



## **SPECIFICATIONS**

NRCan Fire Alarm System Replacement

For:  
Public Works and Procurement, Canada  
Project No. R.098209.001

Stantec Consulting Ltd.  
10160, 112 Street NW, T5K 2L6  
Edmonton, Alberta  
Project No. 1147-78416

June 14, 2018

Section Number	Section Title	No. of Pages
<b>DIVISION 01 – GENERAL REQUIREMENTS</b>		
Section 01 11 00	Summary of Work	3
Section 01 14 00	Work Restrictions	2
Section 01 31 19	Project Meetings	2
Section 01 32 16.07	Construction Progress Schedule – Bar (GANTT) Chart	2
Section 01 33 00	Submittal Procedures	4
Section 01 35 29.06	Health and Safety Requirements	4
Section 01 41 00	Regulatory Requirements	1
Section 01 45 00	Quality Control	2
Section 01 52 00	Construction Facilities	3
Section 01 56 00	Temporary Barriers and Enclosures	2
Section 01 61 00	Common Product Requirements	4
Section 01 73 00	Execution	2
Section 01 74 11	Cleaning	2
Section 01 74 21	Construction/Demolition Waste Management and Disposal	3
Section 01 78 00	Closeout Submittals	7
Section 01 91 13	General Commissioning (Cx) Requirements	9
Section 01 91 31	Commissioning (CX) Plan	8
Section 01 91 33	Commissioning Forms	3
Section 01 91 41	Commissioning Training	3
<b>DIVISION 26 – ELECTRICAL</b>		
26 05 00	Common Work Results for Electrical	15
26 05 00.11	Work Included	3
26 05 00.24	Operations and Maintenance Manual	8
26 05 00.25	Equipment and Systems Demonstration and Instruction	2
26 05 00.26	Electrical Spare Parts and Maintenance Materials	1
26 05 19	Low-Voltage Electrical Power Conductors and Cables	6
26 05 32	Outlet Boxes	2
26 05 33.11	Conduit	5
26 05 53	Identification for Electrical Systems	4
26 08 00.10	Electrical Starting and Testing – General Requirements	5
26 08 00.12	Electrical Performance Testing By Departmental Representative	1
26 22 13.00	Low Voltage Distribution Transformers	3
26 24 16.00	Panelboards	3
26 53 00 00	Exit Signs	1
<b>DIVISION 28 -</b>		
28 05 00	Common Work Results For Electrical Safety and Security	9
28 08 00	Commissioning of Electronic Safety And Security System	2
28 31 02	Addressable Fire Alarm System	16
23 31 23	Fire Detection And Alarm Annunciation Panels	3
23 31 43	Fire Detection Sensors	4
23 31 46	Smoke Detection Sensors	4
23 31 53.13	Fire Alarm Initiation Devices	3
23 31 63.13	Fire Alarm Signalling Devices	3

NRCan Fire Alarm System Replacement  
PWGSC Reference No. R.098209.001  
Project No. 114778416

Section **00 01 10**  
TABLE OF CONTENTS  
Page 2

**END OF SECTION**

**Part 1            General**

**1.1                WORK COVERED BY CONTRACT DOCUMENTS**

- .1        Work of this Contract comprises of replacement of existing fire alarm system at the NRCan Laboratory Facility at Edmonton, Alberta including but not limited to supply installation and verification of a new fire alarm system and associated field devices and upgrade of the emergency lighting system.

**1.2                CONTRACT METHOD**

- .1        Construct Work under one prime construction contract between the Departmental representative and contractor using a stipulated price contract.
- .2        Relations and responsibilities between Contractor and subcontractors assigned by Departmental Representative are as defined in Conditions of Contract. Assigned Subcontractors must, in addition:
  - .1        Furnish to Contractor, bonds covering faithful performance of subcontracted work and payment of obligations thereunder when Contractor:
  - .2        Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide to Departmental Representative.

**1.3                WORK BY OTHERS**

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

**1.4                WORK SEQUENCE**

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

**1.5                CONTRACTOR USE OF PREMISES**

- .1        Limit use of premises for Work, for storage, and restricted access, to allow:
  - .1        Departmental Representative occupancy.
  - .2        Work by other contractors.
- .2        Co-ordinate use of premises under direction of Departmental Representative.

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

#### **1.6 DEPARTMENTAL REPRESENTATIVE OCCUPANCY**

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

#### **1.7 EXISTING SERVICES**

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give the Departmental representative at least 48 hours' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to operations.
- .3 Provide alternative routes for personnel.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services when directed by Departmental Representative and Departmental Representative to maintain critical building and tenant systems.
- .7 Where unknown services are encountered, immediately advise Departmental Representative and Departmental Representative, and confirm findings in writing.
- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .9 Record locations of maintained, re-routed and abandoned service lines.

#### **1.8 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.

- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 List of Outstanding Shop Drawings.
- .6 Change Orders.
- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

**Part 1            General**

**1.1                ACCESS AND EGRESS**

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

**1.2                USE OF SITE AND FACILITIES**

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

**1.3                EXISTING SERVICES**

- .1    Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2    Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3    Provide for personnel traffic.

**1.4                SPECIAL REQUIREMENTS**

- .1    Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANNT) Chart.
- .2    Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .3    Keep within limits of work and avenues of ingress and egress.
- .4    Ingress and egress of Contractor vehicles at site is limited.

**1.5                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, as instructed, for each individual who will require to enter premises.
  - .2    Obtain requisite clearance, as instructed, 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.
- .4 Contractor's personnel will require satisfactory RCMP initiated security screening in order to complete Work in premises and on site.
- .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.

**1.6 BUILDING SMOKING ENVIRONMENT**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                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, affected parties not in attendance Departmental Representative.
- .8     Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

**1.2                PRECONSTRUCTION MEETING**

- .1     Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2     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 Section 01 32 16.07 - Construction Progress Schedules - 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     Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
  - .5     Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .6     Departmental Representative provided products.
  - .7     Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .8     Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
  - .9     Monthly progress claims, administrative procedures, photographs, hold backs.

- .10 Appointment of inspection and testing agencies or firms.
- .11 Insurances, transcript of policies.

**1.3 PROGRESS MEETINGS**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 DEFINITIONS**

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

**1.2 REQUIREMENTS**

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

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

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

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

#### **1.4 PROJECT SCHEDULE**

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 Award.
  - .2 Shop Drawings.
  - .3 Permits.
  - .4 Mobilization.
  - .5 Electrical.
  - .6 Controls.
  - .7 Heating, Ventilating, and Air Conditioning.

#### **1.5 PROJECT SCHEDULE REPORTING**

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

#### **1.6 PROJECT MEETINGS**

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

#### **Part 2 Products**

##### **2.1 NOT USED**

- .1 Not used.

#### **Part 3 Execution**

##### **3.1 NOT USED**

- .1 Not used.

**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 contractor's drawings stamped and signed by Contractor's Authorized Representative.
- .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 5 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, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .8 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Details of appropriate portions of Work as applicable:
    - .1 Fabrication.
    - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
    - .3 Setting or erection details.
    - .4 Capacities.
    - .5 Performance characteristics.
    - .6 Standards.
    - .7 Operating weight.
    - .8 Wiring diagrams.
    - .9 Single line and schematic diagrams.
    - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit 6 prints of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit 6 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

- .12 Submit 6 copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit 6 copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit 6 copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit 6 copies 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 6 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, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
  - .1 This review shall not mean that PWGSC 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.

**1.3 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of 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                REFERENCES**

- .1        Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2        Province of Alberta
  - .1        Occupational Health and Safety Act, R.S.A. - Updated 2013.

**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 2 copies of Contractor's authorized representative's work site health and safety inspection reports to authority having jurisdiction, weekly Departmental Representative.
- .4        Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5        Submit copies of incident and accident reports.
- .6        Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .7        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.
- .8        Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9        On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

**1.3                FILING OF NOTICE**

- .1        File Notice of Project with Provincial authorities prior to beginning of Work.
- .2        Contractor shall be responsible and assume the Principal Contractor role 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. Contractor to submit written acknowledgement to CSST along with Ouverture de Chantier Notice.
- .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 REGULATORY REQUIREMENTS**

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

**1.7 GENERAL REQUIREMENTS**

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

**1.8 RESPONSIBILITY**

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 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 Contractor shall be the Principal Contractor as described in the Quebec Act Respecting Health and Safety code for the Construction for only their scope and areas of work as defined and described this project specification.
- .4 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

**1.9 COMPLIANCE REQUIREMENTS**

- .1 Comply with Occupational Health and Safety Act, General Safety Regulation, Alberta Reg.
- .2 Comply with Occupational Health and Safety Regulations, 1996.
- .3 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

**1.10 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.

#### **1.11 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 Have site-related working experience specific to activities associated with Federal Institutions.
  - .2 Have working knowledge of occupational safety and health regulations.
  - .3 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.
  - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

#### **1.12 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, and in consultation with Departmental Representative.

#### **1.13 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.

#### **1.14 POWDER ACTUATED DEVICES**

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

#### **1.15 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.

#### **1.16 ASBESTOS CONTAINING MATERIAL**

- .1 No material containing asbestos is to be installed on this project.

**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                REFERENCES AND CODES**

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
  - .1 Contract documents.
  - .2 Specified standards, codes and referenced documents.

**1.2                HAZARDOUS MATERIAL DISCOVERY**

- .1 Asbestos: The building contains Asbestos in certain locations. Refer to the attached report for more information. Demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative

**1.3                HAZARDOUS MATERIAL ABATEMENT**

- .1 Should any asbestos, PCB, or Mould be discovered and work stopped, the Departmental Representative will have the Hazardous Material removed.
- .2 Comply with smoking restrictions and municipal by-laws.

**1.4                BUILDING SMOKING ENVIRONMENT**

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

**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                INSPECTION**

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

**1.2                INDEPENDENT INSPECTION AGENCIES**

- .1     Provide equipment required for executing inspection and testing by appointed agencies.
- .2     Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .3     If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.

**1.3                ACCESS TO WORK**

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

**1.4                PROCEDURES**

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

**1.5                REJECTED WORK**

- .1     Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative 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 .

**1.6 REPORTS**

- .1 Submit [4] copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to [subcontractor of work being inspected or tested] [manufacturer or fabricator of material being inspected or tested].

**1.7 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                REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
  - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-0121-M1978(R2003), Douglas Fir Plywood.
  - .3 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.
  - .4 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3                INSTALLATION AND REMOVAL**

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

**1.4                SCAFFOLDING**

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

**1.5                HOISTING**

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

**1.6                ELEVATORS**

- .1 Designated existing and permanent elevators to be used by construction personnel and transporting of materials. Co-ordinate use with Departmental Representative.

- .2 Provide protective coverings for finish surfaces of cars and entrances.

#### **1.7 SITE STORAGE/LOADING**

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

#### **1.8 CONSTRUCTION PARKING**

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

#### **1.9 SECURITY**

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

#### **1.10 OFFICES**

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

#### **1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE**

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

#### **1.12 SANITARY FACILITIES**

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Departmental Representative.

#### **1.13 CONSTRUCTION SIGNAGE**

- .1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by Departmental Representative.
- .2 Indicate on sign, name of Departmental Representative, Contractor and Subcontractor.

- .3 No other signs or advertisements, other than warning signs, are permitted on site.
- .4 Locate project identification sign as directed by Departmental Representative.
- .5 Direct requests for approval to erect Consultant/Contractor signboard to Departmental Representative. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording in both official languages.
- .6 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .7 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Departmental Representative.

**1.14 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

**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                REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
  - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

**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                GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

**1.4                WEATHER ENCLOSURES**

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

**1.5                DUST TIGHT SCREENS**

- .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.

**1.6                ACCESS TO SITE**

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

**1.7                PUBLIC TRAFFIC FLOW**

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

**1.8 FIRE ROUTES**

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

**1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

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

**1.10 PROTECTION OF BUILDING FINISHES**

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

**1.11 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling and remove from site.

**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                REFERENCES**

- .1        Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2        If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

**1.2                QUALITY**

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

**1.3                AVAILABILITY**

- .1        Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2        In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

**1.4                STORAGE, HANDLING AND PROTECTION**

- .1        Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .5 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

## **1.5 TRANSPORTATION**

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

## **1.6 MANUFACTURER'S INSTRUCTIONS**

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

## **1.7 QUALITY OF WORK**

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

## **1.8 CO-ORDINATION**

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

## **1.9 CONCEALMENT**

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

**1.10 REMEDIAL WORK**

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

**1.11 FASTENINGS**

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

**1.12 FASTENINGS - EQUIPMENT**

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

**1.13 PROTECTION OF WORK IN PROGRESS**

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

**1.14 EXISTING UTILITIES**

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

**1.15 DEPARTMENTAL REPRESENTATIVES RESPONSIBILITY OF QUALITY CONTROL**

- .1 Departmental Representative will review shop drawings submitted by the contractor.
- .2 Departmental Representative will perform site visits during construction to ensure work is being performed to specifications and drawings, and to ensure the quality of work done by the contractor.
- .3 Departmental Representative will be present during the fire alarm verification process to ensure the Fire Alarm Verification is being done to Code.
- .4 Departmental Representative will be present at all site meetings.

**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            ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.2            MATERIALS**

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

**1.3            PREPARATION**

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

**1.4            EXECUTION**

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

- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials and remove from site.

**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                PROJECT CLEANLINESS**

- .1     Maintain Work in tidy condition, free from accumulation of waste products and debris, including other than that caused by Departmental Representative or other Contractors.
- .2     Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3     Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .4     Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5     Provide on-site containers for collection of waste materials and debris.
- .6     Provide and use marked separate bins for recycling.
- .7     Dispose of waste materials and debris.
- .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.

**1.2                FINAL CLEANING**

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

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling.

**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 WASTE MANAGEMENT GOALS**

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's waste management goal and Contractor's proposed Waste Reduction Workplan for Construction, Renovation and /or Demolition (CRD) waste to be project generated.
- .2 PWGSC's waste management goal: to divert a minimum 75 percent of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .3 Specific material target percentages for reuse and/or recycling:
  - .1 Electrical - wiring/conduits/boxes: 100%.
  - .2 Packaging: 90%.
- .4 Target percentage goals are achievable for waste diversion. Contractor to review and confirm Departmental Representative's Waste Audit acceptable values.
- .5 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.
- .6 Protect environment and prevent environmental pollution damage.

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
  - .2 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
  - .3 Waste Management Co-ordinator (WMC) : contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
- .2 Reference Standards:
  - .1 Canadian Construction Association (CCA)
    - .1 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.
    - .2 Public Works and Government Services Canada (PWGSC)
    - .3 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.
    - .4 CRD Waste Management Market Research Report (available from PWGSC's Environmental Services).

**1.3 USE OF SITE AND FACILITIES**

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

**1.4 WASTE PROCESSING SITES**

- .1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.

**1.5 STORAGE, HANDLING AND PROTECTION**

- .1 Unless specified otherwise, materials for removal do not become Contractor's property.
- .2 Protect surface drainage, mechanical and electrical from damage and blockage.
- .3 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .4 Separate and store materials produced during project in designated areas.

**1.6 DISPOSAL OF WASTES**

- .1 Do not dispose of waste, volatile materials, mineral spirits, oil, and paint thinner into waterways, storm, or sanitary sewers.
- .2 Remove materials on-site as Work progresses.

**1.7 SCHEDULING**

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 APPLICATION**

- .1 Do Work in compliance with WRW and WSSP.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

**3.2 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
  - .2 Source separate materials to be reused/recycled into specified sort areas.

**END OF SECTION**

**Part 1            General**

**1.1                ADMINISTRATIVE REQUIREMENTS**

- .1    Pre-warranty Meeting:
  - .1    Convene meeting one week prior to contract completion with contractor's representative Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:
    - .1    Verify Project requirements.
    - .2    Review warranty requirements and manufacturer's installation instructions.
  - .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.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3                FORMAT**

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

- .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg and PDF format on CD.

#### **1.4 CONTENTS - PROJECT RECORD DOCUMENTS**

- .1 Table of Contents for Each Volume: provide title of project;
  - .1 Date of submission; names.
  - .2 Addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties.
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
  - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

#### **1.5 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 and samples available for inspection by Departmental Representative.

## **1.6 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 References 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, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

## **1.7 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 Design-Builder'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.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control 01 91 13 - General Commissioning (Cx) Requirements.
- .15 Additional requirements: as specified in individual specification sections.

## **1.8 MATERIALS AND FINISHES**

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

## **1.9 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 site; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative.
    - .2 Include approved listings in Maintenance Manual.

- .5 Obtain receipt for delivered products and submit prior to final payment.
- .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 site 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 AND BONDS**

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

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

**1.12 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
  - .1 Type of product/material.
  - .2 Model number.
  - .3 Serial number.
  - .4 Contract number.
  - .5 Warranty period.
  - .6 Inspector's signature.
  - .7 Construction 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                ACRONYMS**

- .1      Cx - Commissioning.
- .2      EMCS - Energy Monitoring and Control Systems.
- .3      O M - Operation and Maintenance.
- .4      PI - Product Information.
- .5      PV - Performance Verification.
- .6      TAB - Testing, Adjusting and Balancing.

**1.2                GENERAL**

- .1      Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems 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 operation & maintenance manuals.
  - .3      Effectively train O&M staff.
- .2      Contractor to assist in Cx process, for the purpose operating equipment and systems, troubleshooting and making adjustments as required.
  - .1      Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
  - .2      During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3      Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

**1.3                COMMISSIONING OVERVIEW**

- .1      Refer to Section 01 91 31 - Commissioning (Cx) Plan and Section 26 08 00.10 and 28.08.00
- .2      For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.
- .3      Cx to be a line item of Contractor's cost breakdown.
- .4      Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5      Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction

and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

- .6 Departmental Representative will issue Interim Acceptance Certificate when:
  - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
  - .2 Equipment, components and integrated systems have been commissioned and functional as per design intent within the context of the Departmental Representative Project requirement.
  - .3 Final O&M and training manual received, reviewed and approved by Departmental Representative for suitability.
  - .4 Completion of Training session to all Operational and Maintenance Staff.

#### **1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS**

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

#### **1.5 PRE-CX REVIEW**

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

- .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
- .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

## **1.6 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.

## **1.7 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.

## **1.8 COMMISSIONING DOCUMENTATION**

- .1 Refer to Section 01 91 33 - Commissioning (Cx) 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.

## **1.9 COMMISSIONING SCHEDULE**

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM) 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
  - .1 Approval of Cx reports.
  - .2 Verification of reported results.

