall be permitted to be used inside of building (hangar), unless an industrial Hygienist or similarly qualified company prepares an alternate method of construction, and the alternate method is approved by Departmental Representative.

.2 No particulate products of combustion shall be emitted into the building (hangar).

.3 No diesel scrubbers will be accepted as an alternative to the above requirements.

.4 Propane and Electric powered equipment shall be acceptable.

.5 Only rubber treaded/tracked equipment will be allowed inside of building (hangar).

.6 Cutting and coring shall be performed with water to reduce to a minimum generation of airborne particulate and dust.

.7 Any equipment generating heavy vibrations shall be coordinated with Departmental Representative and construction schedule to protect sensitive flight equipment and instrumentation stored in adjacent areas of the building.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1. GENERAL

1.1 REFERENCES

1. *Federal Legislation*
    1. *Canada Labour Code, Part II, section 124 and 125.*
        1. *Canada Occupational Health and Safety Regulations*
    2. *Transportation of Dangerous Goods Act, 1992 (TDGA)*
    3. *PSPC Asbestos Management Standard*
    4. *Canada Consumer Product Safety Act*
        1. *Surface Coating Materials Regulations SOR/2016-193.*
    5. *Canadian Environmental Protection Act, 1999 (CEPA)*
        1. *PCB Regulations (SOR/2008-273)*
        2. *Federal Halocarbon Regulations, 2003 (SOR/2003-289)*
2. *Provincial Legislation*
    1. *Ontario Occupational Health and Safety Act, R.S.O. 1990.*
        1. *Ontario Regulation 490/09 – Designated Substances (O.Reg. 490/09).*
        2. *Ontario Regulation 278/05 – Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations (O.Reg. 278/05).*
        3. *Ontario Regulation 213/91 for Construction Projects (O.Reg. 213/91)*
    2. *Ontario Environmental Protection Act, R.R.O. 1990.*
        1. *Ontario Regulation 347/90, General – Waste Management (O.Reg. 347/90).*
        2. *Ontario Regulation 463/10, Ozone Depleting Substances and Other Halocarbons (O.Reg. 463/10).*
    3. *Ontario Dangerous Goods Transportation Act.*
3. *Canadian General Standards Board (CGSB).*
4. *Canadian Standards Association (CSA International). Selection, Use, and Care of Respirators*
5. *Underwriters' Laboratories of Canada (ULC).*

1.2 DEFINITIONS

Asbestos-Containing Materials (ACMs): means material that contains 0.5 per cent or more asbestos by dry weight as per *Ontario Regulation 278/05*.

Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

Time-weighted average exposure limit (TWAEL): the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week as prescribed by *Ontario Regulation 490/09 Designated Substances*, as amended.

1.3 DESIGNATED SUBSTANCES

Confirm with the Departmental Representative that no additional designated substances have been brought to the project area prior to beginning work.

Additional designated substances and hazardous materials may exist outside the accessible survey areas but are beyond the scope of this project.

Should any additional material, suspected to be a designated substance, be encountered within the project area, any disturbance of such material must be stopped, precautionary measures taken, and the Departmental Representative must be notified immediately. Do not proceed until written instructions have been received.

1. ACRYLONITRILE: Not Identified
2. ARSENIC: Not Identified
3. ASBESTOS: Not Identified

Based on past reports[1] and a DSR Specification provided by Project Managers and RPS, the following materials are asbestos containing;

- Corrugated Transite hangar ceiling panels (assumed to contain asbestos) were observed in good condition in the Fixed Wing Hangar only. No visible and accessible transite panels were observed in any other project areas.
- Non-friable white caulking, applied to the edges of the walls of the Squadron 412 Building that abut the east wall of the main T-58 Building, contains 2% Chrysotile asbestos. There is approximately 20 linear metres of this caulking, in good condition.

Based on past reports and recent sampling, the following materials were found to be non-asbestos containing;

- Drywall joint compound,
- Clear (translucent) caulking,
- Grey caulking, and
- Fire proofing on hanger ceiling.

The old pump house (G108) was inspected and piping was found to be insulated with fibreglass.

Asbestos containing materials are not anticipated to be impacted by project activities.

4. BENZENE: Not Identified
5. COKE OVEN EMISSIONS: Not identified
6. ETHYLENE OXIDE: Not Identified
7. ISOCYANATES: Not Identified

8. LEAD: **Identified**

Work shop floor paint/sealant (442ppm) was found to be above the 90ppm limit for lead, as per Surface Coating Materials Regulations, SOR/2016-193 and is therefore considered lead containing.

Lead is assumed to be present in solder on the joints of copper piping and joint packings of drainpipes.

9. MERCURY: **Identified**

Mercury is assumed to be present in fluorescent light tubes.

10. VINYL CHLORIDE MONOMER: Not Identified

11. POLYCHLORINATED BIPHENYLS (PCBs): **Assumed**

Possible PCB containing fluorescent light fixtures were observed.

1.4 RECOMMENDATIONS

1. ASBESTOS
2. LEAD
    1. Follow recommendations provided in the Ontario Ministry of Labour (MoL) Guideline entitled “Guideline: Lead on Construction Projects”. This guideline classifies all lead disturbances as Type 1, Type 2a, Type 2b, Type 3a or Type 3b work, and assigns different levels of respiratory protection and work procedures for each classification.
    2. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne lead levels that exceed the TWAEL of 0.05 milligram per cubic metre (mg/m^3) prescribed by *O.Reg. 490/09.*
    3. Disposal of construction waste containing lead must be done in accordance with *O.Reg. 347/90 – General Waste Management, as amended*, under the *Ontario Environmental Protection Act, the Ontario Dangerous Good Transportation Act, and the federal Transportation of Dangerous Goods Act*. The classification of the waste is dependent upon the result(s) of leachate test(s). The waste can be classified as “hazardous, “non-hazardous” or “registerable solid waste” depending on the results of the leachate test.
3. SILICA
    1. Comply with *Ontario Regulations O.Reg. 490/09* when performing work that may disturb silica-containing materials.
    2. Silica dust can be generated through such processes as sanding, blasting, grinding, crushing, and sandblasting silica-containing material. Since silica is present in select materials

within the project area, appropriate respiratory protection and ventilation must be used during work.

3. Follow recommendations provided in the MoL Guideline entitled "Guideline: Silica on Construction Projects". This document classifies all silica disturbances as Type 1, Type 2 or Type 3 work, and assigns different levels of respiratory protection and work procedures for each classification. These work procedures should be followed when performing work involving the disturbance of silica-containing materials.

3. Mercury

Mercury containing fluorescent light tubes should be kept intact during removal, handling, sorting, and storage in accordance with O. Reg 490/09.

Waste containing mercury must be managed in compliance with General – Waste Management, RRO 1990, Reg 347.