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

**1.10 COMMISSIONING MEETINGS**

- .1 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .2 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .3 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.
- .4 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .5 Meeting will be chaired by Cx Agent, who will record and distribute minutes.
- .6 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

**1.11 STARTING AND TESTING**

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

**1.12 WITNESSING OF STARTING AND TESTING**

- .1 Provide 14 days notice prior to commencement.
- .2 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.

**1.13 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.

#### **1.14 PROCEDURES**

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
  - .1 Included in delivery and installation:
    - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
    - .2 Visual inspection of quality of installation.
  - .2 Start-up: follow accepted start-up procedures.
  - .3 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.

**1.15 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.

**1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS**

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit 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.

**1.17 TEST RESULTS**

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

**1.18 START OF COMMISSIONING**

- .1 Notify 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.

**1.19 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.

#### **1.20 COMMISSIONING PERFORMANCE VERIFICATION**

- .1 Carry out Cx:
  - .1 Under actual 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.

#### **1.21 WITNESSING COMMISSIONING**

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

#### **1.22 AUTHORITIES HAVING JURISDICTION**

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

#### **1.23 EXTRAPOLATION OF RESULTS**

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

#### **1.24 EXTENT OF VERIFICATION**

- .1 Provide manpower and instrumentation to verify up to 30 % 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 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

**1.25 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 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS**

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

**1.31 OCCUPANCY**

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

**1.32 INSTALLED INSTRUMENTATION**

- .1 Use instruments installed under Contract for PV if:
  - .1 Accuracy complies with these specifications.

- .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

**1.33 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.

**1.34 DEPARTMENTAL REPRESENTATIVE 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                REFERENCES**

- .1    Public Works and Government Services Canada (PWGSC)
- .2    Underwriters' Laboratories of Canada (ULC)

**1.2                GENERAL**

- .1    Provide a fully functional facility:
  - .1    Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
  - .2    Facility user and O&M personnel have been fully trained in aspects of installed systems.
  - .3    Optimized life cycle costs.
  - .4    Complete documentation relating to installed equipment and systems.
- .2    Term "Cx" in this section means "Commissioning".
- .3    Use this Cx Plan as master planning document for Cx:
  - .1    Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
  - .2    Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
  - .3    Sets out deliverables relating to O M, process and administration of Cx.
  - .4    Describes process of verification of how built works meet Departmental Representative's 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    MSDS - Material Safety Data Sheets.
  - .5    PI - Product Information.
  - .6    PV - Performance Verification.
  - .7    TAB - Testing, Adjusting and Balancing.
  - .8    WHMIS - Workplace Hazardous Materials Information System.
- .5    Commissioning terms used in this Section:

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

### **1.3 DEVELOPMENT OF 100% CX PLAN**

- .1 Cx Plan 95% completed by the Departmental Representative and transmit to the Contractor.
- .2 Cx Plan to be 100% completed within 8weeks of award of contract to take into account:
  - .1 Approved shop drawings and product data.
  - .2 Approved changes to contract.
  - .3 Contractor's project schedule.
  - .4 Cx schedule.
  - .5 Contractor's, sub-contractor's, suppliers' requirements.
  - .6 Project construction team's and Cx team's requirements.
- .3 Submit 10% completed Cx Plan to Departmental Representative and obtain written approval.

### **1.4 REFINEMENT OF CX PLAN**

- .1 During construction phase, revise, refine and update Cx Plan to include:
  - .1 Changes resulting from Client program modifications.
  - .2 Approved design and construction changes.
- .2 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

### **1.5 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM**

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
  - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
  - .2 Departmental Representative is responsible for:
    - .1 Monitoring operations Cx activities.
    - .2 Witnessing, certifying accuracy of reported results.
    - .3 Witnessing and certifying fire alarm verification tests.
    - .4 Ensuring implementation of final Cx Plan.
    - .5 Performing verification of performance of installed systems and equipment.
    - .6 Implementation of Training Plan.
    - .7 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.

- .8 Protection of health, safety and comfort of occupants and O&M personnel.
- .9 Monitoring of Cx activities, training, development of Cx documentation.
- .10 Work closely with members of Cx Team.
- .3 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
  - .1 Testing.
  - .2 Performance of Cx activities.
  - .3 Delivery of training and Cx documentation.
  - .4 Assigning one person as point of contact with Departmental Representative and PWGSC Cx Manager for administrative and coordination purposes.
- .4 Contractor's Cx agent implements specified Cx activities including:
  - .1 Demonstrations.
  - .2 Training.
  - .3 Testing.
  - .4 Preparation, submission of test reports.
- .5 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
  - .1 Receiving facility.
  - .2 Day-To-Day operation and maintenance of facility.

## **1.6 CX PARTICIPANTS**

- .1 Employ the following Cx participants to verify performance of equipment and systems:
  - .1 Installation contractor/subcontractor:
    - .1 Equipment and systems except as noted.
  - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
    - .1 To include performance verification.
  - .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
  - .4 Specialist Cx agency:
    - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
- .5 Ensure that Cx participant:
  - .1 Could complete work within scheduled time frame.
  - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O M personnel, including:

- .1 Modify ventilation rates to meet changes in off-gassing.
  - .2 Changes to heating or cooling loads beyond scope of EMCS.
  - .3 Changes to EMCS control strategies beyond level of training provided to O M personnel.
  - .4 Redistribution of electrical services.
  - .5 Modifications of fire alarm systems.
  - .6 Modifications to voice communications systems.
- .6 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

### **1.7 EXTENT OF CX**

- .1 Commission electrical systems and equipment: Fire Alarm and Emergency Lighting Systems.

### **1.8 DELIVERABLES RELATING TO O M PERSPECTIVES**

- .1 General requirements:
  - .1 Compile English documentation.
  - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
  - .1 Warranties.
  - .2 Project record documentation.
  - .3 Inventory of spare parts, special tools and maintenance materials.
  - .4 Maintenance Management System (MMS) identification system used.
  - .5 WHMIS information.
  - .6 MSDS data sheets.
  - .7 Fire alarm device inventory indicating each device and it's physical location.
  - .8 Preventive maintenance program.
  - .9 Contractor's and sub-contractor's as-built drawings.

### **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:
  - .10 Tests performed by Departmental Representative/User.
  - .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.

#### **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 modified generic procedures to suit project requirements.
  - .3 Departmental Representative reserves right to verify up to 30% of reported results at random.
  - .4 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 Departmental Representative to monitor Cx activities.
- .2 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .3 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.
- .4 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

#### **1.13 INSTALLATION CHECK LISTS (ICL)**

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

#### **1.14 PRODUCT INFORMATION (PI) REPORT FORMS**

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

#### **1.15 PERFORMANCE VERIFICATION (PV) REPORT**

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

#### **1.16 DELIVERABLES RELATING TO ADMINISTRATION OF CX**

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

#### **1.17 CX SCHEDULES**

- .1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:

- .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
  - .1 Design criteria, design intents.
  - .2 Cx agents' credentials: 60 days before start of Cx.
  - .3 Cx procedures: 3 months after award of contract.
  - .4 Cx Report format: 3months after contract award.
  - .5 Discussion of heating/cooling loads for Cx: 3 months before start-up.
  - .6 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
  - .7 Notification of intention to start Cx: 14 days before start of Cx.
  - .8 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14days before start of integrated system Cx.
  - .9 Identification of deferred Cx.
  - .10 Implementation of training plans.
  - .11 Cx reports: immediately upon successful completion of Cx.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Departmental Representative.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.

#### **1.18 CX REPORTS**

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

#### **1.19 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 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                INSTALLATION/START-UP CHECK LISTS**

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

**1.2                PRODUCT INFORMATION (PI) REPORT FORMS**

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

**1.3                PERFORMANCE VERIFICATION (PV) FORMS**

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

**1.4                SAMPLES OF COMMISSIONING FORMS**

- .1     Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.
- .2     Revise items on Commissioning forms to suit project requirements.

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

## **1.5 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS**

- .1 When additional forms are required, but are not available from Departmental Representative 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.

## **1.6 COMMISSIONING FORMS**

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
  - .1 Departmental Representative 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 in accordance with Section [01 91 51 - Building Management Manual (BMM)].

## **1.7 LANGUAGE**

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

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                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.

**1.2                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.

**1.3                TRAINING OBJECTIVES**

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

**1.4                TRAINING MATERIALS**

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

- .4 Management Manual.
- .5 TAB and PV Reports.
- .3 Project Manager, Commissioning Manager and Facility 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.

## **1.5 SCHEDULING**

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

## **1.6 RESPONSIBILITIES**

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

## **1.7 TRAINING CONTENT**

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
  - .1 Review of facility and occupancy profile.
  - .2 Functional requirements.
  - .3 System philosophy, limitations of systems and emergency procedures.
  - .4 Review of system layout, equipment, components and controls.
  - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
  - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

- .7 Maintenance and servicing.
- .8 Trouble-shooting diagnosis.
- .9 Inter-Action among systems during integrated operation.
- .10 Review of O M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 This Section covers items common to Sections of Division 26, and 28. This section supplements requirements of Division 1.

**1.2 RESPONSIBILITY FOR EXISTING PROPERTY**

- .1 Contractor shall assume responsibility for the care, custody and control of existing work completed by others which is assigned to him for performance of the Work. This will include any works completed within the existing NRCan Facility where the extent of works detailed in this contract may occur.
- .2 Contractor shall assume responsibility for and shall make good, damage to existing work completed by others attributable to performance of Work of this Contract.

**1.3 SUFFICIENCY OF THE DRAWINGS AND SPECIFICATIONS**

- .1 The Drawings and Specifications shall be held to determine the general character and general arrangement of the Work.
- .2 Drawings and Specifications indicate the general scope of the Project in terms of the dimensions of the Work, the type of structural, mechanical, electrical utility systems and the architectural elements of construction. The Drawings and Specifications do not necessarily indicate or describe all Work required for the full performance and completion of the requirements of the Contract Documents. On the basis of the general scope indicated, described or implied, the Contractor shall furnish all items required for the proper execution and completion of the Work.
- .3 The Contract Documents are issued to facilitate construction by expressing the design intent. The Drawings and Specifications do not necessarily contain all of the details required to construct the project, and contractor supplied detail in the form of detailed construction documents (referred to in the Contract Documents as the Contractors supplied shop drawings, submittals, and field coordination drawings) is required for construction of the Work; all of which set out the specific and final details required for placing and constructing the finished Work. By contrast, the Drawings and Specifications are provided to reflect the finished design of the Work. The Drawings and Specifications are not intended to be used as a set of detailed instructions on how to construct the Work. Construction means, methods, techniques, sequences, procedures, and site safety precautions are the responsibility of the Contractor.
- .4 Shop Drawings, Product Data, Samples and similar submittals provided by the Contractor are not Contract Documents. The purpose of these submittals is to demonstrate the way by which the Contractor proposes to conform to the design intent expressed in the Contract Documents.
- .5 The Contractor must examine the Drawings and Specifications to satisfy himself regarding the design intent and the extent of the proposed Work by personal examination of the existing building, site and surroundings. He shall make his own estimate therefrom of the facilities and difficulties attending the performance and completion of the Work.

- .6 Contractor shall obtain data from construction manager for or departmental representative architectural systems requiring electrical, communication and fire alarm connections such as elevating equipment, door operators, window washing equipment, amenity equipment etc. and allow for providing electrical provisions.

#### **1.4 INTENT**

- .1 Electrical Contractor to provide all labour and materials necessary for complete and operating electrical systems as indicated on the drawings and specified herein. Any work, even if not shown or specified, which is obviously necessary or reasonably implied to complete the work to be done to meet the design intent as if it was both shown and specified.
- .2 The contractor who has contractual relationship with the Departmental Representative shall be responsible for providing complete and workable systems as outlined on drawings and in specifications. The Departmental Representative will not recognize any sub-contractor as such, but will consider all persons engaged on the work to be under the control of the contractor. The Departmental Representative will not under any circumstances, enter into discussions concerning the responsibility of subtrades or the apportionment of work. No claim based on the division of work between specification sections or subtrades will be considered.

#### **1.5 CODES, PERMITS AND INSPECTION**

- .1 Unless otherwise indicated, all references to standards and codes throughout this specification is to the latest applicable edition at the time of bid closing.
- .2 Do complete installation in accordance with CSA C22.1- 2015. In case of a conflict between the code requirements and the contract documents, request clarification prior to proceeding with the work.
- .3 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.
- .4 Abbreviations for electrical terms: to CSA Z85 - Abbreviations for Scientific and Engineering Terms.
- .5 Coordinate with other disciplines and provide plenum rated equipment and devices and plenum rated raceway, wiring and installation methods in all plenum spaces.
- .6 Material and installations shall comply with the requirements of the following codes and standards, codes and standards mentioned in other sections of this specification, as well as other applicable codes and standards to the satisfaction of the Authorities Having Jurisdiction (AHJ):
  - .1 National Building Code (NBC) -2015
  - .2 Alberta Fire Code (AFC) - 2014
  - .3 Canadian Electrical Code (C22.1 2015 version);
  - .4 Canadian Standards Association (CSA); and
  - .5 Underwriters Laboratories of Canada (ULC).
  - .6 CAN/ULC S524-14 Standard for the Installation for Fire Alarm Systems, latest editions.

- .7 Provide the site office with a current copy of the following documents, codes and standards. These documents shall remain on site throughout the duration of construction for electricians and others reference and use. The maintenance of these codes on site may be checked at each site visit. Absence of one or more such documents will be indicated on the field review report as deficiency and non-compliance with contract requirements.
  - .1 Project's electrical specifications;
  - .2 Project's up to date electrical RFIs and responses, SIs and CCNs;
  - .3 Canadian Electrical Code - 2015;
  - .4 CAN/ULC S524-14-Installation of Fire Alarm Systems
- .8 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .9 Pay associated fees.
- .10 Departmental representative will provide drawings and specifications required by Electrical Inspection Authority and Supply Authority at no cost.
- .11 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making such changes.
- .12 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Departmental Representative.

#### **1.6 QUALITY ASSURANCE**

- .1 Electrical Contractor to note that electrical specifications and drawings form part of the Contract Documents and are to be read interpreted and coordinated with all other Divisions. The General and Supplementary Conditions, Division 1, and amendments and supplements thereto form a part of this Division and contain items related to this Division.
- .2 Conform to the requirements of CEC with amendments by local Authorities Having Jurisdiction (AHJ).
- .3 Conform to the requirements of the ABC with amendments by local AHJ. Life safety systems to conform to the latest edition of the ABC and CEC.
- .4 Conform to the requirements of the referenced Standards and Codes. Electrical installation method and electrical equipment shall meet the Codes and Standards referenced in Section 1.6. If discrepancies exist with the contract documents, clarify with the Departmental Representative during the bid stage.
- .5 Obtain and pay for the electrical permits, and inspection from local AHJ.
- .6 Conform to the requirements of the serving electric, telephone and cable television utilities. Obtain copies of customer connection guides, coordinate with the service authorities and facilitate requirements to provide utility connections to the building.

#### **1.7 STANDARDS OF MATERIAL AND WORKMANSHIP**

- .1 All materials to be new, of minimum quality specified and conform to standards of Canadian Standards Association. Where equipment or materials are specified by

technical description only, they are to be of the best commercial quality obtainable for the purpose.

- .2 Where materials are damaged either in transit to site, during the course of installation or following the installation prior to a turn-over, they shall be evaluated by the Departmental Representative as to the course of corrective action or replacement. The final decision shall be at the discretion of the Departmental Representative.
- .3 All work to be executed in a neat and workmanlike manner by qualified tradesmen. Electrical Contractor to keep a competent foreman and all necessary assistants, all satisfactory to the Construction Manager and the Departmental Representatives, on the job during progress of the work. Where reference is made to standards such as EEMAC, NEMA, CSA, IPCEA, ULC, etc., the latest editions and revisions of such standard specifications to apply.
- .4 All electrical equipment to be CSA approved. Electrical equipment that is shown on the drawings or called for in the specifications that is not CSA approved is to be treated by Electrical Contractor in one of the following ways:
  - .1 Make allowance in Contract Price for having said equipment CSA approved, or
  - .2 Make allowance in Contract Price for most expensive CSA approved equivalent.

## **1.8 WARRANTY**

- .1 Refer to Division 1.
- .2 Furnish a written guarantee stating that all work executed and all apparatus installed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of substantial completion certificate. The Trade Contractor shall repair and replace any work, which fails or becomes defective within 12 months of the date of final acceptance of the work during the term of the guarantee/warranty, providing the operating and maintenance instructions have been complied with. The period of guarantee specified shall not, in any way, supplant any other guarantees of a longer period provided by Manufacturers or as called for in the project documents.
- .3 Departmental Representative Requirements During Warranty:
  - .1 Unless specified otherwise the Departmental Representative shall be responsible for all routine maintenance requirements as required in the manufacturer's instructions.
  - .2 The Departmental Representative shall be responsible for replacing all lamps during the warranty period unless it is determined by the Departmental Representative and the Departmental Representative that an unusual rate of failure is encountered.

## **1.9 UNIFORMITY OF EQUIPMENT**

- .1 Unless otherwise specifically called for in the specifications, uniformity of manufacturer to be maintained throughout the building for any particular item or type of equipment.

## **1.10 COMPLIANCE OF EQUIPMENT WITH SPECIFICATIONS**

- .1 Refer to Division 0.

- .2 Electrical Contractor to be completely responsible for ascertaining that every item included in Contract complies in all respects with specifications and drawings. Any item of equipment found by the Departmental Representative not to comply with specifications and drawings to be replaced at no additional cost with an item or unit of the Departmental Representative's choice.
- .3 Catalogue numbers used in the specifications are for reference purposes only. Confirm exact component requirements with technical descriptions provided. Should any discrepancy exist, which leaves doubt as to the true intent and meaning, obtain a ruling from the Departmental Representative.
- .4 Make known in writing to the Departmental Representative ten (10) days prior to the tender closing date any materials specified that are required to complete the work which are not currently available or will not be available for use as called for herein. Failing to do so, it will be assumed that the most expensive alternate has been included in the tender price.

#### **1.11 ALTERNATE PRODUCT APPROVAL**

- .1 Refer to Division 0.
- .2 Electrical Contract amount to be based on equipment specified or alternate equipment that has received prior approval from the Departmental Representative.
- .3 Requests for prior approval of alternates to be received at the offices of the Departmental Representative a minimum of ten [10] business days prior to tender closing. Requests for approval to clearly indicate the specified product and the relevant specifications section, as well as a comprehensive list identifying all areas where the submitted alternate product does not comply with the specifications.
- .4 Notwithstanding item 3, substitution requests shall be complete with proper support documents to clearly identify the equality of the specifications of the suggested product on an item by item basis compared to the specifications listed for the specified product. Requests not meeting this requirement will be returned as insufficient information for review.
- .5 Approved alternates (if any) will be listed in the addenda. Products not identified will not be considered for use on the project.
- .6 No substitution of items specifically called for on the drawings, such as feeders, etc., with other products even the ones listed in specifications, is allowed without timely and proper request and approval. Where substitutions are requested, related technical data must be submitted along with the approval request for e.g. for substituting copper with aluminum feeders, voltage drop details, conduit size fill chart etc. must be submitted.

#### **1.12 DRAWINGS AND SPECIFICATIONS**

- .1 Drawings and specifications are complementary each to the other and what is called for by one to be binding as if called for by both.
- .2 Should any discrepancy appear between drawings and specifications, which leave doubt as to the true intent and meaning, obtain a ruling from the Departmental Representative during the tender stage itself. This should be clarified and documented prior to the bid close. For any clarifications requested after the bid close regarding discrepancies between

drawings and specifications, the Departmental Representative's interpretation of the true design intent and meaning will prevail.

- .3 Electrical drawings indicate general location and route to be followed by conduits and/or wire and do not show all structural and mechanical details. In most cases, conduit or wiring is not shown on drawings or is shown diagrammatically in schematic or riser diagrams. Conduit and wire to be installed to provide a complete operating job and to be installed physically to conserve headroom, furring spaces, etc.
- .4 Follow electrical and structural drawings for details of this work and install electrical conduit, boxes and fittings to coordinate with existing architectural, structural and mechanical work and details. Existing building elements and site are to be measured for accurate building dimensions.
- .5 In order to provide sufficient detail and maximum degree of clarity on the drawings, symbols used for various electrical devices, particularly wall mounted devices, take up more space on the drawings than the device does on the wall. In these instances, locate device on wall with primary regard for convenience of operation and usage of wall space, rather than stringing devices out along wall so as to comply with scale locations of electrical symbols.

### **1.13 PROJECT RECORD DRAWINGS**

- .1 Refer to Division 1.
- .2 Contractor to furnish two sets of ozalid white prints to be used for record work as actually installed. Accurately record on this set of drawings, day by day, all outlets, conduits, luminaires and equipment as actually installed on the job. Any changes to contract work to be similarly recorded.
- .3 Contractor to record all circuit numbers and all conduits, feeders, junction boxes, etc., installed during the course of the project, whether or not such items were shown on the original contract documents. All home run conduit runs up to the respective panel boards for branch circuit lighting and power, all control conduit runs and junction boxes, from source to destination should be indicated in the record drawings.
- .4 Contractor shall record exact routing of conduits for all electrical and low tension systems with sizes in record drawings to Departmental Representative's satisfaction for transcribing into record drawings. Where multiple systems are included in one drawing, different colors shall be used to distinguish the representative system.
- .5 Contractor to update, delete, modify or add to the drawing, notes, schedules and as required, to accurately reflect site conditions.
- .6 Record drawings are to be updated continuously as work progresses. Record drawings must be made available to the Departmental Representative and Departmental Representative's representative for review as may be necessary to ascertain the appropriate level of detail is incorporated with the document. Where this review reveals that in the Departmental Representative's opinion progress of the record drawings, the Contractor shall update the drawings to the appropriate level prior to the next scheduled review.
- .7 Contractor shall pay for and may engage the Departmental Representative to transcribe all information from contractor submitted record prints, reviewed by the Departmental Representative to Autocad versions to submit to the Departmental Representative.

Contractor shall carry the cost for transcribing the record drawings to electronic copies in pdf, Autocad versions. Accuracy of these drawings shall be further verified by the Departmental Representative prior to final payment to the contractor. Costs for preparation of the asbuilt drawings described above to be included in the tender price.

#### **1.14 EXAMINATION OF SITE**

- .1 Refer to Division 0.
- .2 Before submitting tender, visit and examine the site and note all characteristics and features affecting the work. Report discrepancies to the Departmental Representative seven (7) days prior to tender closing. No allowances will be made for any difficulties encountered or any expenses incurred because of any conditions of the site or item existing, thereon, which are visible or known to exist at the time of tender. Failure to advise Departmental Representative of discrepancies will assume Trade Contractor accepts documents as presented without additional cost.

#### **1.15 CONFINED SPACES**

- .1 Unless otherwise prescribed by the Departmental Representative's workplace safety program, treat spaces not designed and constructed for continuous human occupancy as "confined spaces", including but not limited to:
  - .1 horizontal and vertical service spaces, shafts, and tunnels, manholes,
  - .2 inside of equipment which permits entry of the head and/or whole body, and
  - .3 ceiling spaces which are identified as containing a hazardous substance.

#### **1.16 TECHNICAL INFORMATION**

- .1 If Electrical Contractor requires detailed information regarding existing electrical equipment or systems he shall contact the Departmental Representative representative in writing detailing exact information needed, with ample lead time to respond.

#### **1.17 COORDINATION DOCUMENTS**

- .1 Where required, contractor is to prepare co-ordination drawings of installation to determine efficient use of available space, proper sequencing of work, protection of installed work in order to resolve conflicts.
- .2 After acceptance of coordination documents, reproduce and distribute copies as directed by the Departmental Representative.
- .3 Maintain coordination documents throughout construction period. Record changes due to modifications and adjustments.

#### **1.18 TEMPORARY USAGE**

- .1 New distribution equipment or electrical equipment used for any construction purposes shall have the manufacturer's warranty extended for a period of one year from date of substantial completion.

#### **1.19 SUBSTANTIAL COMPLETION**

- .1 Refer to Divisions 0 and 1.

- .2 Prior to a Substantial Completion review being done, Electrical Contractor to submit the following to the Departmental Representative:
  - .1 A complete list of outstanding work as assessed by Electrical Contractor on site. List to be detailed, accurate and shall list room by room, all work not yet complete.
  - .2 A completed substantial completion check list.
  - .3 Project Record drawings.
  - .4 A complete list of any material not on site to complete project.
  - .5 All test results.
  - .6 All electrical operation and maintenance data as specified.
  - .7 Transmittal letter signed by the Departmental Representative's authorized representative indicating all spare parts, tools, etc. turned over to the Departmental Representative, as required by the contract.
  - .8 Acceptable test results for the electrical systems signed off by the Departmental Representative.
  - .9 Checklists and certificates included in Appendix A.
- .3 A Substantial Completion review will not be done until all of this information is received.
- .4 The work will not be considered to be ready for use for the purpose intended, in other words substantially complete and 'C' schedules will not be issued unless the following requirements have been met:
  - .1 All the work called for in contract documents as well as the approved site instructions and change orders have been completed;
  - .2 All deficiencies have been corrected;
  - .3 All code requirements have been met;
  - .4 Systems' programming, adjusting, balancing, start-up and testing have been completed;
  - .5 All demonstrations, trainings and specified seminars have been completed;
  - .6 All documentation noted in item 2 has been completed;
  - .7 Certificate stating that penetrations through fire separations have been sealed with certified fire stopping materials in compliance with Alberta Building Code and Contract requirements, is issued by the construction manager and contractor;
  - .8 Where there are deficiencies existing that to the discretion of the Departmental Representative are not of life safety nature, contractor must obtain the Departmental Representative's sign-off on the list of such deficiencies confirming the Departmental Representative's approval of the Contractor's certificate of Substantial Performance. Submit this confirmation to the Departmental Representative;
  - .9 Certificate of inspection from AHJ is submitted;
  - .10 Certificate of Substantial Performance is issued by the Contractor and Delivered to the Departmental Representative;
  - .11 Obtain and submit a copy of the Departmental Representative's signed-off walk-through inspection.
  - .12 Signed off Checklists and certificates included in Appendix A.

## 1.20 PRACTICAL COMPLETION

- .1 Prior to the Trade Contractor requesting Practical Completion acceptance, Trade Contractor shall submit to the Departmental Representative the following:
  - .1 A written point-by-point list, indicating corrective action taken on each outstanding deficiency.
  - .2 Completed maintenance manuals with record drawings.
  - .3 Letter of warranty/guarantee.
  - .4 Commissioning Authority sign-offs.
  - .5 Departmental Representative's representative sign-offs where specifically requested in the contract documents.
  - .6 List of maintenance training/seminars conducted. Include transmittals signed by those present, topic and length of each seminar.

## 1.21 SHOP DRAWINGS

- .1 Refer to Division 1.
- .2 Immediately following award of contract provide a submittal schedule listing samples, shop drawings, mock-ups, etc. intended to be submitted for review. Include the anticipated date of each submission for each item.
- .3 Without a submittal schedule being submitted by the contractor and without the schedule being reviewed and agreed upon by the Departmental Representative, the shop drawings will not be reviewed. The submittal schedule shall include the specific item, specification & drawing reference, anticipated submission date and date the shop drawings are to be returned after review.
- .4 Submit shop drawings of all electrical components as required by Departmental Representative. Approval of shop drawings is for general design only and does not relieve Contractor and/or his supplier or manufacturer from complying with all requirements of drawings plans and specifications.
- .5 Shop drawings for complementary systems and/or equipment shall be submitted at the same time pertaining to each specification section. Partial submittals of related equipment will be rejected or held until all other related shop drawing information has been submitted (i.e. submit all shop drawings for power equipment at the same time). Submittals of shop drawings that are incomplete will be rejected.
- .6 Contractor shall be responsible for conforming to and coordinating dimensions of equipment with available room dimensions. Electrical equipment dimensions may vary between manufacturers, and therefore, before submitting the shop drawings, it is the electrical contractor's responsibility to verify that the proposed equipment will fit the allocated space. If any discrepancies exist, it shall be brought to Departmental Representative's attention during the shop drawings stage itself.
- .7 Departmental Representative will review shop drawings for the sole purpose of ascertaining conformance with general design concept of the project and with information given in Contract Documents. Departmental Representative's review of a separate item shall not indicate acceptance of an assembly in which the item functions.

This review by Departmental Representative shall not mean that Departmental Representative approved the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or his responsibility for meeting all requirements of the Contract documents as well as applicable federal and provincial/territorial laws, regulations and acts.

- .8 Contractor to take note that any shop drawing reviews required after the second review shall be at expense of Electrical Contractor.
- .9 Prior to submission, all shop drawings to be stamped, dated and signed by Contractor. Any shop drawings without submitted without review stamps by electrical contractor and construction manager shall be returned and will be considered as a second submission.
- .10 By approving and submitting stamped shop drawings, the electrical contractor and construction manager represents that field measurements, field construction criteria, material, catalogue numbers and similar data have been verified and that shop drawings have been checked and coordinated with requirements of the work and contract documents regardless of what the stamp disclaims. Note item 13 below detailing the contractor's responsibility on his shop drawing review.
- .11 Contractor's review of shop drawings shall be completed by the electrical sub-contracting firm and reviewed for general compliance by construction manager. Review shall be completed and review stamp shall be signed by a qualified person in electrical discipline by education and experience who is an employee of the electrical subcontracting firm. Proof of such qualification shall be submitted to Engineer within 2 weeks of his request. Shop drawings signed by a non-qualified person or an administrative assistant will be rejected.
- .12 Contractor to coordinate each shop drawing submission with requirements of the contract documents. Individual drawings will not be reviewed until all related shop drawings and product data is available.
- .13 Contractor to review shop drawings and assume responsibility for:
  - .1 Completeness - including all details specified.
  - .2 Dimensions, field measurements.
  - .3 Riser diagrams & Block diagrams
  - .4 Catalogue numbers and similar data.
  - .5 Conformance with contract documents.
  - .6 Colours.
  - .7 Site conditions.
  - .8 Interference with mechanical equipment including motor sizes and loads, equipment locations and connection points.
- .14 Shop drawing submissions to include:
  - .1 Name of Trade Contractor, Subcontractor, Sub-subcontractor, Supplier and Manufacturer.
  - .2 Specification and Section name
  - .3 Number of pages in the submittal
  - .4 Date and revision dates.

- .5 Project name.
- .6 All pertinent data.
- .7 Dimensions.
- .8 Connection details
- .9 Riser diagrams
- .10 Colour.
- .11 Specification section number.
- .12 Contractor's stamp.
- .13 A clear space of 100 mm x 75 mm on each sheet for placement of Departmental Representative's review stamp. Each sheet to be numbered sequentially.
- .14 Model and type numbers.
- .15 Shop drawings will not be reviewed if they:
  - .1 Are not clearly legible.
  - .2 Do not contain all information required above.
  - .3 Describe other products or models not applicable to this project.
- .16 Boiler plate copies of manuals or drawings shall not be accepted. Shop drawings to only contain information relevant and applicable to the system as covered in these documents. It is the responsibility of the contractor or his suppliers under the contractor's supervision to filter out the boiler plate documents, select the relevant pages, mark suggested products and submit such information only. Non-compliant suggestions will be rejected and the consequential delay shall be caught up with by the contractor.
- .17 Submit for review after the award of the contract, number of copies of shop drawings as specified in Division 1.
- .18 Include with shop drawing submittal, detailed pre-startup check lists, startup/post startup procedures and checklists for each piece of equipment and for each system.
- .19 Submit shop drawings on all wiring devices, relays and motor controls.
- .20 Do not release material or equipment for delivery to site until the Departmental Representative has reviewed applicable shop drawings and all applicable comments have been addressed in writing. Progress payments will not be released until shop drawing review process has been completed in a manner satisfactory to the Departmental Representative.
- .21 Do not resubmit shop drawings or parts thereof, which have previously received favorable review independently or as part of a resubmission. The entire package will be rejected if this requirement is breached.
- .22 Allow at least an average of ten days for the Departmental Representative to review each shop drawing submission. For submissions in excess of 50 pages, allow an extra day for each 20 pages or fraction thereof. Build the same in your construction schedule and plan accordingly.
- .23 Maintain on site, one complete indexed copy of all reviewed shop drawings.
- .24 Refer to technical specifications throughout for additional submittal requirements.

**1.22 ORDERING MATERIAL**

- .1 All materials to be ordered promptly upon award of Contract. Ordering of major materials with longer lead times shall be included in the construction schedule.
- .2 Shop drawings for materials with longer lead times shall be given utmost priority and shall be submitted for Departmental Representative's review in a timely fashion to suit the construction schedule. Refer Division 1 for requirement of construction and submittal schedules.
- .3 Material delivery date not to delay construction schedule. Material not to be accepted from suppliers who cannot meet specified date. When requested, provide evidence of ordering of material.

**1.23 CONTRACT BREAKDOWN**

- .1 Within 14 days after award of Contract, Contractor to submit a breakdown of Contract Price into divisions to the satisfaction of the Departmental Representative with aggregate of breakdown totaling total Contract amount. Breakdown will be used in computing of progress claims. Progress claims, when submitted are to be itemized against each item of the Contract breakdown. Contract breakdown to separately list material and labour for each item as listed herein:

- .1 mobilization
- .2 Fire alarm system
- .3 Conduit & wire
- .4 Luminaries
- .5 Fire alarm verification
- .6 Emergency lighting verification
- .7 O & M manual/training
- .8 Record drawings

**1.24 EQUIPMENT PROTECTION AND CLEAN-UP**

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

**1.25 TEMPORARY OR TRIAL USAGE**

- .1 Temporary or trial usage requested by the Departmental Representative of Electrical equipment supplied under contract shall not represent acceptance. Operate and maintain all equipment and systems during trial usage.
- .2 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

**1.26 MOUNTING HEIGHTS OF EQUIPMENT**

- .1 Mounting height of equipment is from finished floor to centre-line of equipment unless specified or indicated otherwise.

- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise:
  - .1 Local switches: 1200 mm.
  - .2 Receptacles:
    - .1 General: 400 mm.
    - .2 In mechanical rooms, other service rooms, shops, unfinished areas and the like: 1200 mm. Request clarification where uncertain.
- .4 Panelboards: as required by Code so that the highest circuit breaker is no more than 1.7 m above the finished floor. Request clarification in special cases when the height of panelboard is more than practical for the specified criteria.
- .5 Communications outlets: 450 mm.

#### **1.27 FIELD QUALITY CONTROL**

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a Provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being contracted.
- .3 Conduct and pay for all testing unless otherwise indicated.
- .4 Submit electrical forms in the prescribed format to all required systems. See Appendix A attached to the specification.
- .5 Submit checklists forms as a part of the close out documentation in the prescribed format to all required systems. All check lists must be completed and issued prior to Substantial completion request. See Appendix A attached to the specification.
- .6 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .7 Insulation resistance testing:
  - .1 Megger circuits, feeders and equipment up to 300 V with a 500 V instrument.
  - .2 The instrument shall be sufficiently large to thoroughly saturate the circuit under test.
  - .3 Check resistance to ground before energizing.
  - .4 Electronic instruments shall not be subjected to a megger test. Damaged electronic instrument(s) caused by megger test(s) shall be replaced at contractor's expense.
  - .5 Consider ambient temperature and weather conditions, and apply proper correction factors to the measured insulation resistance values.
- .8 When directed to do so, carry out tests in presence of Departmental Representative.

- .9 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .10 Complete all deficient items noted on reports provided by the local authority having jurisdiction.
- .11 Submit test results for Departmental Representative's review.
- .12 Include in the bid all costs associated with testing of systems required within the contract specifications by the manufacturer's factory representatives and providing certification. All documents in this regard must be included with the O&M Manuals.

### **1.28 FIELD REVIEWS**

- .1 The electrical subtrade bidding this project as well as its subcontractors shall be qualified firms with certified journeymen personnel with considerable experience in similar construction work.
- .2 The firms should have internal quality control methods in place to ensure their material is in compliance with the construction documents and their installation is in compliance with all applicable codes including but not limited to the Canadian Electrical Code, Alberta Building Code, Alberta Fire Code and all other codes and standards referenced in this specifications, and in the Canadian Electrical Code, Alberta Building Code and Alberta Fire Code applicable to different aspects of this project, and contract documents, prior to inviting the Departmental Representative for field reviews and witnessing verifications and tests.
- .3 Prior to each field review request, inspect all installations, identify and rectify all code deficiencies. Request field review in writing. Indicate in the request that such quality control has been performed and identify the name and rank of the person performing such quality control. Submit reports mentioned in the other sections of this specification with the request for filed review.
- .4 Field reviews will be conducted for this project at various rough-in stages as agreed with construction manager, progress stages, fire alarm verification, substantial completion and final completion and warranty. Refer Division 1 for details.
- .5 Costs for additional field reviews, where necessary due to deficiencies, additional supervision of Contractor's work quality and the like to the discretion of the Departmental Representative, shall be paid by the contractor, at no extra cost to the Departmental Representative, at cost plus at the hourly rate of the Departmental Representative's staff member performing the field review.