4. PCBs

Should any light or lamp ballast suspected of containing PCBs be encountered during this project, please refer to the Environment Canada Identification of Lamp Ballasts Containing PCBs, August 1991 report, for assistance with PCB identification. If PCB-containing equipment is identified and must be removed, it should be disposed of in accordance with PCB Regulations, SOR/2008-273, the provincial regulation have jurisdiction and must be shipped in accordance with Dangerous Goods Transportation Act, RSO 1990, c D.1.

2. PRODUCTS

Not used

3. EXECUTION

Not used

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Divisions 02, 03, 05, 06, 07, 08, 09, 21, 22, 23, 25, 26, 28,31, 32 & 33.

1.2 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and, Departmental Representative.

.8 Representative of Contractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include:
- .1 Appointment of official representative of participants in the Work.
- .2 Schedule of Work: in accordance with 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.
- .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .5 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .6 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.7 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
.8 Monthly progress claims, administrative procedures, photographs, hold backs.
.9 Appointment of inspection and testing agencies or firms.
.10 Insurances, transcript of policies.
.11 Health and Safety.

1.4 PROGRESS MEETINGS

.1 During course of Work and 4 weeks prior to project completion, schedule progress meetings bi-weekly.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.

.3 Notify parties minimum 14 days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

.5 Agenda to include the following:
.1 Review, approval of minutes of previous meeting.
.2 Review of Work progress since previous meeting.
.3 Field observations, problems, conflicts.
.4 Problems which impede construction schedule.
.5 Review of off-site fabrication delivery schedules.
.6 Corrective measures and procedures to regain projected schedule.
.7 Revision to construction schedule.
.8 Progress schedule, during succeeding work period.
.9 Review submittal schedules: expedite as required.
.10 Maintenance of quality standards.
.11 Review proposed changes for affect on construction schedule and on completion date.
.12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Divisions 03, 05, 06, 07, 08, 09, 23, 25, 26, 28 & 33.

1.2 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.3 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit to Departmental Representative within 10 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.5 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Departmental Representative will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
- .1 Award.
- .2 Shop Drawings, Samples.
- .3 Permits.
- .4 Mobilization.
- .5 Excavation.
- .6 Backfill.
- .7 Building footings.
- .8 Slab on grade.
- .9 Structural Steel.
- .10 Siding and Roofing.
- .11 Interior Architecture (Walls, Floors and Ceiling).
- .12 Plumbing.
- .13 Lighting.
- .14 Electrical.
- .15 Piping.
- .16 Controls.
- .17 Heating, Ventilating, and Air Conditioning.
- .18 Millwork.
- .19 Fire Systems.
- .20 Testing and Commissioning.
- .21 Supplied equipment long delivery items.

.3 Contractor's proposed schedule based on project phasing and work restriction draft plans shall be submit to Departmental Representative for approval.

.4 Changes to Schedule and Notice:
- .1 Changes to Approved Schedule - minimum 3 weeks notice.

.2 Electrical shut downs - minimum 3 weeks notice.
.3 Other shut downs - minimum 1 week notice.
.4 Site Access - minimum 48 hours notice.

1.7 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 10 days for Departmental Representative's review of each submission.

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, 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 include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Contractor.
  - .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 Representative's review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within 3 years of date of contract award for project.

.13 Submit electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
  .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.18 Delete information not applicable to project.

.19 Supplement standard information to provide details applicable to project.

.20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copy 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.

.21 The review of shop drawings by Departmental Represenative is for sole purpose of ascertaining conformance with general concept.
  .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
  .2 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 sub-trades.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Province of Ontario
  .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.0.1, as amended and O. Reg. 213/91 as amended - Current edition.

.2 Canadian Standards Association (CSA)
  .1 CAN/CSA Z460-13 (R2018), Control of Hazardous Energy - Lockout and Other Methods.
  .2 CSA Z462-18, Workplace Electrical Safety.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  .1 Results of site specific safety hazard assessment.
  .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit three (3) copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.

.4 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.5 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

.6 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.7 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

.8 The constructor shall advise the Departmental Representative of any accident, injury, near-miss incident, fire, explosion or Chemical spill occurring at the Work site and any visit to the site by a governmental enforcement official. The constructor shall provide a written report within 24 hours of any accident, injury, near-miss incident, fire, explosion or chemical spill. Submit copies of incident and accident reports.

.9 Submit to the Departmental Representative for review, one complete Hazard Assessment Site Specific Health and Safety Plan (HASSSP) in an indexed format, and in a three ring binder. Once the Departmental Representative has reviewed and accepts the HASSSP binder the Departmental Representative will return to contractor for site use. HASSSP shall include COVID-19 Safety Plan.

.10 Contractor shall provide fire safety plan to departmental representative for review with main fire safety plan, and sign off.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

.2 Contractor shall be responsible for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award.

.3 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

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

1.6 GENERAL REQUIREMENTS

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

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

1.7 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

.3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.4 Ensure the site supervisor is an employee of the constructor and that this person is present and available at all-times throughout the life of the project.

1.8 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.

.2 Comply with the Health and Safety requirements of CSA Z462.

.3 Comply with the Health and Safety requirements of CAN/CSA Z460.

1.9 UNFORESEEN HAZARDS

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

.2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety co-ordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.10 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
- .1 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
- .2 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

1.11 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction.

1.12 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

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

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.13 WORK STOPPAGE

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

1.14 DIESEL POWERED EQUIPMENT

.1 Contractor may not use any diesel fired powered equipment such as scissor lifts on the site.

1.15 POWER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Divisions 03, 05, 06, 07, 08, 09, 21, 22, 23, 25, 26, 28 & 33.

1.2 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)
  .1 CCDC 2-94, Stipulated Price Contract.

1.3 INSPECTION

.1 Refer to CCDC 2, GC 2.3.

1.4 PROCEDURES

.1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REJECTED WORK

.1 Refer to CCDC, GC 2.4.

.2 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.

.3 Make good other Contractor's work damaged by such removals or replacements promptly.

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

1.6 REPORTS

.1 Submit 4 copies of inspection and test reports to Departmental Representative.

.2 Provide copies to contractor of work being inspected or tested.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

1.8 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

.2 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.

1.9 MILL TESTS

.1 Submit mill test certificates as requested.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 National Research Council of Canada (NRCC)
  .1 National Fire Code of Canada 2015.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 ACCESS TO SITE

.1 Provide and maintain access as required for access to Work.

1.4 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation 1 week prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

.5 Use fire retardant screens and covers meeting National Fire Code 5.6.1.2.

1.5 ACCESS ACROSS NEW OPEN EFFLUENT DRAIN TRENCHES

.1 Provide steel plates of adequate quantity and thickness across new open effluent drain trenches during construction to accommodate equipment traffic to and from hangar, snow removal equipment to access air side hangar site, and to maintain occupant access to and from facility. Steel plate thickness shall be verified by a Professional Engineer licensed to practice in the Province of Ontario. Coordinate layout with work draft working phasing plan, and submit to Departmental Representative for approval.