### **1.29 CONDUIT SLEEVES**

- .1 Provide conduit sleeves for all conduit and wiring passing through rated walls and floors. Sleeves to be concentric with conduit or wiring. Coordinate with structural and construction manager.
- .2 Except as otherwise noted conduit sleeves are not required for holes formed or cored in interior concrete walls or floors.
- .3 Conduit sleeves shall extend 50 mm above floors in unfinished areas and wet areas and 6 mm above floors in finished areas.
- .4 Conduit sleeves shall extend 25 mm on each side of walls in unfinished areas and 6 mm

in finished areas.

- .5 Conduit sleeves shall extend 25mm beyond exterior face of building. Caulk with flexible caulking compound.
- .6 Sleeve Size: 12 mm clearance all around, between sleeve and conduit or wiring.
- .7 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.
- .8 Packing of Sleeves:
  - .1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and conduit shall be caulked with waterproof fire retardant non-hardening mastic.
  - .2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

**1.30 EQUIPMENT INSTALLATION**

- .1 Provide means of access for servicing equipment.
- .2 CSA identification and equipment labels to be clearly visible after installation.

**1.31 FIRE WATCH**

- .1 The owner will provide fire watch services during times where the fire alarm system or portion there-off is required to be off line for the execution of the contract only. Work to be phased to keep fire watch requirements to a minimum of duration, and not during weekends. Should a fire watch be required, provide a minimum of 4 days advance notice the the departmental representative. Fire watch devices must the approved by the Departmental representative in writing. Departmental representative reserves the right to re-schedule the fire watch requirements to accommodate the operational requirements of the building.
- .2 Where a fire watch is required due to Hot Permit work it will be the responsibility of the contractor to provide the necessary personnel at his own cost to satisfy the fire watch requirements of the building operator.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                INTENT**

- .1     Provide all labour and materials required to complete electrical work. Misinterpretation of any requirements of either drawings or specifications shall not relieve Electrical Contractor of responsibility to complete the work. Where required written confirmation to be obtained from the Departmental Representative prior to submitting tender.
- .2     Where specification and drawings conflict, the Contractor shall formally request clarification seven (7) days prior to tender closing. Otherwise the Contractor shall allow the most expensive solution within the tendered scope.

**1.2                SETTING OUT OF WORK**

- .1     Contractor to lay out work, do all necessary leveling and measuring. Figures, full size and detail drawings to take precedence over scale measurements of drawings. No plea as to action or direction other than provided by the Departmental Representative will be admitted in justification of any error in construction where departure is made from the drawings, specifications or contract. Electrical Contractor responsible to take his own measurements for work.
- .2     Correct work completed contrary to the intent of the drawings and specifications and bear all costs for same. Where intent of the drawings and specifications is not clear, obtain clarification from the Departmental Representative before proceeding with work. Provide prompt installation of work when coordinating with other trades as in advance of concrete pouring or similar work. Provide sleeves and locate them for contractor.
- .3     Where equipment supplied by Contractor must be built-in with work of other trades, supply equipment to be built-in or measurements to allow necessary openings to be left so as not to hold up work.
- .4     Contractor to be responsible for any damage caused by improper location or carrying out of his work.
- .5     Make reference to electrical, and structural drawings when setting out work. Obtain field dimensions to verify. Consult with respective trades in setting out locations for conduit runs, luminaires, panel assemblies, etc., so that conflicts are avoided and symmetrical even spacing is maintained.
- .6     Layouts shown for in the layouts are for estimating purposes only. Coordinate installation of equipment, outlets and equipment with final room equipment layout as established by Contractor.
- .7     Coordinate and agree layout of electrical system installation with the Departmental Representative prior to setting out of the electrical equipment within the rooms and substations. Sizes of electrical equipment such as branch circuit panels, etc. may vary between manufacturer's. Prior to submitting the shop drawings for electrical and stand-by power distribution system from the proposed manufacturer, ensure that the proposed gear fits within the allocated space shown in the drawings. It is required that the electrical layout be laid out to maximize space for future installation. Contractor may submit the proposed layout to accommodate the above requirements for Departmental Representative review prior to proceeding with the rough-in of conduits and tray systems for feeders.

**1.3 EXAMINATION OF SITE**

- .1 Visit site and thoroughly investigate locations, connections and details of all services and systems which in any way affect or tie-in with work of these specifications and drawings.
- .2 No extras will be allowed for work resulting from conditions which would have been evident upon a thorough examination of the site.
- .3 Notify Departmental Representative, in writing, of any discrepancies or points of doubt or contention.

**1.4 EXCAVATION AND BACKFILLING**

- .1 Provide all excavation, sand leveling and bedding for electrical installation.
- .2 Supervise all backfilling of electrical services and underground conduit runs.
- .3 All concrete work directly related to the electrical installation including housekeeping bases, curbs, conduit encasement etc. are required to be provided to meet the design intent.

**1.5 CUTTING AND PATCHING**

- .1 Contractor to be responsible for all cutting required for electrical installation. Structural members not to be cut without the consent of the Structural.
- .2 Contractor to be responsible for patching and repairing of surfaces damaged by cutting for electrical work. Finishes to match existing in appearance and quality.
- .3 Where work by Contractor damages work of other trades, Contractor to repair and make good such damage to the satisfaction of the trade concerned and the Departmental Representative.

**1.6 ACCESS DOORS**

- .1 Number of access doors to be kept to an absolute minimum and to be used only with permission of the Departmental Representative. Contractor to supply all access doors required for access to electrical components or boxes.
- .2 Access doors to be installed by trades into whose work the doors are to be located in.
- .3 Where access is required to pullboxes, and junction boxes, these boxes to be located in removable type ceiling areas where possible or adjacent to recessed luminaires.
- .4 Where it is absolutely impossible to service certain equipment through removable type ceilings or recessed luminaires and where special permission has been obtained from the Departmental Representative, Contractor to supply and install access doors required for servicing of such work. Access doors to be complete with necessary frames and hinged doors held closed with captive type studs. Access panels to be of not less than 14 gauge steel, prime coated and painted on the job to match the wall or ceiling finish.
- .5 Access doors to be ULC fire rated where installed in fire rated assemblies.
- .6 Minimum size to be 610 mm by 610 mm.

**Part 2            Products**

**2.1                NOT USED**

**Part 3            Execution**

**3.1                NOT USED**

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 This section describes criteria and content for the Electrical Operations and Maintenance Manual. The items described are supplementary to the requirements specified in Division 1.
- .2 Allow for within the bid and pay for rendering the services of a specialist to complete the electrical system O&M manuals as required within the contract documents.
- .3 Include signed-off copies of all testing & commissioning, witnessing and sign-offs by Departmental Representative for various systems detailed in the specifications.

**1.2 SCOPE**

- .1 Scope will include:
  - .1 The supply and preparation of four (4) sets of O&M manual binders and tabs.
  - .2 The preparation of all written system descriptions and schematics (neatly drafted) for each tab section. Format as directed by the Departmental Representative, utilizing proportional typewritten format, with schematics in appendices at the end of each section. System description shall include an overview of basic design philosophy, description of future expansion capability, general construction of components, electrical characteristics not readily deduced from the contract documents, basic system configuration and interfaces with other systems existing or new.
  - .3 Securing and assembling all necessary literature describing operational and maintenance procedures for all equipment into the O&M manual binders, including Preventative Maintenance data as described below. Preventative maintenance data and maintenance suggestions to be compiled in tabular format in applicable section to provide a comprehensive overview of maintenance procedures.
  - .4 Preparing in coordination with Electrical Contractor and equipment manufacturer's technical specialist, scheduled maintenance sheets and check lists. Scheduled maintenance sheets shall include safety in maintenance data plus detailed daily, monthly and yearly scheduled maintenance information. Format as directed by the Departmental Representative.
  - .5 Preparation of safety in maintenance suggestions and procedures.
  - .6 Summarized daily, monthly and yearly maintenance charts.
  - .7 Prestonia No. 2047-10 plastic sheet protectors for all drawings larger than 210 mm × 275 mm. Locate drawing title block on lower right hand corner.
- .2 Contractor shall be responsible for:
  - .1 Supplying Four (4) copies of all information as described below:
    - .1 Final shop drawings.
    - .2 All wiring diagrams.
    - .3 List of all major trades, sub-trades and suppliers including names of equipment supplied and by whom, addresses, phone numbers, facsimile numbers and contact persons.

- .4 Obtaining all data necessary to compile a complete comprehensive Preventative Maintenance program. Data gathered shall be neatly handwritten on forms provided by the Departmental Representative. Data to be collected for all systems described in the index below.
- .5 Spare/replacement parts lists for all of the above. Copies of the electrical contractor's data collection sheets available during tendering period when requested.
- .6 Test results as outlined in other sections of this specification.

### **1.3 SUBMITTALS**

- .1 Contractor to submit complete system description and schematics by 50% complete stage of construction. O&M manuals to be submitted to the Departmental Representative 90% complete three (3) months prior to substantial completion inspection.
- .2 Contractor to provide sample of art work and fabric cover (before having binders constructed) to the Departmental Representative.

### **1.4 OPERATIONS AND MAINTENANCE MANUAL FORMAT**

- .1 Hard Copy Format
  - .1 Electrical O&M manuals to be assembled in 210 mm × 275 mm capacity, expanding spine catalogue binders complete with plated piano hinges, bound in heavy
  - .2 Red fabric; refer to Division 01 for complete requirements. Electrical contractor to provide sufficient quantity to allow all binders to hold system data while in full closed position (not expanded).
- .2 Electronic Format
  - .1 In addition to the specified hardcopy, provide an electronic copy in pdf format. Electronic copy to be produced on a CD-ROM in the latest version of Acrobat.
  - .2 The electronic format shall include Autocad versions of the project as built drawings
  - .3 CD-ROM to be reproducible by Departmental Representative as required to carry out his duties.
  - .4 Electronic copy to consist of a single .pdf file divided into chapters to allow a quick and easy access to the different sections of the manual.
  - .5 All log sheet, maintenance tables preventative maintenance sheets intended to be completed by the Departmental Representative are to be completely interactive allowing the Departmental Representative to complete all pertinent information and save, print or modify these forms as required.

### **1.5 MANUAL SYSTEM CATEGORIES**

- .1 Organize manual into the following major system categories:
  - .1 Emergency Lighting
  - .2 Exit Luminaires
  - .3 Interior lighting
  - .4 Fire alarm system
  - .5 Main control panel
  - .6 Annunciators

- .7 Ancillary devices
- .8 Battery backup
- .9 Devices
- .10 Sequence of operation
- .11 Interface with other systems
- .12 Block diagrams
- .13 Riser diagram
- .2 Provide master divider tabs and index for each major system category, with white tabs, 75 mm in length.

## **1.6 SUB-SYSTEM DIVISIONS**

- .1 Divide major system categories into subsystems as follows:
  - .1 FA – Fire Alarm Systems:
    - .1 XXXX
    - .2 XXXX

## **1.7 OPERATIONS SECTION**

- .1 In each system or category and/or subsystem, include an operations section which includes:
  - .1 System Description
  - .2 System Operating Instructions
  - .3 Schematic Diagrams
  - .4 Equipment Data Sheets
- .2 System Descriptions: prepare descriptions which , at least, includes the following:
  - .1 Fire Alarm System - FA:
    - .1 Overview of the fire alarm system
    - .2 Single line diagram of entire system panels, annunciators and devices.

## **1.8 SYSTEM OPERATING INSTRUCTIONS**

- .1 Prepare system operating instructions, with the Manufacturers' and Suppliers bulletins as backup. Provide the following:
  - .1 Power Distribution System - PDS:
    - .1 Provide an overall description of operation of power system in both normal and emergency mode.
    - .2 Protective schemes such as overcurrent, short circuit, undervoltage, ground fault, including lock out and restraint as applicable.
    - .3 Transfer schemes both normal and emergency.
    - .4 Stand-by power generation, including ATS sequencing for major loads during power outage and emergency conditions.

## **1.9 SYSTEM SCHEMATICS**

- .1 Include all schematics that are applicable, which will assist in operation and maintenance of system.

### **1.10 EQUIPMENT IDENTIFICATION**

- .1 Provide data for each component of the system.
- .2 The Departmental Representative will supply one reproducible copy of forms requested by the Contractor for use on the project.
- .3 The Contractor shall produce all necessary equipment identification forms not included.
- .4 The Departmental Representative will transform Departmental Representative produced forms in the Department format and will provide one reproducible copy to the Contractor.
- .5 Equipment Identification forms are only required for Power Distribution System equipment.

### **1.11 MAINTENANCE SECTION**

- .1 General:
  - .1 Summarize data for this section from Contractor supplied maintenance submissions, supplemented by any additional appropriate data.
  - .2 Include maintenance as a section of each system.
  - .3 Organize data into sections, with divider tabs as follows:
    - .1 Maintenance Tasks and Schedules
    - .2 Spare Parts
    - .3 Suppliers and Contractors
    - .4 Tags and Directories
    - .5 Maintenance Brochures
  - .4 Maintenance Tasks and Schedules:
    - .1 Organize data according to system category, with further breakdown into individual systems as used in operations division of the manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from maintenance manufacturer's brochures, for each component of system in following format:
      - .1 Daily
      - .2 Weekly
      - .3 Monthly
      - .4 Semiannually
      - .5 Annually
      - .6 When required
- .2 Spare Parts List:
  - .1 Organize data according to system category, with further breakdown into individual systems as used in operations division of manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from maintenance manufacturer's brochures, for each component of system.
- .3 Suppliers and Contractors List:
  - .1 Provide summary of suppliers and contractors for each component of the system. List name, address and telephone number of each.
- .4 Tags and Directories:

- .1 Provide a copy of tags and directories as specified in Contract Documents.
- .5 Maintenance Brochures:
  - .1 Include copies of all manufacturers' printed maintenance brochures pertaining to each product, equipment or system. Provide section index and divider tabs. Maximum of twenty-five sheets or one brochure per tab.

## **1.12 CONTRACTS DOCUMENTS AND STANDARDS SECTION**

- .1 Coordinate collection of data required for this section.
- .2 Organize all data required by Construction Contract into sections, with divider tabs, as follows:
  - .1 Drawing List
  - .2 Shop Drawings and Product Data
  - .3 Certificates
  - .4 Warranties and Bonds
  - .5 Reports
  - .6 Standards Division
- .3 Drawing List: provide a list of all drawings required for performance of construction contract.
- .4 Shop Drawings and Product Data: provide final copies of all shop drawings and product data required by the Contract Documents. Include section index and divider tabs. Maximum of twenty-five sheets or one shop drawings per tab.
- .5 Certifications: provide copies of contractor certifications for the performance of the product and systems, and test reports verifying performance of products and systems. Include section index and divider tabs with maximum of twenty-five sheets or one report per tab. This should include, but not be limited to the following:
  - .1 Electrical systems inspection.
  - .2 Occupational Health and Safety inspection.
  - .3 Any other certificates required under individual Specification Section for any system.
- .6 Warranties and Bonds: include one copy each of the Contractor's warranty, manufacturers' warranties longer than one year, bond, and any service contract provided by Contractor. Provide section index.
- .7 Reports: include copies of all reports relating to the testing, adjusting and balancing of equipment and systems, as required by the contract specification Sections 26 08 10. Include section index and divider tab for each report.
- .8 Standards Division: allow 25 mm binder space for standards.

## **1.13 OVERVIEW TO OPERATION AND MAINTENANCE MANUALS**

- .1 Refer to Section 26 05 00.25, Equipment and Systems Demonstration and Instruction.

**Part 2            Products**

**2.1                NOT USED**

**Part 3            Execution**

**3.1                NOT USED**

**END OF SECTION**

**NOTES**

\* = WHERE APPLICABLE

**ELECTRICAL O&M MANUAL**

← LEC06  
 FORMAT TYPE "A" BINDERS. 240mm X 290mm EXPANDING BINDERS C/W PLATED PIANO HINGES, STAMPED LETTERING (WORDS AS PER OWNER). PROVIDE FINISHED BINDERS IN NON-EXPANDED STATE.  
 --O&M MANUAL TO BE PREPARED BY A SPECIALIZED DOCUMENTATION AGENT.

TITLE PAGE

WHITE TAB

**ELECTRICAL SYSTEMS INDEX AND INTRODUCTION**

- GRAPHIC O&M MANUAL STRUCTURE.
- TABLE OF CONTENTS FOR ALL ELECTRICAL O&M MANUALS.
- DETAILED WRITTEN MANUAL INTRODUCTION.
- SCHEDULED MAINTENANCE SUMMARY CHART COMPILED FROM EACH SECTION.
- WARRANTY/SCHEDULEC MAINTENANCE LOG SHEET (SAMPLE PROVIDED).
- WARRANTY/SCHEDULEC MAINTENANCE LOG SHEET (BLANK).

WHITE TAB

**CONSULTANT/CONTRACTOR/SUPPLIER LIST**

- NAMES, ADDRESSES, PHONE/FAX NO., LIST FOR EACH.

RED TAB

**SAFETY IN MAINTENANCE**

- DETAILED SUGGESTIONS AND PROCEDURES INCLUDING A DETAILED LOCKOUT/TAGOUT PROGRAM.

GREEN TAB

**CONTRACTOR WARRANTY/GUARANTEE CERTIFICATES**

- WARRANTY LETTERS, INSPECTION AUTHORITY REPORTS.

**P.D.S. 1.0 POWER DISTRIBUTION SYSTEMS**

→ ORANGE TAB

SUBSECTION - P.D.S. 1.1  
 ORANGE TAB

**SYSTEM #1 OPERATIONS, DESCRIPTIONS**

- DETAILED WRITTEN DESCRIPTION, INCLUDING EQUIPMENT DETAILS, LOCATIONS, AND SCHEMATICS.
- \* CONTROL DESCRIPTION/SCHEMATICS.
- \* OPERATIONS DESCRIPTION

RED TAB

**MAINTENANCE**

- SCHEDULED MAINTENANCE PROCEDURES.
- SAFETY IN MAINTENANCE PROCEDURES.
- \* DAILY, MONTHLY, WEEKLY, BI-YEARLY, YEARLY CHECKLISTS AND CHECKLIST CHARTS FOR EACH PIECE OF EQUIPMENT.
- \* MANUFACTURER SCHEDULED MAINTENANCE CHARTS & CHECKLISTS.
- \* WIRING DIAGRAMS/SCHEMATICS.
- \* SPARE PARTS LIST.
- \* CONTRACTOR PREPARED DATA COLLECTION SHEETS

BLUE TAB

**COMPONENTS**

- \* DETAILED MANUFACTURER COMPONENT DATA.
- \* DIRECTORIES.
- \* SCHEDULES.

YELLOW TAB

**DOCUMENTS, SHOP DRAWINGS**

- SHOP DRAWINGS.

GREEN TAB

**TEST RESULTS**

- \* MANUFACTURER'S TEST RESULTS, CERTIFICATION AND WARRANTY
- \* CONTRACTOR'S TEST RESULTS

**L.T.G. 2.0 - LIGHTING SYSTEMS**

← GREY TAB

**F.S.S. 3.0 - FIRE SAFETY SYSTEMS**

← RED TAB

**C.T.L. 4.0 - COMMUNICATIONS AND LOW TENSION SYSTEMS**

← GREEN TAB

**ESK-01**

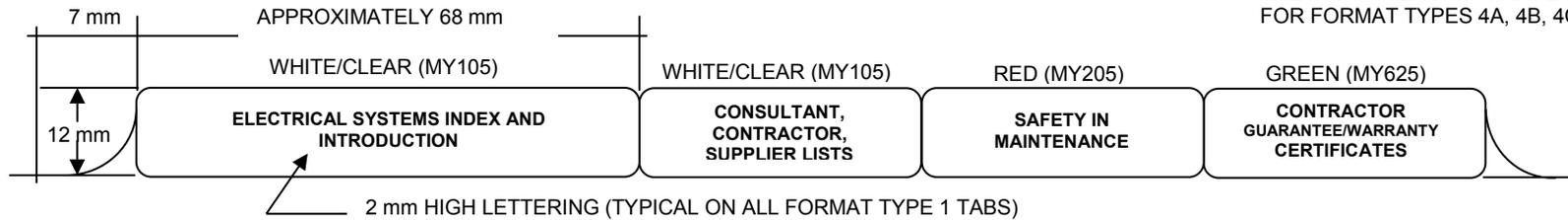
**GRAPHIC OPERATIONS & MAINTENANCE MANUAL STRUCTURE**

# ELECTRICAL O & M MANUAL – LAMINATED MYLAR TAB FORMAT

## FORMAT TYPE 1 – LAMINATED MYLAR TABS

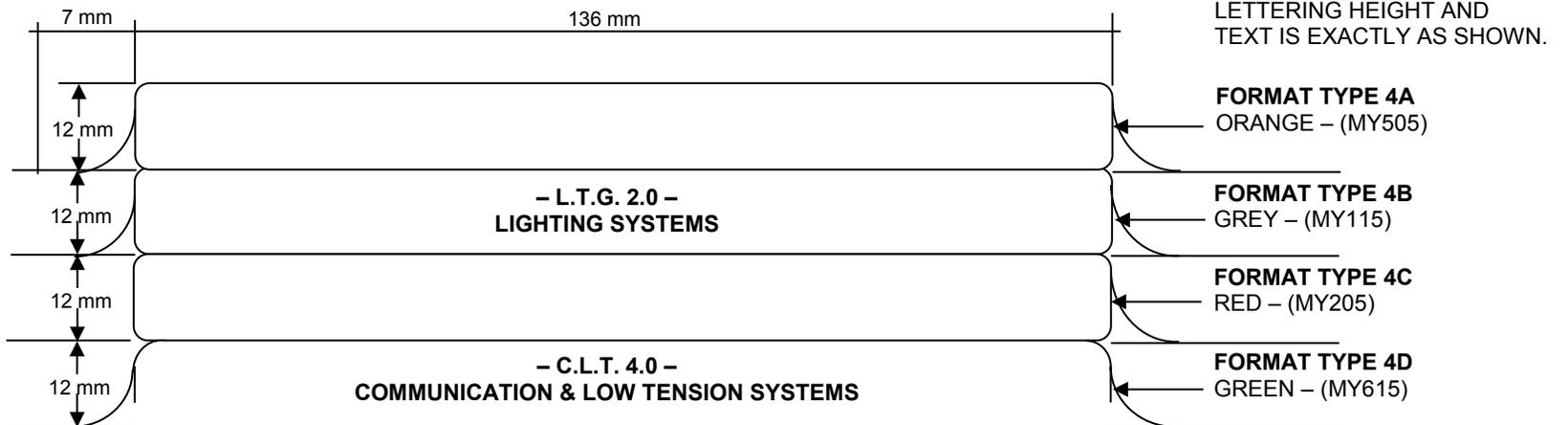
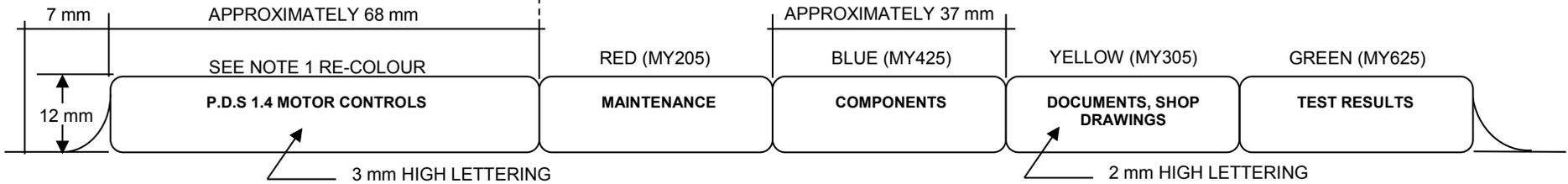
\*NOTE 1\*

FORMAT TYPE 2  
SUBSECTION TABS TO MATCH IN COLOUR  
THE MAJOR SECTION TABS LISTED BELOW  
FOR FORMAT TYPES 4A, 4B, 4C & 4D.



## FORMAT TYPE 2

## FORMAT TYPE 3 – LAMINATED MYLAR TABS



ESK-02

**Part 1 General**

**1.1 SUMMARY**

.1 Intent

- .1 Provide demonstration and instruction sessions to familiarize the Departmental Representatives operation and maintenance personnel with electrical systems and their operation and maintenance.

**1.2 RELATED REQUIREMENTS**

- .1 Equipment and System Demonstration and Instruction Division 1

**1.3 MANUFACTURER'S SITE SERVICES**

- .1 Arrange and pay for appropriately qualified manufacturer's representatives (Fire Alarm System) to provide or assist in providing electrical equipment and systems demonstration and instruction seminars for systems specified in this Section.

**1.4 DEMONSTRATION AND INSTRUCTION SEMINARS**

- .1 Provide Operator Training Seminar(s) including content specified herein and by Division 1.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 SYSTEM AND EQUIPMENT DEMONSTRATIONS AND INSTRUCTION SEMINARS**

- .1 Provide demonstration and instruction seminars for the following equipment and systems identified. Include in demonstrations and instruction seminars, the information specified for each piece of equipment and system.
- .2 Training seminars shall be a combination of classroom session and "hands-on" field demonstrations.
- .3 Some systems may require two independent seminars, one for the maintenance staff and on seminar for the user groups. Accommodate split seminars as required.
- .4 Times indicated for each seminar are approximate only and may be adjusted by the Departmental Representative or his representative as required.
- .5 Fire Alarm System (By Manuf. Rep.)

Time Allotted: 4 hours

- .1 Alarm silence.
- .2 Trouble conditions, alarm and silence.
- .3 Annunciator and control panel operation.

- .4 Mechanical systems control.
- .5 Control panel module replacement.
- .6 Alarm Alarm lamp replacement.
- .7 Power supply.
- .8 Sequence of operation under alarm conditions:
  - .1 First stage
  - .2 Second stage
  - .3 Central station tie-in
  - .4 Sprinkler system interface
  - .5 Fan shutdown
  - .6 Fire damper interface
  - .7 Troubleshooting procedures.
  - .8 Maintenance requirements and procedures.
  - .9 Spare parts.
- .6 Lighting: Time Allotted: 1 hours
  - .1 Interior/Exterior Lighting:
    - .1 Description of each luminaire with respect to lamp and ballast or any other special features:
      - .1 Troubleshooting procedures.
      - .2 Maintenance procedures.
      - .3 Re-lamp schedules.
      - .4 Spare parts.
    - .2 Emergency Lighting Battery Units and Exit Lights:
      - .1 Troubleshooting procedures.
      - .2 Maintenance procedures.
      - .3 Spare parts.
- .7 Site Tours
- .8 Provide a series of walk through Contractor guided tours of facility to allow operators to familiarize themselves with the buildings electrical systems.
- .9 Coordinate timing of tours with the Departmental Representative. Allow for tours at approximately the following times.
  - .1 90% complete stage. Three weeks prior to Interim Acceptance of the work.
  - .2 At substantial completion acceptance of the work.
- .10 Contractor shall generate respective sign-in sheets during the demonstation and training sessions for each system. Obtain sign-off from authorized representatives stating that the requirements are met. Include in O&M manuals and close out documentation.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        This section will describe the different types of cables and conductors to be used for voltage level from 50 to 750 VAC.
- .2        Power cables where indicated on the drawing shall be Copper RW90 in rigid PVC, rigid metal or EMT conduits as required by the drawings and Codes. Alternatively, PVC Jacketed Teck 90 Armored cables with interlocking aluminum armour and integral ground conductors in cable trays could also be installed coordinating the routing and spatial requirements with other disciplines.
- .3        Refer to the requirements of Alberta Building Code, Canadian Electrical Code all applicable Codes, local AHJ ordinances and bulletins and include for provisions for providing fire rating of conductors for all life safety system cables within stacked electrical and communication riser rooms.
- .4        The cable sizes given within drawings are based on CEC 2015 using copper conductors. Contractor shall review and resize the feeder conductor and conduits based on the actual routing to ensure that the voltage drop do not exceed 2% from the service connection point to any branch circuit panel within the project in accordance with AI technical design guidelines.
- .5        Aluminum cables for feeders are not permitted in this project.

**1.2                REFERENCES**

- .1        Contractor and manufacturers shall comply with the latest edition of the below codes and standards.
- .2        CSA C22.2 NO. 38-14, Thermoset Insulated Wires & Cables
- .3        CSA C22.2 NO. 239-17, Controls and Instrumentation cables
- .4        CSA-C22.2 No 0.3 (R2014) Test Methods for Electrical Wires and Cables.

**1.3                QUALITY ASSURANCE**

- .1        Insulation resistance testing using a calibrated Megger using 500 volts DC voltage between phases and to ground to be performed on all 208 volts feeders prior to energization.
- .2        Insulation resistance testing on as noted above shall be recorded by the contractor in a standard format and included within the documentation and operating and maintenance manuals.
- .3        Insulation resistance of all branch circuits in the building areas shall be tested to requirements as detailed in Section 26 08 00.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Building Wires:

- .1 All interior building wiring to be 98% conductivity copper, with 600-V RW90 XLPE insulation unless specified otherwise using conduit and wires.
  - .2 For this project, feeder conductors will be sized by the Departmental Representative based on copper.
  - .3 Conductors: Copper, stranded for 10 AWG and larger. Minimum size is #12AWG
  - .4 Branch Circuit Wiring: conductors smaller than #12 AWG not permitted for 120V lighting, power or motor branch circuits and control wiring.
- .2 Teck Cables:
- .1 Cable: to CAN/CSA-C22.2 No. 131.
  - .2 Conductors:
    - .1 Grounding conductor: copper.
    - .2 Circuit conductors: copper, size as indicated.
  - .3 Insulation: Cross-linked polyethylene type RW90 XLPE, 600V for 120/208V system and 1000V for 347/600V system.
  - .4 Inner jacket: polyvinyl chloride material.
  - .5 Armour: interlocking galvanized steel.
  - .6 Overall covering: thermoplastic polyvinyl chloride material.
  - .7 Fastenings:
    - .1 One hole malleable iron straps to secure surface cables 53 mm and smaller. Two hole steel straps for cables larger than 53 mm.
    - .2 Channel type supports for two or more cables at 1500 mm centers.
    - .3 Six mm diameter threaded rods to support suspended channels.
  - .8 Connectors: Watertight approved for TECK cable.
  - .9 Install Teck cables within cable trays.
- .3 Armoured cables:
- .1 Conductors: insulated, stranded copper, type THHN 90°C rated. Minimum size to be #12 AWG.
  - .2 Bonding conductor shall be the same size as the current carrying conductors. Green insulated copper running with the line conductors in the same cable assembly. Insulation shall be the same as for line conductors. Bare bonding conductor is not acceptable.
  - .3 Fillers shall be non-hygroscopic and non-wicking. Core binder shall be corrugated polyester.
  - .4 The metal sheath shall be galvanized steel or aluminum. The metal sheath shall be extruded onto the cable or applied longitudinally, then wrapped and welded. The sheath shall then be corrugated for greater flexibility.
  - .5 Jacketing: When PVC jacketing is required, the jacket shall be flame-retardant PVC with a temperature range of -40°C to 90°C.
  - .6 Fittings shall be UL listed and identified for such use with metal clad continuous corrugated sheath cable, with or without PVC jacketing, as is appropriate for the installation.

- .7 Connectors shall be of steel or malleable iron and shall be a squeeze type clamp connector with a locknut for non-jacketed metal clad cable. Compression gland type connectors shall be used for jacketed metal clad cable.
- .4 Other armored cables:
  - .1 Conductors: insulated, copper, size as indicated. Minimum size to be #12 AWG.
  - .2 Type: AC90.
  - .3 Armour: interlocking type fabricated from aluminum strip.
  - .4 Connectors: Standard or watertight to suite environment and approved for AC cable.
- .5 Control Cables:
  - .1 Conductors: Multi-conductor, PVC insulated, PVC jacketed, copper, unshielded pair, overall shield, minimum size to be #16 AWG.
  - .2 Insulation: 105°C Flame retardant PVC.
  - .3 Aluminum foil/polyester shield with tinned copper drain wire.
  - .4 Jacket to be UL listed, sunlight and moisture resistant, sequentially marked, nylon ripcord for jacket removal.
  - .5 Conductors are to be black/white number coded, rated for 300V at 105°C.
  - .6 Standard of Acceptance: Nexans Instrumentation Cable Type PLTC or approved equal.
- .6 Grounding and bonding conductors shall be Class B stranded insulated copper conductor of sizes indicated and required by the Canadian Electrical Code.
- .7 For wiring of control circuits in custom enclosures use extra flexible (minimum 21 strand) RW90 wiring.
- .8 Use TBS 90 #14 AWG wiring to be used in switchgear assemblies.
- .9 AC90 cabling: minimum number and size of conductors to be as for conductors installed in conduit.

## **2.2 ACCESSORIES**

- .1 All terminations for main power conductors shall be made using hydraulically crimped long barrel lugs.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 General
  - .1 Conductor length for parallel feeders to be identical. Provide permanent plastic nametag indicating load fed.
  - .2 Lace or clip groups of feeder conductors at all panelboards, pullboxes, and termination points.
  - .3 Where feeder cables are installed in conduit each conduit to be identified with Lamacoid nametag engraved with identification of equipment being fed. Tag to be fastened to cable using UV resistant or stainless steel wraps. Provide nametag at either end of the conduit where it enters the respective panel.

- .4 All grounding and bonding conductors and straps to be copper. All ground and bonding conductors to have green insulation jacket.
- .5 The number of conductors combined in a homerun not to exceed that shown on the drawing, where indicated in drawings.
- .6 Each conductor is to be identified at each end where they are spliced or terminated in a pullbox, panel, fitting, or device. Conductors that pass through a pullbox are to be identified in that box. The identification tag shall show the panel designation and circuit number or wire number on each conductor.
- .7 At all panels and enclosures where devices are mounted on hinged covers install 21-strand flexible conductors from bottom of cabinet to top of cabinet at fixed hinge side of door. Loop wiring back down the moveable hinge side of door to provide full 90° opening capability without unduly straining the wiring.
- .8 Current transformer secondary wiring shall be #12 AWG stranded. Current transformer leads shall incorporate ring type tongues for termination purposes.
- .9 Separate bonding conductors are required for all feeder cabling and branch circuits unless otherwise specifically permitted.
- .2 Installation of Building wires:
  - .1 Install wiring as follows:
    - .1 In conduit systems in accordance with Section 26 05 34.
    - .2 Do not splice the wiring between three and four way switches inside the luminaire enclosures.
    - .3 Minimum wire size for receptacles in parkade areas is #12 AWG copper.
    - .4 Separate neutral and ground wires to be provided for circuits.
- .3 Installation of Teck cables:
  - .1 Install cables in cable trays, trenches or support racks.
  - .2 Terminate cables using approved cable glands suitable for TECK 90 cables in accordance with manufacturer's recommendation.
  - .3 Provide rigid PVC conduit sleeve, minimum size 53 mm or larger if so required by code, for all Teck cable running under finished surfaces such as asphalt, concrete, tile and the like.
- .4 Installation of Armoured Cables (AC90):
  - .1 Armoured cables is only allowed for:
    - .1 Luminaire drops;
    - .2 AC90 cable may be utilized only for recessed T-bar luminaire drops from ceiling mounted outlet boxes, maximum distance of 3 meters..
    - .3 For recessed fluorescent luminaires in acoustic ceiling provide sufficient AC90 cable and/or flexible conduit to allow luminaires to be relocated minimum of 1.5 metres in any direction.
    - .4 Each individual luminaire to be serviced by an individual AC90 cable drop from the associated junction box in the ceiling space.
    - .5 Where the contractor demonstrates that conduit installation is impractical; and
    - .6 Other applications specifically indicated elsewhere within the contract documents.

- .2 Group cables wherever possible.
- .3 Terminate cables in accordance with manufacturer's recommendation.
- .4 Do not use for any other areas outside the residential suite areas of the project except as noted in item 1.
- .5 Installation of Control Cables:
  - .1 Install control cables in conduit
  - .2 Ground control cable shield.
  - .3 All costs associated with the supply and installation of low voltage control wiring for 50V and under and related materials to be carried by Divisions 23 and 20 unless otherwise noted in the project documents.
  - .4 Provide line voltage control wiring, raceway and terminations. Coordinate with Divisions 23 and 20 at the time of tender and bid accordingly. Failed to do so, provide all necessary whatsoever at no extra cost.

### 3.2 VOLTAGE REGULATION

- .1 The drawings indicate the general routing of conduit runs and not exact routing, either horizontally or vertically.
- .2 Feeder conductor sizes selected shall be minimum as given in the conductor schedule or may be larger based on the routing of conduit and run lengths. Perform voltage drop calculations if it exceeds the permitted lengths noted in the single line diagram.
- .3 Branch circuit conductor sizes shall be #12 AWG or larger based on the routing of conduit and run lengths, in order to comply with the ASHRAE 90.1 voltage drop requirements for branch circuits.
- .4 All voltage drop calculations to be based on the Canadian Electrical Code (CEC), Part I, and utilizing a current of 80% of the circuit protective device specified.
- .5 When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop (based on 80% of circuit protective device) does not exceed 3%. Increase wire size from #12 AWG, if necessary, to ensure that the 3% voltage drop is not exceeded.
- .6 Reference conductor length schedule for project areas are given below..