1.6 CONSTRUCTION FENCING AND BARRIERS

.1 Refer to Section 01 14 00 - Work Restrictions.

.2 Construction fencing and barriers shall be provided at the perimeter of each construction phase, as per draft work restrictions, and revised accordingly throughout construction to suit project phasing boundaries. Final construction fencing layouts shall be as per final work phasing plans prepared by Contractor, and approved by Departmental Representative.

.3 At boundary of each phase of construction outside of the hangar (airside), Provide 2,133 mm high (7 ft) steel construction fence with lockable openings and gates as required to accommodate work and work restrictions, including but not limited to, snow removal equipment and access to and from building .

.4 At boundary of each phase of construction within the hangar (airside and groundside), provide 2,133 mm high (7 ft.) steel construction fence with lockable openings and gates as required to accommodate work and work restrictions, 2,133 mm high (7 ft.) opaque visual barrier, and, on construction side of fencing, additional tarp/fabric/or poly vapour barrier carrying a 15 minute fire rating, taped to floor slab and extending at least as high as steel construction fencing to contain sparks and limit spread of dust and debris.

.5 Perimeter employee pathway at internal boundary of construction fencing: contractor shall organize and provide controlled access to halt work, make safe construction perimeter pathway, and escort staff along the pathway to their destination. Access to existing interior and exterior building openings, such as doorways and stairs shall be maintained for employee access where possible. Any blocked access shall be coordinated with contractor phasing plan, and construction schedule and approved by departmental representative.

.6 Contractor shall provide a covered and enclosed employee pathway to and from existing East building addition to allow unhindered employee access to building addition during construction period.

.7 A means to lock and secure all construction barriers, gates, and fencing shall be provided.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Divisions 03, 05, 06, 07, 08, 09, 21, 22, 23, 25, 26, 28 & 33.

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only remove from site.

.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 marked separate bins for recycling.

.7 Dispose of waste materials and debris at designated dumping areas on Crown property, off site.

.8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 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 other.

.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.

.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.

.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.18 Clean roofs, downspouts, and drainage systems.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Foam Discharge Testing, Effluent and Foam Concentrate:

- .1 Upon completion of foam discharge testing, clean-up and disposal of foam effluent and (or) foam concentrate shall be performed by an EPA certified cleaning contractor.
- .2 Provide anti-foaming agent as required to speed up cleaning to suit construction schedule.
- .3 Provide EPA certified clean-up and disposal services as many times as required to suit final phased construction schedule approved by departmental representative.
- .4 Clean up shall include all areas in and outside of Hangar T-58, above and below grade, that has come in contact with foam effluent during acceptance testing, or at any time throughout the construction period. Clean up shall also include interior of below grade exterior effluent tank, drains and vents to and from exterior effluent tank, and any effluent that has leaked beyond the limit of discharge testing containment tarping, or any other spillage of effluent or foam concentrate.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Environmental Protection Act (CEPA)
  .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:
  .1 Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative to:
    .1 Verify Project requirements.
    .2 Review manufacturer's installation instructions and warranty
  .2 Departmental Representative to establish communication procedures for:
    .1 Notifying construction warranty defects.
    .2 Determine priorities for type of defects.
    .3 Determine reasonable response time.
  .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
  .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.3 Provide evidence, if requested, for type, source and quality of products supplied.

.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 and French, and electronic copy.

1.4 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings.
  .1 Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.
.1 Bind in with text; fold larger drawings to size of text pages.

1.5 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;
.1 Date of submission; names.
.2 Addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties.
.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:
.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

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

1.6 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.
.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.
.1 Do not use record documents for construction purposes.

.5 Keep record documents available for inspection by Departmental Representative.

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress.
- .1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.
- .7 Referenced Standards to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:
- .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
- .2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, required by individual specifications sections.

.7 Provide digital photos, if requested, for site records.

1.8 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.
- .1 Give function, normal operation characteristics and limiting conditions.
- .2 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.
- .1 Include regulation, control, stopping, shut-down, and emergency instructions.
- .2 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 co-ordination 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.

1.9 MAINTENANCE MATERIALS

.1 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 items.
  - .1 Submit inventory listing to Departmental Representative.
  - .2 Include approved listings in Maintenance Manual.

.2 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 items.
  - .1 Submit inventory listing to Departmental Representative.
  - .2 Include approved listings in Maintenance Manual.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.11 WARRANTIES

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.

.3 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.4 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
- .1 Separate each warranty with index tab sheets keyed to Table of Contents listing.
- .2 List ontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form and contain full information.
- .5 Co-execute submittals when required.
- .6 Retain warranties until time specified for submittal.

.5 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.6 Include information contained in warranty management plan as follows:
- .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
- .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
  - .1 Name of item.
  - .2 Model and serial numbers.
  - .3 Location where installed.
  - .4 Name and phone numbers of manufacturers or suppliers.
  - .5 Names, addresses and telephone numbers of sources of spare parts.
  - .6 Cross-reference to warranty certificates as applicable.
  - .7 Summary of maintenance procedures required to continue warranty in force.
  - .8 Cross-Reference to specific pertinent Operation and Maintenance manuals.
  - .9 Organization, names and phone numbers of persons to call for warranty service.
  - .10 Typical response time and repair time expected for various warranted equipment.
- .3 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.7 Respond in timely manner to oral or written notification of required construction warranty repair work.

.8 Written verification to follow oral instructions.
- .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.

.2 Departmental Representative: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.

.3 Preparation:
- .1 Verify conditions for demonstration and instructions comply with requirements.
- .2 Verify designated personnel are present.
- .3 Ensure equipment has been inspected and put into operation.
- .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.

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

.5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows:
- .1 2 x 3 hour sessions for each official language (French and English), or 4 x 3 hour sessions for one official language, as directed by Departmental Representative.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Give time and date of each demonstration, with list of persons present.

.5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

.1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
- .1 Instruct Departmental Representative.
- .2 Provide written report that demonstration and instructions have been completed.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
  .1 This Section specifies roles and responsibilities of Commissioning Training.

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Departmental Representative will provide:
  .1 Descriptions of systems.
  .2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
  .1 Start-Up, operation, shut-down of equipment, components and systems.
  .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
  .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:
  .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

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

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:
  .1 "As-Built" Contract Documents.
  .2 Operating Manual.

.3 Maintenance Manual.

.3 Project Manager, Commissioning Manager and Property Manager will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:
- .1 Transparencies for overhead projectors.
- .2 Multimedia presentations.
- .3 Manufacturer's training videos.
- .4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be 3 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:
- .1 Implementation of training activities,
- .2 Coordination among instructors,
- .3 Quality of training, training materials,

.2 Departmental Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

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

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

1.9 VIDEO-BASED TRAINING

.1 Manufacturer's videotapes to be used as training tool with Departmental Representative's review and written approval 1 month prior to commencement of scheduled training.