#### Maximum One-way Length of Run

Conductor	120 Volts	347 Volts
#12	20 m	65 m
#10	30 m	105 m
#8	50m	175 m
#6	90 m	280 m

- .7 The above table is based on 80% capacity of a 15 amp circuit. All other loads will require calculations to be conducted by the installing contractor to determine appropriate wire size as per the CEC.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1            This section details specifications for standard and specialty wiring device outlet boxes, as well as multi device outlet assemblies.

**1.2                REFERENCES**

- .1            CSA c22.1, 2015-Canadian Electrical Code, Part 1

**1.3                QUALITY ASSURANCE**

- .1            Boxes: hot dip galvanized, conforming to CSA requirements.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Interior boxes:
  - .1            Electro-galvanized steel single gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
  - .2            Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
  - .3            102 mm square or octagonal outlet boxes for luminaire outlets.
  - .4            102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.
  - .5            Sectional boxes are not allowed.
- .2            Exterior boxes: provide cast corrosion-resistant deep type boxes, Crouse Hinds F series.
- .3            Multi device outlet assemblies shall be manufactured from 16 gauge cold rolled galvanized steel.
- .4            Boxes for rigid steel conduits: Cast FS or FD aluminum feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle and exterior devices. To be Crouse Hinds or approved equal.

**2.2                COMPONENTS**

- .1            Boxes for ceiling to be octagon No. 54171, and/or square No. 52171 or 72171.
- .2            Boxes for flush mounting switches, receptacles, low tension, telephone to be boxes with matching plaster cover for single or two gang outlets. For larger boxes use GSB solid type as required. For masonry work use MBD type boxes.
- .3            Boxes for surface mounted switches, receptacles, low tension, telephone to be 100 mm square 52171 with Taylor 8300 series covers. Electrical/Mechanical Rooms.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 All outlet boxes to be flush mounted in all areas, except mechanical rooms, electrical rooms and above removable ceilings.
- .2 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.
- .3 No sectional or handy boxes to be installed.
- .4 For outlets mounted in exterior walls provide insulation behind outlet boxes to prevent condensation through boxes.
- .5 Maintain integrity of vapour barriers for all outlet boxes mounted in exterior walls.
- .6 For outlets mounted above counters, benches, splashbacks, co-ordinate location and mounting heights with built-in units. Refer to architectural details. Where heating units occur, adjust outlet mounting height to coordinate with same.
- .7 Refer to wiring device and low-tension sections of these specifications and to architectural layouts for mounting heights of outlet boxes.
- .8 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor.
- .9 Where outlet boxes penetrate through a fire separation, they are to be tightly fitted with non-combustible material to prevent passage of smoke or flame in the event of a fire.
- .10 Backboxes for ceiling mounted devices shall be supported utilizing non-combustible supports.
- .11 Coordinate cutting of openings in millwork with construction manager and architectural drawings.
- .12 Use Cast FS box or wire mold style box for surface mounted devices in public areas.
- .13 Outlet boxes in metal stud wall to be solidly anchored on two sides of the box to the wall system to ensure box will not move within the wall.

**END OF SECTION**

**Part 1           General**

**1.1               SUMMARY**

- .1       This section describes the conduit and conduit fittings that will be utilized on the project. The drawings do not necessarily indicate all conduit runs or configurations. The contractor is to layout the conduit system to suit the encountered conditions on-site and as specified herein.
- .2       Contractor shall design the conduit system to meet all applicable codes.
- .3       Record drawings shall indicate all conduit systems as installed by the Contractor regardless if such systems were shown on the tender documents.
- .4       Installation of conduit system in external areas of this project shall conform to Category 1 location (defined as locations where excessive moisture is present) as required by Section 22 of Canadian Electrical Code.
- .5       Provide structural supports for conduit system in accordance with specification and CEC requirements.

**Part 2           Products**

**2.1               MATERIALS**

- .1       Conduit layouts to be planned up to a maximum fill of 40% where allowed by the appropriate sections of the CEC.
- .2       Minimum size of conduit to be 21 mm.
- .3       Conduit: rigid threaded galvanized steel and/or electrical metallic tubing. Rigid galvanized steel with protective PVC coating where indicated.
- .4       Couplings: rigid threaded galvanized steel, set screw and liquidtight. All EMT connectors and couplings over 41 mm to be steel. Die cast zinc NOT permitted.
- .5       Flexible conduit: steel armour, flexible plastic jacketed type with liquidtight connectors.
- .6       Non metallic duct: rigid PVC, 2, PVC and/or RTRC (fibreglass reinforced self-extinguishing watertight epoxy duct).
- .7       Conduit Fittings:
  - .1       Fittings: manufactured for use with conduit specified. Coating: same as conduit.
  - .2       Factory "ells" where 90° bends are required for 27 mm and larger conduits.
  - .3       Set screw where allowed by code and watertight connectors and couplings elsewhere.
  - .4       Conduit Moisture Sealant: Sealant to be moisture barrier type, non-toxic, non-shrink, non-hardening, putty type hand applied material providing effective barrier under submerged conditions.
- .8       Conduit fastenings:
  - .1       One hole malleable iron straps to secure surface conduits 53 mm and smaller. Two hole steel straps for conduits larger than 53 mm.
  - .2       Beam clamps to secure conduits to exposed steel work.

- .3 Channel type supports for two or more conduits at 1.5 m OC.
- .4 Threaded rods, 6 mm dia., to support suspended channels.
- .9 Expansion fittings for Rigid Conduit:
  - .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
  - .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
  - .3 Weatherproof expansion fittings for linear expansion at entry to panel.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Electrical metallic tubing may be utilized in poured concrete walls or block walls filled with concrete provided that all stubups through floors or walls are of rigid threaded galvanized steel. Electrical metallic tubing may be utilized for all exposed runs except where subject to mechanical injury in accordance with Code.
- .2 Install rigid threaded galvanized steel conduit encased in concrete where installed below structural floor slab, below slab-on-grade and for all stubouts to underground site wiring. All steel conduit installed below grade that is not encased in concrete to be painted with two coats of asphaltum base paint.
- .3 All wiring to be installed in conduit. Flexible conduit to be installed from ceiling outlet box to tee bar mounted luminaires and connections from flush conduit floor stubs. All bonding conductors to be sized for appropriate AC 90 cabling or flexible conduit size. Provide surplus flexible conduit for connection to each ceiling luminaire to allow future relocation of luminaire 1.5 m in any direction without rewiring.
- .4 Do NOT install conduit in structural floor slabs.
- .5 Rigid PVC conduit to be installed in accordance with manufacturer's installation requirements using rigid PVC fittings. Conduit straps to allow lineal movement and expansion joints to be installed in accordance with manufacturer's recommendations. All couplings, expansion couplings, adapters and fittings to be installed with solvent weld.
- .6 Underground wiring to be installed in rigid PVC plastic pipe or rigid steel conduit as indicated on the drawings. Adaption from plastic to steel conduit to be by means of conduit or plastic pipe connector with conduit to plastic being threaded and plastic to plastic being welded. Connections to be watertight. All steel conduit and steel conduit portions stubbing out from the building to be painted with two coats of asphaltum base paint. Where non-metallic conduit is utilized, all bends and elbows shall be rigid galvanized steel.
- .7 Rigid galvanized steel conduit shall be used where installed through grade beams, foundation walls and for all stubouts from car heater post bases, exterior distribution centre bases, and luminaire bases. In all cases rigid galvanized steel sections to be not less than 3 m in length, terminating not less than 2 m from concrete base or wall surface.
- .8 Install conduit free from dents and bruises and plug ends to prevent entrance of dirt or moisture. Clean out conduit prior to installation of conductors.
- .9 Coordinate installation of conduit in brick or block walls with masonry trade to allow mason to thread brick or blocks over conduit.

- .10 Install conduit to avoid interference with work or equipment of other trades and to maintain maximum headroom.
- .11 Junction boxes when used to be installed in areas that are accessible through luminaire openings and/or access panels upon construction completion.
- .12 Seal conduit with approved sealant or fibreglass where conduits leave heated area and enter an unheated area.
- .13 Provide necessary flashing and pitchpockets to create watertight joints where conduits pass through roofing membrane.
- .14 Utilize approved expansion fittings complete with bonding jumper where conduit crosses building expansion lines. Install feeder runs of conduit in suspended ceiling spaces in such a manner that there is a bend or off-set adjacent to the major building expansion line to take up building movement. In lieu of this, utilize approved expansion fitting.
- .15 All conduits installed in ceiling spaces to be mounted on conduit racks. Conduit racks to be coordinated with mechanical ducting and the specific rack configuration to be approved by the Departmental Representative prior to installation. Conduit racks to be sized and configured to provide at least 25 percent future capacity.
- .16 All empty conduits to be cleaned, swabbed and provided with #22 gauge galvanized metal pullwire or nylon pullstring. For the purpose of this paragraph, an empty conduit is any conduit where conductors are not installed as part of this specific contract, but may be installed by others prior to project completion.
- .17 The Departmental Representative reserves the right to retain other contractors to install electrical or other systems in empty conduit systems prior to substantial completion of this contract. Electrical Contractor to install pullwires in all empty conduits prior to substantial completion and at times as reasonably directed by the Departmental Representative.
- .18 Where cables or conduits pass through non-rated walls, pack space between wiring and sleeve full with caulking compound suitable for the application and paint to match the wall finish.
- .19 Connections and couplings of conduits for external installation and within areas with high moisture content shall be carried out by using glands approved for use within wet locations.
- .20 Dry conduits out before installing wire.
- .21 Provide junction boxes with strain relief not greater than every 30m of run length of conduits when installed with vertical risers. Where conductors larger than #2 AWG are used, obtain manufacturer's recommendation based on the conductor dimensions and weights, to obtain the maximum span for providing strain relief and supporting the conductors
- .22 Provide plastic bushing at the end of raceway, per CEC rule 12-906, to protect conductors from abrasion where they issue from raceways. This applies to all raceway and all wiring regardless of voltage or application. EMT connector without insulated throat or bushing installed between the conduit and box meets the 12-906 requirement for conductors smaller than #8 AWG.
- .23 Conduits installed underground:
  - .1 Slope conduits to provide drainage.
  - .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

- .3 Seal both ends of conduits with sealant to prevent ingress and transmission of foreign material and moisture.
- .4 Provide rigid galvanized steel conduit sleeve, minimum size 53 mm or larger if so required by code, for all Teck cable running under finished surfaces such as asphalt, concrete, tile and the like.
- .24 Conduits in cast-in-Place Concrete:
  - .1 Locate to suit reinforcing steel. Install in centre one third of slab.
  - .2 Protect conduits from damage where they stub out of concrete.
  - .3 Install sleeves where conduits pass through slab or wall.
  - .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
  - .5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
  - .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
  - .7 Organize conduits in slab to minimize cross-overs.

**3.2 CONDUIT INSTALLATION SCHEDULE**

- .1 Install conduit as indicated except where otherwise required by Canadian Electrical Code.

TYPE	LOCATION
1. Galvanized Rigid Steel	Service entrance.
	Conduit stubups in concrete grade beams at car heater posts and lamp standards.
	Exposed conduit stubups.
	Areas subject to mechanical damage.
	Service conduit riser in building
	Through grade beams.
	Hazardous areas
	Fire rated wiring. (Use conduits where permitted by ULC
2. PVC DBII	Encased primary service.
3. Rigid PVC	All other exterior underground conduit runs not subject to shear or other mechanical damage.
	Generator feeder and control conduits
	Utility secondary electrical conduits
	Incoming teecommunication services
4. Liquid-tight flexible steel conduit	All Motor connections.
	Damp locations.
	Boiler Rooms.
	Fire alarm sprinkler devices.
	Connections to any vibrating equipment

5.	Flexible steel conduit	Luminaire connections.
		Control device connections
		Low tension device in acoustical grid ceilings.
		Transformer connections.
6.	EMT (Electrical Metallic Tubing)	All other locations.

**3.3 CONDUIT SIZING SCHEDULE**

- .1 The following schedule has been included to clarify conduit dimensions used throughout these specifications and on the drawings.

<b>Standard Size</b>	<b>Common Metric Size</b>	<b>2015 CEC Metric Design</b>
¾"	19 mm	21 mm
1"	25 mm	27 mm
1 ¼"	32 mm	35 mm
1 ½"	38 mm	41 mm
2"	50 mm	53 mm
2 ½"	63 mm	63 mm
3"	75 mm	78 mm
3 ½"	90 mm	91 mm
4"	100 mm	103 mm

**END OF SECTION**

**1.1 SUMMARY**

- .1 Add content here.

**1.2 RELATED REQUIREMENTS**

- .1 Painting and Coating Section 099000

**1.3 PAINTING AND FINISHES**

- .1 All electrical fittings, supports, hanger rods, pullboxes, channel frames, conduit racks, outlet boxes, brackets, clamps, etc. to have galvanized finish or enamel paint finish over corrosion resistant primer.
- .2 All panelboards, distribution centres, motor control centres, transformers, etc., to be factory finished in alkyd high gloss enamel applied over corrosion resistant primer. Matte or flat type finish paint not acceptable. Factory finished units that are scratched or marked during installation or shipping to be touched up with matching spray-on air dry lacquer or, if required to provide a satisfactory job, completely refinished.
- .3 Colour Schedule:

Voltage/System	Colour	Man. & Colour Chip Number
120/208V	ASA 61 Grey	N/A
347/600V	Sand	Endura Coatings CLR 23532

- .4 All 347/600 volt equipment including pullboxes and raceways to be finished in sand.
- .5 All 120/208 volt equipment including pullboxes and raceways to be finished in grey.
- .6 Fire alarm pullboxes and junction boxes to be finished in red.
- .7 Low voltage switching terminal cabinets and pullboxes to be finished in black enamel.
- .8 Door monitor, access control system pullboxes, staff panic system and junction boxes to be finished in rust.
- .9 Miscellaneous (future) system pullboxes and junction boxes to be finished in pink.

**1.4 NAMETAGS**

- .1 Clearly identify main distribution centre, sub-distribution panels, power panels, lighting panels, disconnect switches, starters, contactors, motor control centres, terminal cabinets, junction boxes, On/Off switches, receptacles, and transformers by permanent labels described below.
- .2 Nametags to be of 3-layer laminated plastic, black/white/black (red/white/red for emergency) with etched lettering giving white letters on black background where called for on the drawings or in the specifications. Size of lettering as indicated below:

Device	Lettering
Receptacle, etc.	3 mm
Panelboards	9 mm
Transformers	12 mm
Distribution Centres	12 mm
MCC Cells	9 mm
Disconnects	9 mm
Main Distribution	25 mm

- .3 Nameplates for exterior installation shall be UV stabilized or stainless steel.
- .4 Terminal cabinets and pullboxes: indicate system and voltage.
- .5 On/Off switches: indicate areas being served.
- .6 Fire alarm end-of-line resistors: identify zone numbers.
- .7 Fire alarm modules: identify address and function.
- .8 Fire alarm monitor control modules, etc: identify address and device monitored or controlled.
- .9 347 volt lighting switch: label "347 volt switch".

#### 1.5 CONDUIT IDENTIFICATION

- .1 All conduit for electrical systems to be colour coded. Colour coding of conduit to consist of paint applied to couplings and connectors in colours identified so as to provide easy identification, to satisfaction of the Departmental Representative.
- .2 Colour coding to be in accordance with 26 05 53. 1.2.

#### 1.6 BOX IDENTIFICATION

- .1 Above Removable Ceilings: in areas where pullboxes, junction boxes, and/or cabinets are located above removable ceilings, finish to be in colour specified both on outside and inside. Coverplates to be painted on both sides in the colour specified. Provide panel and circuit numbers or appropriate low tension system identification on coverplate with 12 mm letters in indelible ink. Indicate "Emergency " where applicable.
- .2 Non-removable Ceilings: where pullboxes, junction boxes, and/or cabinets are located on or in non-removable ceilings, the interior only shall be finished in the colour specified. Interior faces of coverplates to be painted to match box interior finish.

#### 1.7 COLOUR CODING OF CONDUCTORS

- .1 Conductors to be colour coded throughout the building with the same colour applying to the same phase throughout. Colour coding to be by insulation colour or permanently applied colour banding at all distribution centres and panels. Colour coding to be as follows:
  - .1 Equipment grounding conductor – green.
  - .2 Neutral conductor – white.
  - .3 120/208 volt phase wires – red, black and blue.

- .4 347/600 volt phase wires – orange, brown and yellow.
- .2 At all distribution centres, pullboxes, wireways, etc., feeder conductors of each feeder group to be neatly laced or clipped into a feeder group with each conductor identified as to load fed. At all pullboxes, junction boxes and device outlet box locations identify each conductor as to panel and circuit, i.e., Panel 2A circuit 23 – identify 2A-23. Similar to system proposed for power, conductor identification to be provided for all systems at all pullbox, junction box and device locations.
- .3 All conductors for fire alarm system to be colour coded with separate colour used for each of the following systems: smoke detector box circuits; trouble circuits; auxiliary control circuits; gong circuits, etc. Provide bead markers identifying zones at each device location, junction box, annunciators and panels.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                INTENT**

- .1        This Section specifies general requirements common to all starting and testing of electrical equipment and systems. Read this Section in conjunction with related sections, where specific portions of electrical starting and testing work will be specified.
- .2        Except where otherwise specified, arrange and pay for the testing and related requirements specified in this and related sections.
- .3        If test results do not conform with applicable requirements, repair, replace, or adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

**1.2                REFERENCE DOCUMENTS**

- .1        Perform tests in accordance with:
  - .1        These Contract Documents.
  - .2        Requirements of authorities having jurisdiction.
  - .3        Manufacturer's published instructions.
  - .4        Applicable CSA, IEEE, IPCEA, EEMAC, NEMA and ASTM standards.
- .2        If requirements of any of the foregoing conflict, notify the Departmental Representative before proceeding with tests and obtain clarification.