.2 On-Site training videos:
- .1 Videotape training sessions for use during future training.
- .2 To be performed after systems are fully commissioned.
- .3 Organize into several short modules to permit incorporation of changes.

.3 Production methods to be high quality.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Related Requirements
- .1 Divisions 03, 05, 06, 07, 08, 09, 21, 22, 23, 25, 26, 28 & 33.

.3 Acronyms:
- .1 AFD - Alternate Forms of Delivery, service provider.
- .2 BMM - Building Management Manual.
- .3 Cx - Commissioning.
- .4 O&M - Operation and Maintenance.
- .5 PI - Product Information.
- .6 PV - Performance Verification.
- .7 TAB - Testing, Adjusting and Balancing.

1.2 REFERENCE STANDARDS

.1 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 409, Standard on Aircraft Hangars, 2016 Edition.

.2 Underwriters' Laboratories of Canada (ULC)
- .1 CAN-ULC-S1001-11-R2018, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.3 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
- .1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.
- .2 Ensure appropriate documentation is compiled into the BMM.
- .3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
- .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
- .2 During these checks, adjustments to be made to enhance performance to meet environmental requirements.

.3 Design Criteria: as per Departmental Representative's requirements or determined by designer. To meet Project functional and operational requirements.

.4 Integrated Systems Testing of Fire Protection Life Safety Systems:
- .1 All fire protection and life safety systems shall be tested to CAN-ULC-S1001 and NFPA (Fire) 409.
  - .1 Extent of Testing:
    - .1 Diesel Fire Pumps
    - .2 Wet Sprinkler Systems
    - .3 High Expansion, Low Level Foam Fire Suppression System
    - .4 Sump Pumps within Hangar Effluent Drainage System
    - .5 Fire Alarm System
    - .6 AFFF hand hose system
- .2 The integrated testing coordinator shall be knoweldgeable and experience the design,installation and operation of fire protection and life safety systems, and the fire protection and life safety functions of building systems.
- .3 The integrated testing coordinator shall have knowledge and understanding of:
  - .1 The codes and standards that regulate the design and installation of fire protection and life safety systems.
  - .2 How individual and integrated fire protection and life safety systems are designed to operate during normal operating conditions and emergency conditions; and,
  - .3 Methods of validating the intended functionality of integrated fire protection and life safety systems.
- .4 The integrated testing coordinator shall have all licenses and certificates if required by;
  - .1 Federal, Provincial, Territorial, or other applicable regulations and/or contractual obligations.
- .5 Integrated Systems Testing Planning Phase;
  - .1 During this phase of the project the design professional shall provide documentation detailing each interconnection between fire protection and life safety systems to the Integrated Testing Coordinator to prepare the integrated test plan. Such documentation shall include, but not be limited to:
    - .1 Building Floor Plans;
    - .2 Fire Protection and Life Safety System design documentation (drawing and specifications),including;
      - .1 Sequence descriptions (showing coordination between Mechanical and Electrical systems), and,
      - .2 Mechanical and Electrical riser diagrams.
    - .3 Manufacturer's operation and testing instructions, as requested by the Integrated Testing Coordinator; and,
    - .4 Documentation of any alternative solutions and/or deviations from the requirements of codes and standards.
- .6 Roles and Responsibilities of the Integrated Systems Testing Coordinator.
  - .1 The Integrated testing coordinator shall prepare an integrated testing plan for the testing of Integrated Fire Protection and Life Safety Systems.
  - .2 The Integrated testing plan shall consist of a report outlining the following:
    - .1 The functional objectives of system integrations;
    - .2 The sequence of operation of Integrated Fire Protection and Life Safety Systems which;
      - .1 Describe operation under normal operating conditions, and,
      - .2 Describe operation and under fire conditions.
    - .3 Test protocol and procedures for Integrated Fire Protection and Life Safety Systems; and
    - .4 A procedure for notifying building occupants of Integrated System Testing; and
    - .5 Alternate measure, such as notification and safety protocols, for ensuring occupant safety during integrated systems testing.

1.4 COMMISSIONING OVERVIEW

.1 Section 01 91 13.13 - Commissioning Plan.

.2 For Cx responsibilities refer to Section 01 91 13.13 - Commissioning Plan.

.3 Cx to be a line item of Contractor's cost breakdown.

.4 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the system is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.6 Departmental Representative will issue Interim Acceptance Certificate when:
- .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
- .2 Equipment, components and systems have been commissioned.
- .3 O&M training has been completed.

.7 Contractor shall hire an independent 3rd party Cx Agent with experience in life safety systems to manage contractor Cx responsibilities.

1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.6 PRE-CX REVIEW

.1 Before Construction:
- .1 Review Contract Documents, confirm by writing to Departmental Representative.
  - .1 Adequacy of provisions for Cx.
  - .2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:
- .1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:
- .1 Provide comments on Cx plan.
- .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
- .3 Fully understand Cx requirements and procedures.
- .4 Have Cx documentation shelf-ready.
- .5 Understand completely design criteria and intent and special features.
- .6 Submit complete start-up documentation to Departmental Representative.
- .7 Have Cx schedules up-to-date.
- .8 Ensure "As-Built" system schematics are available.
- .9 Submit manufacturer PI and PV forms for Departmental Representative review with draft PI and PV forms.

.10 Provide detailed Cx schedule for review and approval by Departmental Representative.
.11 Submit draft training plan for review and approval by Departmental Representative.

.4 Inform Departmental Representative of discrepancies and deficiencies on finished works.

1.7 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

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

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
.1 Submit no later than 4 weeks after award of Contract:
.1 Name of Contractor's Cx agent.
.2 Draft Cx documentation.
.3 Preliminary Cx schedule.
.2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.
.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.9 COMMISSIONING DOCUMENTATION

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

.2 Departmental Representative to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Departmental Representative.

1.10 COMMISSIONING SCHEDULE

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

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

1.11 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart and as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage. Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
- .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
- .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Contractor, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.12 STARTING AND TESTING

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

1.13 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.14 MANUFACTURER'S INVOLVEMENT

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

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.
  .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
  .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:
  .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
  .2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:
  .1 Experienced in design, installation and operation of equipment and systems.
  .2 Ability to interpret test results accurately.
  .3 To report results in clear, concise, logical manner.

1.15 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:
  .1 Included in delivery and installation:
    .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
    .2 Visual inspection of quality of installation.
  .2 Start-up: follow accepted start-up procedures.
  .3 Operational testing: document equipment performance.
  .4 System PV: include repetition of tests after correcting deficiencies.
  .5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
  .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
  .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
  .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
    .1 Rejected equipment to be remove from site and replace with new.
    .2 Subject new equipment/systems to specified start-up procedures.