**1.3                COORDINATION WITH DEPARTMENTAL REPRESENTATIVE'S COMMISSIONING AGENCY**

- .1        The project will be subjected to a commissioning process by the Departmental Representative. The Departmental Representative will separately purchase from one or more agents, specific testing and commissioning activities typically but not limited to the following:
  - .1        Testing of emergency lighting systems.
  - .2        Witnessing of the Fire Alarm Verification by a Professional Engineer.
- .2        In addition, the Departmental Representative's Commissioning Agent shall be allowed to witness any in-contract testing, adjusting, start-up, and demonstration procedures.
- .3        Co-operate with independent testing agencies and allow for all labour, equipment, and tools necessary to assist in completion of the commissioning process as defined herein.
  - .1        Prior to execution of any testing, start-up or demonstration, verify with the Departmental Representative's Commissioning Agent any tests required to be witnessed. Provide sufficient notice to Departmental Representative's Commissioning Agent and Departmental Representative prior to commencement of procedures.
- .4        Co-operate with the commissioning agency as follows:

- .1 Inform commissioning agency minimum 7 working days in advance of all testing.
- .2 Provide copies of manufacturer's operating and maintenance brochures and product bulletins for all major equipment. This information to be made available immediately after approval of shop drawings, but no later than three weeks prior to testing.
- .3 Allow Departmental Representative's Commissioning Agent free access to site during construction phase.

#### **1.4 CO-ORDINATION**

- .1 Co-ordinate starting of electrical equipment and systems with testing and demonstration and instruction of
  - .1 Electrical equipment and systems specified in Electrical Contractor.
  - .2 Mechanical equipment and systems specified in Mechanical Contractor.
  - .3 Other equipment and system specified in other Divisions.
- .2 Where any equipment or systems requires testing prior to starting, ensure that such work has been completed prior to starting of electrical equipment and systems.

#### **1.5 SCHEDULING**

#### **1.6 SUBMITTALS**

- .1 Submit to the Departmental Representative a list of equipment and instruments which will be used in starting, testing, balancing and adjusting electrical equipment. The Departmental Representative may require changes to the proposed equipment and instruments.
- .2 Submit to the Departmental Representative sample forms, which will be used to record and monitor test results. Modify these forms as directed by the Departmental Representative.

#### **1.7 REPORT**

- .1 Submit Contractor Start-Up Report forms in accordance with Division 1 documenting starting and testing procedures performed, and observed tests results obtained.

#### **1.8 FACILITY START-UP REPORTS**

- .1 Facility Start-up Reports form an integral part of the Commissioning Check Sheets. All start up reports must be completed and signed off by the applicable Trade contractors and his Sub-Sub Contractor.
- .2 The Trade Contractor is responsible for ensuring completion of all Commissioning Check Sheets, and keeping same neatly assembled and available for review by the Commissioning Agent throughout the course of construction.
- .3 Where start-up of equipment by a manufacturer is specified in these specifications, a separate report must be completed by the manufacturer detailing procedures and test results. These reports are to be inserted in the Commissioning Check Sheet Binder in the appropriate sections.

### **1.9 CONTRACTOR AND MANUFACTURER REPORTS**

- .1 Log and tabulate test results on appropriate Commissioning Check Sheets provided by the Departmental Representative's Commissioning Agent.
- .2 Submit completed Commissioning Check Sheets immediately after tests are performed.
- .3 Where a particular Commissioning Check Sheets does not provide space to record specific test results required as part of the specifications Trade Contractor shall submit his own test forms for review and input by the Departmental Representative.
  - .1 Record all data gathered on site on Commissioning Check Sheets or approved test report forms.
  - .2 Note any damage, missing parts or incomplete work on the Commissioning Check Sheets.
  - .3 Record date of corrected deficiencies on form.
  - .4 Maintain one photocopy on site of all data taken during starting and testing period.
  - .5 Maintain one copy of all final starting, testing, balancing and adjusting reports on site up to interim acceptance of the work for reference purposes.
- .4 Arrange for manufacturer to submit copies of all production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment to the Departmental Representative prior to shipping.
- .5 Arrange for manufacturer to submit brief step-by-step description of entire starting procedure a minimum of one week prior to starting equipment.

### **1.10 STARTING AND TESTING – GENERAL**

- .1 Prior to testing ensure all electrical equipment is cleaned and free of dust.
- .2 After testing, protect equipment subject to dust from construction activities.
- .3 Notify the Departmental Representative when starting and testing of all systems has been completed.
- .4 Do not conceal or cover equipment until inspected, tested and approved by the Departmental Representative.
- .5 Assume all liabilities associated with starting, testing and balancing procedures.
- .6 Assume all costs associated with starting, testing, adjusting and balancing, including supply of testing equipment and witnessing of factory testing by Contractor and the Departmental Representative.

### **1.11 WITNESSING OF STARTING AND TESTING**

- .1 The Departmental Representative's Commissioning Agent may witness elected starting, testing, and cleaning procedures.
- .2 Provide sufficient notice (minimum five days) prior to commencing tests requiring witnessing by the Departmental Representative and/or the Departmental Representative.

- .3 The Consultant or the Departmental Representative's Commissioning Agent may witness all or any portion of testing and starting procedures performed by Contractor or Contractor's Testing Agent.
- .4 Contractor shall make himself available for all tests specified in Section 26 08 00.12 and 28.xx.xx.xx.
- .5 Advise the Departmental Representative in advance that starting, testing, adjusting or cleaning processes are ready to commence. Consult with Departmental Representative to determine which procedures they may elect to witness. Provide advance notice in writing prior to commencement of each procedure or series of procedures to allow the Departmental Representative to allow for witnessing of tests.

#### **1.12 MANUFACTURER'S STARTING RECOMMENDATIONS**

- .1 Prior to starting equipment or systems, obtain and review manufacturer's installation, operation and starting instructions. Read in conjunction with procedures specified in Sections 26 08 00.11, 26 08 00.12, 26 08 00.13.
- .2 Use manufacturer's and supplier's starting personnel where required to maintain validity of manufacturer's warranty. Confirm with manufacturer that all testing specified in this Section and Sections 26 08 00.11 and 26 08 00.12 will not void any warranties.
- .3 Compare installation to manufacturer's published data and record discrepancies. Modify procedures detrimental to equipment performance prior to starting equipment.

#### **1.13 MANUFACTURER'S SERVICE ON SITE**

- .1 Arrange and pay for qualified manufacturer's representatives to supervise starting and testing of following electrical equipment and systems:
  - .1 Fire Alarm System
- .2 Manufacturer's personnel shall be experienced in design and operation of equipment and systems being started and have ability to interpret results of readings, and tests and report results in a logical fashion.
- .3 Pre-start-up checks and function tests for electrical equipment to be provided by authorized manufacturer's service representative. Electrical Contractor to include all costs for involvement of manufacturer's representatives for this work.

#### **1.14 CORRECTION OF DEFICIENCIES**

- .1 Correct all contract deficiencies found during electrical starting and testing of equipment and systems and the Departmental Representative's performance verification.
- .2 Performance Testing
- .3 Following Substantial completion Performance testing of electrical equipment and systems by the Trade Contractor will commence.
- .4 The Departmental Representative may witness any or all tests or start-ups which are the responsibility of the Contractor as specified in Section 26 08 00.11 - Electrical Starting and Testing by Contractor.

- .5 The Trade Contractor and/or his designated manufacturer's representative will be fully responsible for completing all testing of systems as specified. The Departmental Representative's Commissioning Agent may request certain functions and/or components of the systems to be demonstrated in detail.

**1.15 IMPLEMENTATION**

- .1 Except where otherwise specified, perform all testing and related requirements specified herein during Facility Start-Up, prior to Substantial Completion of the Work.

**1.16 STARTING AND TESTING PHASES**

- .1 Starting and testing program generally consists of following five distinct phases:
  - .1 Pre-Starting: visual inspection
  - .2 Starting: actual starting procedure.
  - .3 Post-Starting: operational testing, adjusting or balancing and equipment run-in phase.
  - .4 Substantial Completion of the Work: final cleaning, re-testing, balancing and adjusting and maintenance.
  - .5 Final Acceptance of the Work: re-testing and fine-tuning of system to prove all deficiencies have been corrected.
- .2 After each distinct phase of work has been completed, correct deficiencies before commencing the next phase.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 SAMPLE CHECK SHEETS**

- .1 A random sampling of Commissioning check sheets as they will be issued to the Trade Contractor has been included as part of these specifications. The sample Check Sheets do not constitute a complete Check Sheet Set, but has been included to assist the Trade Contractor in assessing his involvement with the commissioning process. Individual Commissioning Check Sheets will be issued for each system, system component and device on the project at the discretion of the Commissioning Agent.

**END OF SECTION**

**Part 1 General**

**1.1 TESTING**

- .1 Test included in this section will be paid by: Departmental Representative.
- .2 These tests are provided for information purposes to permit the Contractor to make appropriate allowances for coordination of work with the Departmental Representative.

**1.2 INTENT**

- .1 Read this Section in conjunction with Section 26 08 00.10, Electrical Starting and Testing - General Requirements and other related electrical starting and test sections.

**1.3 PRE-REQUISITES**

- .1 Provide records of all production tests specified in other sections of these specifications or as required by EEMAC or CSA for all power distribution equipment to Departmental Representative prior to field testing specified in this section with applicable copies of factory tests issued to the independent testing firm for comparative results.
- .2 Any manufacturer, supplier or contractor who objects to test procedures, methods and test voltage levels specified herein to confirm objections in writing at least 10 working days prior to tender closing stating all reasons for such objections. Failing to do this constitutes acceptance of all test procedures stated herein and ensures that warranties are not voided by such tests and procedures.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 FIRE ALARM VERIFICATION**

- .1 The Departmental Representative will retain the services of a verification agent to direct verification of the fire alarm system in accordance with:
  - .1 CAN/ULC-5537-96 "Verification of Fire Alarm System Installations".
  - .2 Alberta Labour General Safety devices Services Division "Fire Alarm Systems Manual, Revision 8".
  - .3 Requirements of authority having jurisdiction.

**END OF SECTION**

- .1 General

## 1.2 SUMMARY

## 1.3 RELATED REQUIREMENTS

- .1 Identification for Electrical Systems Section 26 05 53
- .2 Electrical Starting and Testing - General Requirements Section 26 08 00.10

## 1.4 REFERENCES

- .1 Transformers to be built and tested in accordance with CSA standard C9-M1981 for dry-type transformers.

## 1.5 SHOP DRAWINGS

- .1 Full shop drawings to be submitted to the Departmental Representative for review prior to manufacture.

## 1.6 TESTING

- .1 Submit fully certified performance test data including noise levels for review prior to manufacture.

## 2. Products

### 2.1 ACCEPTABLE PRODUCTS – DISTRIBUTION TRANSFORMERS

- .1 Polygon Industries Limited
- .2 Hammond Manufacturing
- .3 Delta
- .4 Square D/Topaz

### 2.2 COMPONENTS

- .1 Distribution Transformers:

Transformers to be 600/208 volt, 60 Hz, Delta primary, grounded star secondary, air cooled type, copper wound, double dipped vacuum impregnated high temperature non hygroscopic silicon varnish, natural circulation in ventilated enclosure, Class H, 220°C insulation with temperature rise not exceeding 115°C maximum 40°C ambient. Transformers shall have a minimum efficiency of 96.5%.

- .1 Provide four primary 2-1/2% full capacity taps, two above and two below nominal voltage. Voltage regulation at 4% or better.

- .2 Provide transformer capacities as indicated on the drawings.
- .3 Transformer enclosure to be complete with sprinkler drip cover. Louvered ventilation slots to be sloped downwards and outwards to prevent moisture entrance from above.
- .4 Transformer impedance for all units rated at 225 kVA and below to be between 4.5 and 5%. Transformer impedance for all units rated above 225 kVA up to 450 kVA to be between 5 and 6%.
- .5 Transformers shall be constructed to supply non-linear loads having a load K factor of K13 where indicated on the drawings.
- .6 Dry-type transformers shall all be of the same manufacture.
- .7 High and low voltage terminal boards shall be heavy duty and clearly marked for trouble free connections. Terminal board is not to deform due to cable connections. Coil leads are to be welded to the terminal studs.
- .8 Noise emission shall not exceed 50 dB at full-load.
- .9 Scott-T connected transformers will not be acceptable.
- .10 All termination points shall be located at the bottom 1/3 of the transformer enclosure. No terminations shall be located above this point.
- .11 For transformers larger than 225 kVA, provide temperature gauge complete with alarm contacts to indicate high temperature conditions to the Building Automation System.
- .12 Transformer enclosures to be finished in primary voltage color as specified.

### **3. Execution**

#### **3.1 INSTALLATION**

- .1 Unless otherwise noted, all transformers to be floor mounted on 100 mm concrete housekeeping bases complete with approved ASTM vibration isolation dampers.
- .2 Primary and secondary connections for distribution transformers to be flexible, of sufficient length to prevent transmission of vibration to building structure.
- .3 Primary and secondary connections for distribution transformers shall be made in lower bottom third of transformer enclosure.
- .4 Provide line side disconnect switch as indicated on drawings.

### **3.2 NAMETAGS**

- .1 Provide nametags indicating full electrical data, connection diagrams, impedance, efficiency and voltage regulation to be mounted on core and coil and enclosure.

**END OF SECTION**

## **1 GENERAL**

### **1.1 SUMMARY**

#### **.1 Design**

.1 This section includes the requirements for lighting and power panelboards.

.2 All panelboard trims to be finished in enamel over corrosion resistant primer as per Section 26 05 53.

### **1.2 RELATED REQUIREMENTS**

.1 Identification for Electrical Systems Section 26 05 53

.2 Electrical Panelboard Schedules Section 26 06 20.16

.3 Contractors Section 26 29 01

### **1.3 REFERENCES**

.1 Panelboards shall comply with CSA C22.2 No 29-M1983.

### **1.4 SHOP DRAWINGS**

.1 Full shop drawings to be submitted to the Departmental Representative for review prior to manufacture.

## **2. PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

.1 Schneider

.2 Siemens

.3 Cutler Hammer

.4 General Electric

## 2.2 COMPONENTS

- .1 Enclosure: rust resistant sheet steel enclosure with interior supports, bonding wire connectors provisions for isolated ground bus and adjustable panel interior supports. Wiring gutters shall be sized to comply with CSA Code Part 1 "Panelboards and Panel Enclosures".
- .2 Interior: factory assembled sequence style rectangular section: copper bussing for 3 phase, 4 wire grounded neutral system application. Branch breakers are to be bolt on type. Main lugs or main breakers shall be installed at the top or bottom of the panel bus as required. Where double tub arrangements are specified, sub-feed lugs are to be provided for the cross connection.
- .3 Neutral bus to be full capacity solid neutral insulated from the enclosure. Neutral bus to be complete with one branch lug for each 1-pole branch circuit position.
- .4 A grounding bus shall be provided in each panel. Grounding bus shall have one lug for each 1-pole branch circuit position.

## 2.3 TRIM

- .1 Trim cover is to be for surface mounted panelboards. Trim cover shall have a door over the circuit breaker handles. Door shall have concealed hinges, with a flush catch and lock assembly. Surface mounted panelboards to be complete with sprinkler drip cover.
- .2 Trim shall be dead front type and render all live parts for the panel inaccessible.
- .3 A panel directory pocket is to be provided on the interior of the breaker cover.
- .4 Panel bus ampacity and number of branch circuit breakers is to be as noted in the panelboard schedules.
- .5 Provide 2 keys for each panelboard lock. Provide 5 circuit breaker "lock-on" devices for each panelboard.

## 3. EXECUTION

### 3.1 INSTALLATION

- .1 Install panelboard securely, plumb and square to adjoining surfaces.
- .2 Mount panelboards at 1800mm to top of trim.
- .3 Provide all mounting brackets, busbar drillings and filler pieces for spaces.
- .4 Affix typewritten directory to the inside cover of panelboard indicating loads controlled by each circuit. Directory to be approved by the Departmental Representative prior to installation. Panel directories to include room numbers and/or room designations.
- .5 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.
- .6 Provide lock dogs on all breakers controlling fire alarm, exit lights and emergency lighting equipment.

- .7 Provide typewritten directories in plastic envelope inside all panelboards which are contactor controlled and/or which have pullboxes in their feeder. Directories to indicate locations of all contactors and pullboxes.

**END OF SECTION**

**1. General**

**1.1 SUMMARY**

**1.2 RELATED REQUIREMENTS**

- .1 Common Work Results for Electrical Section 26 05 00

**2. Products**

**2.1 EXIT LIGHTS**

- .1 Thin profile, universal mounting, heavy duty cast metal housing and green running man graphic. Exit lights to be for 120 volt AC, single circuit operation with LED (light emitting diodes) with rows along the top and bottom edges, shielded so as not to be visible from the front. Emergi-Lite LPEX50, Lumacell LER400 or approved equal, thin series. Exit light types to be as listed herein:

- C1 ceiling mounted, single face.
- C1A ceiling mounted, single face, arrows as indicated.
- C2A ceiling mounted, double face, arrows as indicated.
- E2A end wall mounted, double face, directional arrows as indicated.
- W back wall mounted.
- WA back wall mounted, arrows as indicated.

- .2 Weatherproof, as per above, grommeted, sealed, and approved for exterior installation.

- .3 Units to consume less than 2 watts and to have 5-year warranty.

**3. Execution**

**3.1 INSTALLATION**

- .1 Where exit lights are mounted on tee bar ceilings, support exit light from tee bar.
- .2 Wall mounted exit lights to be mounted 2290 mm to underside.
- .3 Use existing circuiting.
- .4 Provide weatherproof exit signs for all exterior installations.
- .5 Ceiling mounted exit lights in all service spaces to be suspended to 2290 mm to underside.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Scope
  - .1 This section describes items that are commonly required for the proper operation and installation as specified in Division 28.
  - .2 This section shall be read together with the sections describing specific systems, components and the manufacture, installation, operation and maintenance thereof.
  - .3 Where a discrepancy is noted between the various sections, notify the Departmental Representative for an interpretation. In the absence of written clarification, the Departmental Representative will assume that the most expensive solutions is applicable for use on the projects.

**1.2 GENERAL REQUIREMENTS**

- .1 System to be complete with all necessary components to provide functions required whether or not each and every item is necessarily mentioned. All components to be production proven models. Custom designed units will only be considered for those items that are not currently available on commercial market. System to be supplied and installed by an established communications contracting firm that is approved by the Departmental Representatives.
- .2 Selection of system to be made on the basis of quality and suitability of equipment, service facilities, and past performance of contracting firm.
- .3 Before proceeding with installation, successful system installer to submit to Departmental Representative for approval a complete detailed proposal as outlined in Clause 1.6, Shop Drawings.
- .4 All conduit, pullboxes, junction boxes and terminal panels are to be installed to provide a complete conduit system for each of the systems.
- .5 Unless otherwise specified, all wiring for systems to be PVC insulated, unshielded, twisted pair.
- .6 All wiring to be installed in conduit, unless otherwise specified.
- .7 The system, when complete, must perform to complete satisfaction of Departmental Representative and must be free of all interference from cross-talk, hum, switch and relay noise, etc. All wiring in Communications and Electrical Rooms to be terminated and neatly installed, laced and tagged.
- .8 Selection of type of cable to be at discretion of system installer but the system, when complete, must perform to the complete satisfaction of the Departmental Representative and must be free of all interference from cross-talk, hum, switch and relay noise, etc. All wiring to be terminated in terminal panels, junction boxes, etc., on suitable terminal strips or blacks, and to be neatly installed, laced and tagged where required. All terminals in terminal panels and junction boxes to be made with solderless connectors to terminal blocks with separate terminal for each conductor.