1.16 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.

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

1.17 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.18 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.19 START OF COMMISSIONING

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

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.20 INSTRUMENTS /EQUIPMENT

.1 Submit to Departmental Representative for review and approval:
- .1 Complete list of instruments proposed to be used.
- .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:
- .1 2-way radios.
- .2 Ladders.
- .3 Equipment as required to complete work.

1.21 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:
- .1 Under accepted simulated operating conditions, over entire operating range, in all modes.
- .2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.22 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.23 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.24 EXTENT OF VERIFICATION

.1 Elsewhere:
- .1 Provide manpower and instrumentation to verify up to 100 of reported results, unless specified otherwise in other sections.

.2 Number and location to be at discretion of Departmental Representative.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Perform additional commissioning until results are acceptable to Departmental Representative.

1.25 REPEAT VERIFICATIONS

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

1.26 SUNDRY CHECKS AND ADJUSTMENTS

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

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

1.27 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.28 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.29 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.30 TRAINING

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

1.31 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.32 OCCUPANCY

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

1.33 INSTALLED INSTRUMENTATION

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

1.34 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:
  .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.

.2 Instrument accuracy tolerances:
  .1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:
  .1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.35 DEPARTMENTAL REPRESENTATIVE'S PERFORMANCE TESTING

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 REFERENCE STANDARDS

.1 American Water Works Association (AWWA)

.2 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 3, Standard for commissioning of Fire Protection Life Safety Systems.
- .2 NFPA (Fire) 4, Standard for Integrated Fire Protection and Life Safety Testung, 2018 Edition.
- .3 NFPA (Fire) 11, Standard for Low-, Medium-, and High-Expansion Foam, 2015 Edition.
- .4 NFPA (Fire) 13, Automatic Sprinkler Systems Handbook, 2019 Edition.
- .5 NFPA (Fire) 20, Standard for the Installation of Stationary Fire Pumps for Fire Protection, 2019 Edition.
- .6 NFPA (Fire) 409, Standard on Aircraft Hangars, 2016 Edition.

.3 National Research Council of Canada
- .1 NRCC NBCC-2015, National Building Code of Canada.

.4 Public Works and Government Services Canada (PWGSC)
- .1 PWGSC - Commissioning Guidelines CP.3. Guide to the development of the Commissioning Plan.

.5 Underwriters' Laboratories of Canada (ULC)
- .1 CAN-ULC-S1001-11-R2018, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.3 GENERAL

.1 Provide a fully functional System:
- .1 Systems, equipment and components meet functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
- .2 O&M personnel have been fully trained in aspects of installed systems.
- .3 Optimized life cycle costs.
- .4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:
- .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
- .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
- .3 Sets out deliverables relating to O&M, process and administration of Cx.
- .4 Describes process of verification of how built works meet design requirements.
- .5 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.

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

.5 Commissioning terms used in this Section:
- .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
- .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan.

.2 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.

.3 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.5 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.2 Departmental Representative 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 Departmental Representative ensures Cx activities are carried out to ensure delivery of a fully operational project including:
  - .1 Review of Cx documentation from operational perspective.
  - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
  - .3 Protection of health, safety and comfort of occupants and O&M personnel.
  - .4 Monitoring of Cx activities, training, development of Cx documentation.
  - .5 Work closely with members of Cx Team.
- .3 Departmental Representative:
  - .1 Organizing Cx.
  - .2 Monitoring operations Cx activities.
  - .3 Witnessing, certifying accuracy of reported results.
  - .4 Witnessing and certifying TAB and other tests.
  - .5 Developing BMM, Cx Plan and draft PI & PV forms.
  - .6 Ensuring implementation of final Cx Plan.
  - .7 Performing verification of performance of installed systems and equipment.
  - .8 Implementation of Training Plan.

.4 Contractor: contractor, subcontractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
  .1 Testing.
  .2 TAB.
  .3 Performance of Cx activities.
  .4 Delivery of training and Cx documentation.
.5 Contractor's Cx agent implements specified Cx activities including:
  .1 Demonstrations.
  .2 Training.
  .3 Testing.
  .4 Preparation, submission of test reports.

1.6 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:
  .1 Installation contractor:
    .1 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
  .1 To include performance verification.

.3 Specialist Cx agency:
  .1 Possessing specialist qualifications and installations providing environments essential to program but are outside scope or expertise of Cx specialists on this project.

.4 Ensure that Cx participant:
  .1 Could complete work within scheduled time frame.

.5 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 1 month prior to starting date of Cx for review and approval.

1.7 EXTENT OF CX

.1 Cx Architectural Systems:
  .1 Architectural:
    .1 Doors, windows, related hardware:
      .1 New door hardware.

.2 Commission mechanical systems and associated equipment:
  .1 Plumbing systems:
    .1 Domestic CWS and HWS.
    .2 Regular sanitary contractor.
    .3 Sump pumps.
    .4 Combination emergency shower/eye wash.
    .5 Trench drains.
  .2 HVAC and exhaust systems:
    .1 Exhaust systems and related systems.
    .2 Unit heaters.
  .3 Fire and life safety systems:
    .1 Special fire suppression systems identified herein:
      .1 Airplane & helicopter hangar foam system.
      .2 Foam hand-hose system.

.2 Diesel fire pumps P-20A, P-20B and P-20C
.3 Wet pipe sprinkler systems.
.4 Standpipe and hose systems.
.5 Fire extinguishers.

.3 Commission DDC BAS Control Systems:
.1 Temperature sensors and HVAC controls.
.2 Motorized dampers.

1.8 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:
.1 Compile English and French documentation.
.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:
.1 Warranties.
.2 Project record documentation.
.3 Inventory of spare parts, special tools and maintenance materials.
.4 Maintenance Management System (MMS) identification system used.
.5 WHMIS information.
.6 WHMIS Safety Data Sheets (SDS).
.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.9 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:
.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:
.1 Cx as used in this section includes:
.1 Cx of components, equipment, systems, subsystems, and integrated systems.
.2 Factory inspections and performance verification tests.

.3 Deliverables: provide:
.1 Cx Specifications.
.2 Startup, pre-Cx activities and documentation for systems, and equipment.
.3 Completed installation checklists (ICL).
.4 Completed product information (PI) report forms.
.5 Completed performance verification (PV) report forms.
.6 Results of Performance Verification Tests and Inspections.
.7 Description of Cx activities and documentation.
.8 Description of Cx of integrated systems and documentation.
.9 Tests of following witnessed by PWGSC Design Quality Review Team:
.1 All systems indicated in Item 1.8, Extent of Cx.
.10 Tests performed.
.11 Training Plans.
.12 Cx Reports.
.13 Prescribed activities during warranty period.

.4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.

.5 Departmental Representative to participate.

1.10 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:
- .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
- .2 Departmental Representative to use approved check lists.
- .3 Departmental Representative will monitor some all of these pre-start-up inspections.
- .4 Include completed documentation with Cx report.
- .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
- .6 Departmental Representative will monitor some of these inspections and tests.
- .7 Include completed documentation in Cx report.

.2 Pre-Cx activities - ARCHITECTURAL:
- .1 Exterior walls: conduct thermographic surveys to ensure appropriate level of tightness after exterior envelope has been completed. Permanent HVAC systems are able to provide appropriate negative or positive pressure, a temperature of at 20 degrees C can be maintained between inside and outside and wind speed is less than 10 kph.
- .2 Doors, windows, related hardware:
  - .1 Door and window hardware.

.3 Pre-Cx activities - MECHANICAL:
- .1 Plumbing systems:
  - .1 "Bump" each item of equipment in its "stand-alone" mode.
  - .2 Complete pre-start-up checks and complete relevant documentation.
  - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
- .2 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.

.4 Pre-Cx activities - LIFE SAFETY SYSTEMS
- .1 Include equipment and systems identified above, and.
  - .1 As per Item 1.8.3, Cx of Fire and Life Safety Sytems..
- .2 Reports of test results to be witnessed and certified by Departmental Representative before verification.

.5 Pre-Cx activities - ELECTRICAL.

1.11 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 Departmental Representative to monitor all of these start-up activities.
.1 Rectify start-up deficiencies to satisfaction of Departmental Representative.

.4 Performance Verification (PV):
.1 Approved Cx Agent to perform.
.1 Repeat when necessary until results are acceptable to Departmental Representative.
.2 Use procedures to suit project requirements.
.3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
.4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.
.5 Departmental Representative reserves right to verify up to 30% of reported results at random.
.6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.12 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.

.2 Departmental Representative to monitor Cx activities.

.3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.

.4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.

.5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.13 INTEGRATED TESTING OF FIRE AND LIFE SAFETY SYSTEMS

.1 General:
.1 This section includes general requirements relating to integrated testing of fire protection and life safety systems, specifying general requirements to verify and document that all interconnections between systems provided for fire protection and life safety functions are installed and operating in conformance with their design criteria.
.2 Where fire protection and life safety systems and systems with fire protection and life safety functions are integrated with each other, they are to be tested as a whole to verify that they have been properly integrated. Integrated testing is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.

.2 Integrated fire and life safety systems include:
.1 Fire alarm system.
.2 Hangar foam and foam hand hose systems.
.3 Fire pumps and controllers.
.4 Water supply.
.5 HVAC and associated systems forming part of integrated HVAC systems.
.6 Emergency generator.
.7 Foam/effluent drainage and collection system.

.3 Integrated test participants:
- .1 Design professional.
- .2 Integrated Test Coordinator.
- .3 Installing and testing contractors.
- .4 Equipment manufacturers.
- .5 Departmental Representative.

.4 Responsibilities:
- .1 Departmental Representative:
  - .1 Develop the design criteria for the integration of the various systems.
    - .1 Departmental Representative to document the integration performance for each system for which they hold design responsibility.
  - .2 Provide documentation to Integrated Test Coordinator detailing each interconnection between fire protection and life safety systems.
  - .3 Review and approve integrated test plan.
  - .4 Notify the Integrated Test Coordinator of changes to the integrated fire protection and life safety systems that impact the integrated test plan.
  - .5 Provide written confirmation that acceptance testing has been conducted and the systems have been installed in accordance with the design and are ready for integrated testing.
  - .6 Participate in the integrated testing, as outlined in the integrated test plan.
  - .7 Where deficiencies and/or failures occur, Departmental Representative to review with Installation Contractors and Verifying Parties, as appropriate and participate in resolution.
- .2 Integrated Test Coordinator:
  - .1 The Integrated Test Coordinator shall be responsible for preparation and implementation of the integrated test plan.
  - .2 Tests of integrations between the systems indicated in 1.14.2 are to be incorporated into the integrated test plan, based on specific configuration and condition of the systems.
  - .3 The integrated test plan shall include the following:
    - .1 Functional objectives of the system integrations.
    - .2 Sequence of operations of the integrated systems.
    - .3 Test protocol and procedures for integrated testing.
    - .4 Procedures for notifying building occupants of integrated testing.
    - .5 Safety protocols.
  - .4 The integrated test plan is to be submitted to the Departmental Representative for approval.
  - .5 Develop integrated testing forms based on the test protocol and procedures.
  - .6 Provide notification to the Departmental Representative and Authority Having Jurisdiction of the integrated systems test.
  - .7 Conduct pre-testing checks.
  - .8 Implement the integrated test plan.
  - .9 Prepare integrated test report and submit to Departmental Representative.
- .3 Contractors:
  - .1 Install the fire protection and life safety systems in accordance with the design drawings and specifications.
  - .2 Provide material and test certificates as required.
  - .3 Participate in the acceptance testing as required by the Departmental Representative, applicable Codes, and referenced Standards.
  - .4 Provide written confirmation that the fire protection and life safety systems have been installed and individually tested and are ready for integrated system testing.
  - .5 Participate in the integrated testing, as outlined in the integrated test plan.
  - .6 Where deficiencies and/or failures occur, installing contractor to review with the Departmental Representative and Verifying Parties, as appropriate, and participate in resolution/correction.

.4 Verifying parties:
- .1 Conduct verification testing of fire protection and life safety systems as required by the applicable Codes and referenced Standards or as required by other Sections that form this specification package.
- .2 Provide written documentation confirming the fire protection and life safety systems have been verified and installed as per the design.
- .3 Participate in the integrated testing, as outlined in the integrated test plan.
- .4 Where deficiencies and/or failures occur, verifying parties to review with the Departmental Representative and Installing Contractors, as appropriate, and participate in resolution/correction.

.5 Equipment manufacturers:
- .1 Provide operating and testing instructions, as requested by the Integrated Test Coordinator.
- .2 Participate in the integrated testing, as outlined in the integrated test plan.

.6 Departmental Representative:
- .1 Provide access to the building as required to implement the integrated test plan.
- .2 Provide escorts as required to facilitate implementation of the integrated test plan.
- .3 Participate in the integrated testing, as outlined in the integrated test plan.

.5 Phasing:
- .1 The integrated test plan shall be developed for the entire building, with consideration for the integrated tests which will be required for each occupancy phase identified within the overall integrated testing plan.
- .2 The integrated test plan shall ensure that the integrated fire protection and life safety systems within each area to be occupied are tested for proper integrated operation.
- .3 Where a building is occupied in phases, and an integrated fire protection and life safety system is complete and undergoes integrated systems testing, the system integrations are not required to be retested for subsequent integrated systems tests provided ongoing construction does not impact previously tested system integrations.

.6 Integrated testing to be witnessed by Departmental Representative and Integrated Test Coordinator and documented on approved report forms, as developed by the Integrated Test Coordinator.

.7 Safety protocols:
- .1 Information for all parties involved with the integrated systems testing shall include safety protocols, which are to be formulated and implemented prior to integrated systems testing. These safety protocols are to include:
  - .1 Health and safety regulations.
  - .2 Personal protective equipment.
  - .3 Workplace Hazardous Materials Information System (WHMIS).
  - .4 Site-specific training and/or practices.
- .2 Safety protocols for the building, its operators, and for the test personnel shall be documented, reviewed by all parties, implemented, and adhered to.
- .3 Team collaboration is necessary due to the potential for unexpected outcomes associated with different test scenarios that may be implemented.
- .4 Safety is to be incorporated into all aspects of the integrated testing plan based on the site specific configuration and characteristics.
- .5 Safety protocols for integrated systems testing team members are to include instructions on how to deal with emergencies in the building and/or facility, and emergencies with team members.
- .6 The integrated testing plan is to consider the phased occupancy plan.

1.14 INSTALLATION CHECK LISTS (ICL)

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

1.15 PRODUCT INFORMATION (PI) REPORT FORMS

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

1.16 PERFORMANCE VERIFICATION (PV) REPORT

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

1.17 CX SCHEDULES

.1 Contractor to prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
- .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
  - .1 Design criteria, design intents.
  - .2 Pre-TAB review: 28 days after contract award, and before construction starts.
  - .3 Cx agents' credentials: 30 days before start of Cx.
  - .4 Cx procedures: 3 months after award of contract.
  - .5 Cx Report format: 3 months after contract award.
  - .6 Discussion of heating/cooling loads for Cx: 1 month before start-up.
  - .7 Submission of list of instrumentation with relevant certificates: 14 days before start of Cx.
  - .8 Notification of intention to start TAB: 14 days before start of TAB.
  - .9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
  - .10 Notification of intention to start Cx: 7 days before start of Cx.
  - .11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
  - .12 Identification of deferred Cx.
  - .13 Implementation of training plans.
  - .14 Cx reports: immediately upon successful completion of Cx.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

.3 Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

1.18 CX REPORTS

.1 Contractor to submit reports of tests, witnessed and certified by Departmental Representative who will verify reported results.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.19 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.

1.20 TRAINING PLANS

.1 Refer to Section 01 79 00.13 - Demonstration and Training for Building Commissioning.

1.21 FINAL SETTINGS

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
  .1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:
  .1 Special procedures as specified in relevant technical sections.
    .1 Product manufacturer's installation instructions and recommended checks:
    .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. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 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 develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.

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

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

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

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

1.7 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

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

1.8 LANGUAGE

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 INTENT

.1 This section specifies general requirements common to all start-up and performance verification (PV) of electrical components, equipment and systems specified elsewhere in Division 26 and must be read in conjunction with said specifications. The testing, verification, & commissioning indicated in Division 26 Specifications forms part of commissioning requirements.

1.2 PRODUCT INFORMATION (PI) AND PERFORMANCE VERIFICATION (PV) FORMS

.1 Refer to Section 01 91 13.16 - Commissioning Forms for system's requirements and for strategy for use.

.2 Procedures for use:
- .1 Include information such as equipment code, location, nameplate data, manufacturer, contact name & phone number.
- .2 Equipment manufacturer to submit copies of production test records prior to shipment.
- .3 Equipment manufacturer to submit step-by-step description of complete start-up procedures so as to permit Departmental Representative to repeat start-up at any time.

1.3 QUALITY ASSURANCE

.1 Starting, testing procedures to be in accordance with:
- .1 These specifications.
- .2 Requirements of authorities having jurisdiction.
- .3 Manufacturers' instructions or recommendations.
- .4 Applicable portions of relevant standards such as ASTM, CSA, EEMAC, IEEE, IPCEA, NEMA.

1.4 MANUFACTURERS' INVOLVEMENT

.1 Prior to start-up of equipment or systems, obtain manufacturer's installation, start-up and operation instructions and review with Departmental Representative:
- .1 Compare installation with manufacturer's published data, record discrepancies and review with manufacturer.
- .2 Modify procedures detrimental to equipment performance and review same with manufacturer, before start-up.

.2 Integrity of warranties:
- .1 Use manufacturer's trained start-up personnel where required to maintain integrity of warranty.
- .2 Verify with manufacturer that testing as specified will not void any warranties.

.3 Qualified manufacturer's representative to supervise start-up and testing as required by relevant section.

.4 Manufacturer's personnel to be experienced in design, installation and operation of equipment and systems and be able to interpret results of readings and tests accurately and to report results in clear, concise, logical manner.

1.5 DEFICIENCIES

.1 Correct deficiencies found during start-up and testing to satisfaction of Departmental Representative.

1.6 PROCEDURES

.1 Document all tests on approved PV forms.

.2 Start-up and testing to be in the following distinct phases:
- .1 Delivery and installation: Includes:
  - .1 Verification of conformity to specification, approved shop drawings, PI report forms.
- .2 Start-up: Includes start-up procedures.
- .3 Operational testing: Includes equipment run-in.
- .4 Pre-substantial performance verification: Includes repetition of tests after correction of deficiencies, final cleaning, and maintenance.
- .5 Post-substantial performance verification: Includes fine-tuning.

.3 After each distinct phase has been completed, correct deficiencies and obtain approval of Departmental Representative before commencing the next phase.

.4 Perform load balance, power factor and voltage testing during integrated system testing and fine-tuning of facility.

1.7 CONTROL SCHEMATICS

.1 To be "as-built".

.2 Include:
- .1 Update of terminal numbers, wire numbers, circuits, etc.
- .2 Record of terminal numbers at connection points to equipment by other Divisions.
- .3 All additional junction boxes and terminal strips that are provided.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 PERFORMANCE VERIFICATION FORMS (PV) AND PRODUCT INFORMATION FORMS (PI)

.1 Some typical performance verification forms are provided to the Contractor for verification of equipment, components and systems. Additional forms of similar format to be developed by Contractor for each system to be commissioned. The Contractor shall provide the required shop drawing information and verify the correct installations and operation of each item on these forms. This to include information such as equipment code, location and nameplate data. The systems verification cannot take place before all related equipment has been verified as correct.

.2 As a minimum, verification forms for the following systems are to be completed for this project.
- .1 New Normal Power Distribution System (below 750 V)
  - .1 Panels.
- .2 Motor Control System
  - .1 Motor Control Centre.
  - .2 Motor starter.
  - .3 Motor rotation and controls.
  - .4 Circuit breakers.
  - .5 Disconnect switches.

.3 A report form is to be completed for each individual piece of equipment in a category requiring verification.

.4 Where additional verification forms are required, develop appropriate verification forms and submit them to Departmental Representative for approval prior to use.

.5 Submit completed test reports immediately after tests are performed.
- .1 Record all data gathered on site on approved verification forms.
- .2 Provide the Departmental Representative with original of each completed verification form.
- .3 Maintain one photocopy on site of all data taken during starting and testing period.
- .4 Maintain one copy of all final starting, testing, balancing and adjusting reports on site up to interim acceptance of the work for reference purposes.

.6 All final verification forms are to be typewritten.

.7 Submit to Departmental Representative for approval.

.8 Make corrections and re-submit as requested by Departmental Representative.

.9 Manufacturer's Reports:
- .1 Arrange for manufacturer to submit copies of all production test records for production tests required by these specifications prior to shipping.
- .2 Arrange for manufacturer to submit brief step-by-step description of entire starting procedure to allow Departmental Representative to repeat starting at any time.

3.2 WITNESSING OF STARTING AND TESTING

.1 Prior to starting and testing of electrical equipment or systems, prepare a schedule for the required testing. Review schedule with Departmental Representative and commissioning authority for acceptance.

.2 Provide sufficient notice (minimum seven days) prior to commencing tests.

.3 Departmental Representative may witness all or any portion of testing and starting procedures performed by the Contractor.

.4 Contractor to be present for all tests of Division 26 systems, as well as related systems (HVAC, controls, etc.).

3.3 GENERAL EQUIPMENT STARTING TESTING

.1 Energizing Electrical Equipment:
- .1 Prior to energizing equipment provided under other sections:
  - .1 Confirm equipment nameplate data with characteristics of power supply

.2 Verify supply voltage and phase rotation.
.3 Ensure all independent testing as specified in related sections has been completed and deficiencies have been corrected.
.4 Close and open all devices to ensure proper mechanical operation.
.5 Megger all feeders and record results on approved verification forms.

.2 Insulation Resistance Testing (Megger Test):
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Check resistance to ground before energizing.
.4 Carry out tests in presence of Departmental Representative.
.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
.6 Submit test results for Departmental Representative's review.

.3 Coordination of Protective Devices:
.1 Ensure circuit protective devices such as overcurrent trip relays, fuses are installed to design values and settings as per approved study.

.4 Voltage Testing and Adjusting:
.1 Test voltage at service entry point, motor control centres and secondary of transformers. Record voltages at interim acceptance and three months after practical completion for a period of four hours during a normal work day.
.2 Adjust transformer tap settings to compensate for under-voltage or over-voltage conditions, if directed to do so by Departmental Representative.

3.4 LOW VOLTAGE POWER DISTRIBUTION (BELOW 750 V)

.1 Low Voltage Distribution Panels:
.1 Enclosure:
.1 Visual inspection.
.2 Torque all bus connections to manufacturer's requirements and seal with red lacquer.
.3 Megger test main bus at 1000 V.
.4 Check phasing and continuity of horizontal and vertical bus.

.2 Wiring checks
.1 Check polarity and verify phase relationship on all three phase metering circuits.
.2 Where errors are discovered and changes are required, mark up and note on vendor prints the corrective action required.

.3 Instrumentation:
.1 Perform wiring checks as listed above.

.4 Breakers:
.1 Moulded case breakers 150 Amp frame and larger:
.1 Inspection and testing per this specification section.

.5 Fused or unfused disconnect switches:
.1 Visual inspection and cleaning.
.2 Megger test.
.3 Mechanical function test.

.2 Circuit Breaker:
.1 Breakers - Moulded case breakers to 150 Amp:
.1 Visual inspection.
.2 Mechanical function test.
.3 Set all units with adjustable magnetic trip units.

.2 Breakers - Moulded case breakers 150 Amp frame and larger:
.1 Visual inspection.
.2 Megger test.

.3 Mechanical function test.
.4 Set all units with adjustable magnetic trip units.
.5 Where solid state protection is provided with larger breakers, test units as follows:
.1 Inspect and test in accordance with manufacturer's most recent installation and maintenance brochure.
.2 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instruction.
.3 If the manufacturer's tester is not available, use an approved relay tester unit with the proper test data and test accessories.
.4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of the relay circuit to test the trip operation.
.5 Check C/T and P/T ratios and compare to coordination data.

.3 Disconnect Switch - Fused/Non-fused:
.1 Fused and Non-Fused up to 1000 V:
.1 Complete equipment verification form.
.2 Conduct visual inspection.
.3 Perform operational check.

.4 Panelboard:
.1 Power and Lighting Panels:
.1 Conduct load balancing for all panels as defined in this section.
.2 Enclosure:
.1 Visual inspection.
.2 Torque all bus connections.
.3 Circuit directory & labelling.

.5 Wiring & Cables:
.1 General
.1 Test conductors at distribution centres and panel boards for insulation resistance to ground (megger test).
.2 Test service grounding conductors for ground resistance.
.3 Provide Departmental Representative with list of test results on approved verification form showing location at which each test was made, circuit tested and results of each test.
.4 Remove and replace entire length of cable if cable fails to meet any of the test criteria.

.6 Metering and Switchboard Instruments:
.1 Inspection and testing per High Voltage Power Distribution as defined in this section.

.7 Motor Control Systems:
.1 Motor Control Centres
.1 Visual inspection and cleaning.
.2 Ensure all starters are properly labelled prior to testing.
.3 Remove starter covers to expose all bussing and confirm phasing continuity and rotation and the identification of bussing.
.4 Torque test all bus connections and cable terminations to manufacturer's recommended levels.
.5 After the bus connections have been torque tested, apply red lacquer to bolted connections.
.6 Megger test - phase to phase and phase to ground.
.7 Doctor test bus connections and starter/feeder assemblies as follows:
.1 Across starter assembly with disconnect and contactor contacts closed (from line side of disconnect to load side of contactor).
.2 From source connection at MCC to each starter disconnect line terminals to check MCC bussing and stab connections.

.8 Ensure moving and working parts are lubricated where required.
.9 Operate starters to provide satisfactory performance of motor control centre during 8 h period.
.10 Complete equipment verification form.

.2 Motor Starter
.1 Operate switches, contactors to verify correct functioning.
.2 Perform starting and stopping sequences of contactors and relays.
.3 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as per design requirements.
.4 Complete equipment verification form.

.3 Motors
.1 Prior to starting motors:
.1 Confirm motor nameplate data with motor starter heater overloads, setting of MCP's and sizing of fuses.
.2 Verify rotation.
.2 Measure and record operating load amp readings for all three phase motors.

3.5 PRODUCT INFORMATION AND PERFORMANCE VERIFICATION FORMS

.1 Electrical equipment forms to be provided are as follows:
.1 Low Voltage Panels
.2 Moulded Case Circuit Breakers
.3 Disconnect Switches - Fused/Unfused
.4 Motor Control Centre
.5 Motor Starters

END OF SECTION