- .9 System contractor is to coordinate with Division 26 for supply and installation of all backboards, conduit and pullboxes, and installation of junction boxes, device boxes and terminal panels where required to provide a complete conduit system. Substantial corrosion resistant pullwires to be installed in all conduit runs.
- .10 System contractor to supply all specialty junction boxes, device boxes and terminal panels to Electrical Contractor for installation.
- .11 If a particular system requires more or larger conduit, boxes or panels than that shown on drawings, they are to allow for such changes in tender price. No extras will be allowed for additional conduit or increased conduit, boxes or panel size required to accommodate any particular make of system.
- .12 Under no circumstances will the contractor be allowed to reduce conduit and panel sizes or revise layouts without prior written approval of the Departmental Representative.
- .13 All wiring for systems to be PVC insulated, shielded, twisted pair, multi conductor or coaxial, as called for or as required.
- .14 All materials, equipment, devices, components, wire and cable provided under this contract shall be CSA approved and listed with ULC as required by code authorities.

### **1.3 RESPONSIBILITY FOR EXISTING PROPERTY**

- .1 Contractor shall assume responsibility for the care, custody and control of existing work completed by others which is assigned to him for performance of the Work.
- .2 Contractor shall assume responsibility for and shall make good, damage to existing work completed by others attributable to performance of Work of this Contract.

### **1.4 SUFFICIENCY OF THE DRAWINGS AND SPECIFICATIONS**

- .1 The Drawings and Specifications shall be held to determine the general character and general arrangement of the Work.
- .2 Drawings and Specifications are “design” documents that indicate the general scope of the Project in terms of the dimensions of the Work, the type of structural, mechanical, electrical utility systems and the architectural elements of construction. As “design” documents, the Drawings and Specifications do not necessarily indicate or describe all Work required for the full performance and completion of the requirements of the Contract Documents. On the basis of the general scope indicated, described or implied, the Contractor shall furnish all items required for the proper execution and completion of the Work.

- .3 The Contract Documents are issued to facilitate construction by expressing the design intent. The Drawings and Specifications do not necessarily contain all of the details required to construct the project, and much more detail in the form of detailed construction documents (referred to in the Contract Documents as the Contractors shop drawings, submittals, and field coordination drawings) is required for construction of the Work; all of which set out the specific and final details required for placing and constructing the finished Work. By contrast, the Drawings and Specifications are provided to reflect the finished design of the Work. The Drawings and Specifications are not intended to be used as a set of detailed instructions on how to construct the Work. Construction means, methods, techniques, sequences, procedures, and site safety precautions are the responsibility of the Contractor and give the Contractor the necessary latitude in carrying out the construction of the Work.
- .4 Shop Drawings, Product Data, Samples and similar submittals provided by the Contractor are not Contract Documents. The purpose of these submittals is to demonstrate (for those portions of the Work for which submittals are required by the Contract Documents) the way by which the Contractor proposes to conform to the design intent expressed in the Contract Documents.
- .5 The Contractor must examine the Drawings and Specifications to satisfy himself regarding the design intent and the extent of the proposed Work by personal examination of the existing building, site and surroundings. He shall make his own estimate therefrom of the facilities and difficulties attending the performance and completion of the Work.

## **1.5 RISER DIAGRAMS**

- .1 For each and every system specified in Division 28, provide single line riser diagram depicting room location of every device in the system and mount diagram in suitably sized glass frame mounted adjacent to respective main control cabinet.

## **1.6 MEMORY PROTECTION**

- .1 In all Division 28 installed systems, provide protection against memory loss due to short duration power failures.
- .2 This protection shall take the form of an internal auxiliary power supply for microprocessor and memory components unless it is built from non-volatile components.
- .3 The equipment involved shall retain its status during interruptions lasting up to 20 seconds. It shall not be necessary to reload, reset or reprogram such equipment.
- .4 The equipment is not expected to continue functioning during the power outage. Indicating lights and other signals may cease momentarily. However, upon power restoration (either normal or emergency) shall regain its status and resume its operation with no ill effect due to the interruption.
- .5 The equipment shall indicate failure of auxiliary power supply by pilot light, message or other acceptable means.

**1.7 HARMONIC CONTENT**

- .1 Provide line filters to reduce the harmonic content of non-linear loads. Such filters shall be mounted inside the equipment enclosure (the enclosure shall be increased in size if necessary) and shall limit total Distortion Factor (harmonic factor) to 3% as defined and measured in ANSI/IEEE Std 519 titled: "Guide for Harmonic Control and Reactive Compensation of Static Power Converters."

**1.8 TRANSIENT PROTECTION**

- .1 Electronic components forming parts of computerized equipment and system controls are sensitive to transients in electrical power lines and to short duration power outages. Provide protection against disruption caused by these conditions.
- .2 Many electronic loads are nonlinear. AC to DC converters (rectifiers) and switching mode power supplies are examples of loads in which the load current is not proportional to the instantaneous voltage, or is discontinuous. Such nonlinear loads create considerable harmonic distortion on the electrical system supplying the loads, even when the source voltage is a clean sine wave. The nonlinear loads will distort that voltage wave, making it nonsinusoidal. Prevent this effect.
- .3 Computerized equipment may generate spurious emissions in the form of conducted and radiated electrical/ electromagnetic interference. The operation of sensitive electronic equipment may be impeded by such omissions. Ensure electromagnetic compatibility is complied with.
- .4 Each system specified in Division 28 shall be protected against transients in the power system and in the communication and signalling lines (i.e. spikes, glitches or surges).
- .5 Protection shall be for both common and differential modes.
- .6 The protection shall comply with the requirements of IEEE Standard 472 (ANSI/IEEE C37.90) titled "Guide For Surge Withstand Capability Tests".
- .7 The manufacturer shall install the transient protection devices within the equipment enclosure or case, and clearly label or otherwise identify the components used.

**1.9 ELECTROMAGNETIC COMPATIBILITY**

- .1 Emission Limits:
  - .1 Equipment emission of electromagnetic radiation shall be limited to Class-B of FCC RULES PART-15 subpart – J as tested in accordance with FCC measurements procedure MP-4 titled: "FCC measurement of Radio Noise Emission from Computing Devices".
  - .2 The Departmental Representative shall be notified where the above requirement cannot be met. The Departmental Representative may authorize class-A qualification or any other qualification of limited electromagnetic emission.
- .2 Susceptibility Limits:
  - .1 Equipment shall perform normally in presence of electromagnetic field of one V/m in accordance with ANSI/IEEE C63.12 titled: "Recommended Practice on Procedures for Control of System Electromagnetic Compatibility".

- .2 The susceptibility to power conducted emission of electromagnetic radiation shall be one volt as defined and measured in the standard.
- .3 Equipment shall be capable of performing on supply systems containing notches without false triggering of circuits. This should be for notch depth of 0.7 of the rated maximum line voltage and width of 250 microseconds as stipulated in the standard.
- .3 The Departmental Representative shall be notified where equipment does not meet the requirements so that corrective measures can be sought.
- .4 Regulatory Requirements: All materials, equipment, devices, components, wire and cable provided under this contract shall be CSA approved and listed with ULC as required by code authorities.
- .5 Wireless Systems:
  - .1 Any and all wireless components shall operate in the ISM bands 2.4GHz or 5.8GHz. There shall be no short or long term licensing costs associated with any wireless components of this system.

#### **1.10 COORDINATION**

- .1 Contractor shall coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified.
- .2 The Departmental Representative will not be liable for any additional costs as a result of missed dates or poor coordination of the supplying contractor with other trades.

#### **1.11 SHOP DRAWINGS**

- .1 Shop drawings for all Division 28 systems and components shall be submitted in the format as specified in 26 05 00.
- .2 In addition to the requirements of 26 05 00 the following apply to shop drawing submission for Division 28.
  - .1 Shop drawings to be submitted as outlined herein and contain all items within one complete submission.
  - .2 Shop drawings which are submitted incomplete will be returned to Contractor without review.
  - .3 Shop drawings to include a complete material list with manufacturer, style, model number and quantity. Wire and cable to be included in material list.
  - .4 Shop drawings to include manufacturer's specification sheets with photographic depiction of all system components. Specification and descriptive data to include dimension, weight, appearance, connection provisions, materials, metal gauges and operating specification, characteristics, features and controls.
  - .5 Under no circumstances will wiring schematics or typical wiring details be considered as circuit diagrams.
- .3 Riser diagrams and detail drawings to be Autocadd format. At completion of the project, update all riser diagrams and provide Departmental Representative with printed copy as well as an electronic copy.

- .4 No material or equipment to be delivered to the jobsite prior to final approval of shop drawings unless otherwise specified and documented in writing by the Departmental Representative.

### **1.12 OPERATING MANUALS**

- .1 Operating manuals to be furnished as specified in Section 26 05 00.24. Operating instructions to consist of following:
  - .1 Individual factory issued manuals containing all technical information on each type of equipment installed. In event such manuals are not available from the factory, system installer to establish same and compile within the manual to satisfaction of the Departmental Representative.
  - .2 Each manual to contain a system parts list, a parts list for individual components, detailed schematics and recommended maintenance procedures. Advertising brochures or operational instructions shall not be considered as technical manuals. Refer to Section 26 05 00.24 for manual compilation.
  - .3 Engineering drawings depicting layout and interconnection of all system components and as-built conduit layout.
- .2 In addition to the above described manuals, system installer to deliver one (1) set of all shop and circuit drawings, wiring schedules and single line block drawings.
- .3 Each manual section to contain a title page, table of contents, statement of guarantee including termination date and name of person to be called in event of equipment failure.

### **1.13 QUALITY ASSURANCE**

- .1 Systems shall be installed by a contractor designated and trained by the manufacture and shall provide written confirmation of this fact.
- .2 Personnel installing communications cabling shall be trained and conversant with communications cabling practices required for this project. Proof of certification must be provided prior to commencement of work.

### **1.14 TESTING**

- .1 Equipment panel elevations for each panel or panel group. Elevations to indicate component layouts, cable routing and terminal blocks.
- .2 Complete engineering drawings of all custom made components indicating all materials, gauges, finishes and wiring diagrams.  
Provide single line riser diagram depicting room location of every device in the system.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Provide CSA approved products capable of performing as specified.

**Part 3 Execution**

**3.1 GENERAL**

- .1 All wires and cables shall be neatly clamped in position. If special measures, such as brackets, frames, etc. are required to provide a neat and sturdy configuration, such measures shall be the responsibility of the Contractor. All electrical connections shall be sound. Damaged or nicked wires shall not be acceptable; care should be exercised in this regard when stripping wires and cables. All terminations relying on friction for electrical and mechanical connection shall be tested in accordance with manufacturers instructions and shall meet the performance requirements detailed therein. Electrical tape shall not be used on wires and cables. Lacing shall be employed wherever possible. Terminal lugs shall be used on all wiring (particularly where connection is to screw-thread terminals) except where solder or other type terminals may be specified. Where a number of wires are involved in a harness, terminal fanning strips shall be used unless a multi-pin connector is provided.
- .2 Where wires are connected to lugs which are clamped under screw terminals so as to be removable by loosening or removing the screws, not more than one wire shall be attached to each lug, so that each wire can be removed individually from the screw terminals. The requirement will not apply in the case of common connections or daisy chaining of distribution circuits which will not need to be disconnected for servicing purposes. Not more than two lugs shall be attached to each screw terminal.

**3.2 ENCLOSURES**

- .1 All electrical connections, cross connection, etc. shall be made within lockable, covered steel enclosures. Outdoor enclosures shall be environmentally sealed and gasketed. Indoor enclosures shall provide dust protection.

**3.3 CRIMPING**

- .1 Crimp connections shall be made in accordance with the manufacturer's instructions. Solid conductors may be used with crimp connections only in such cases as crimping resistor leads, etc., where the use of solid conductor wiring cannot be avoided. In all other cases only stranded wiring shall be used on crimp connections. All solid conductors connected to terminals by crimping action shall also be soldered.

**3.4 SOLDERING**

- .1 In the case of solder connections, the insulation on individual wires shall not be stripped back more than 1.5 mm from the joint. Soldering shall be executed so that a positive electrical and a strong mechanical connection is assured. Leads shall not be wrapped more than once around the terminal. "Cold" soldered or doubtful joints shall not be acceptable. Soldered connections on the back of connector plugs (i.e., Cannon plugs) are to be insulated by means of a short length of insulating tubing placed over each wire in the connector. Where insulation material is subject to heating during soldering, the material shall be undamaged and the fastened parts shall not be loosened.

### **3.5 CABLING**

- .1 All wires and cables installed external to consoles, racks, and electrical boxes shall be contained in conduit rigidly and securely mounted. Applications which are indoors or outdoor above ground shall use metal conduit; applications which are outdoor underground may use plastic conduits where authorized.
- .2 Individual insulated wires shall be formed into cable harnesses neatly run, properly dressed, supported, and securely tied with flat lacing tape or cable ties.

### **3.6 SLACK**

- .1 Wires and cables shall be as short as practicable except that sufficient slack shall be provided to:
  - .1 Prevent undue stress on cable forms, wires and connections.
  - .2 Enable parts to be removed and replaced during servicing without disconnecting other parts.
  - .3 Facilitate movement of equipment for maintenance purpose.
  - .4 Allow a minimum of 1 meter slack at all cabinets and enclosures to allow for reconnects due to wire breakage. Exceptions may be allowed where lead lengths must be kept short for electrical performance reasons (e.g. radio frequency conductors).
- .2 Units in drawers and slide-out racks shall be provided with sufficient slack to permit pulling the units out without breaking connections. All cross-connection wiring, i.e., jumper and hook-up wiring, shall be neat, however, this wiring shall not be laced and shall be left slack enough to allow easy tracing by manual methods. The amount of slack left shall be reasonably standard throughout the installation. Parts mounted on a hinged door (e.g. panel-door) shall be wired by means of a single cable, arranged to flex without being damaged when the door is opened and closed. However, if physical separation between wires is essential for electrical reasons, or if the number of wires involved is so great as to make a single cable impractical, more than one flexible cable may be employed.

### **3.7 PROTECTION**

- .1 Wires and cables shall be placed and protected to avoid contact with rough or irregular surfaces or sharp edges. Where wires run through holes in metal, they shall be protected by suitable grommets or bushings.

### **3.8 SUPPORT**

- .1 Wires and cables shall be properly supported and secured to prevent stress on conductors and terminals.

### **3.9 CLEARANCE**

- .1 Clearance between wires and cables, and heat emitting parts, shall be such as to avoid deterioration of the wires or cables because of heat dissipated by these parts.

**3.10 SPLICING AND JOINING**

- .1 Wire and cable shall not be spliced and connectors are not permitted inside conduit runs. Where connectors are used on cable assemblies they shall be of a locking type which will not disengage under tension.

**3.11 INDUCTIVE AND CAPACITIVE EFFECTS**

- .1 Wires and cables including harness wire and cables shall be located so that inductive and capacitive effects do not adversely affect system operation. The amount of twist in paired wires shall be increased over the length of wire not covered by the cable sheath.

**3.12 TESTS AND ADJUSTMENTS**

- .1 Upon completion of system installation, tests to be conducted by the system installer to determine system conformity to the requirements of the specification.  
  
Tests to be conducted in presence of Departmental Representative and/or his representative who may suspend or discontinue tests at any time performance is considered unsatisfactory. Resumption of testing to cover the previously untested elements and any completed elements at the discretion of the Departmental Representative.
- .2 All equipment or wiring provided by system installer which tests prove to be defective or operating improperly to be corrected or replaced promptly at no additional cost to the Departmental Representative.

**3.13 TRAINING**

- .1 System installer to conduct training program for designated maintenance and operating personnel. Program to include but not be limited to the following:
  - .1 Operation: designated personnel to be trained to accomplish and understand all aspects of system operation.
  - .2 Maintenance: designated personnel to be trained to perform routine maintenance on the system.
- .2 Training period schedule to be established by the Departmental Representative. Training periods to take place after system verification and prior to building occupancy.
- .3 Allow one full day minimum for training seminars.

**END OF SECTION**

**Part 1 General**

- .1 This section describes the general requirements for testing and commissioning of Electronic Safety & Security Systems.

**1.2 GENERAL**

- .1 Upon completion of the installation, the Electronic Safety and Security Systems Contractor is to provide three (3) full documentation sets to the owner.
- .2 Documentation is to be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine-generated (final) copies of all drawings are to be submitted within 30 working days of the completion of each testing phase. At the request of the Consultant or Owner, the communications contractor shall provide copies of the original test results.
- .3 The owner may request that a 10% random field re-test be conducted on the system, at no additional cost, to verify documented findings. Tests should be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the owner, including a 100% re-test. This re-test should be at no additional cost to the Owner.

**1.3 TEST RESULTS DOCUMENTATION**

- .1 Test documentation should be provided on disk within three (3) weeks after the completion of the project. The disk should be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results should include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document should detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- .2 Where the system is connected using Fibre Optic or Category 6 cabling, all cabling shall be tested to the requirements of section 27 08 00
- .3 Fire Alarm Systems to be tested to the requirements of CAN/ULC S537 latest edition, and as noted elsewhere in these specifications.

**1.4 AS-BUILT DRAWINGS**

- .1 The drawings are to include cable routes and outlet locations. Outlet locations should be identified by a sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used should be consistent throughout all documentation provided. For Fire Alarm Systems, the drawings are to denote the device loop and address of each individual device, including monitor and control modules. The Owner

will provide floor plans in paper and electronic formats on which as-built construction information can be added. These documents will be modified accordingly by the Electronic Safety and Security Systems Contractor to denote as-built information as defined above and returned to the Owner.

- .2 The Contractor should annotate the base drawings and return a hard copy (same plot size as originals) and electronic form.

## **1.5 VERIFICATION DOCUMENTATION**

- .1 As part of the commissioning process, contractor to provide verification sheet identifying each device and its name, function, unique identifier and location within the facility.
- .2 Contractor to note by yes, no or not applicable, the appropriate functions checked and certify same by application of technician's signature and date of verification.
- .3 Verification sheets to be turned over to the Owner at completion of commissioning.

### **Part 2 Products**

#### **2.1 NOT USED**

### **Part 3 Execution**

#### **3.1 NOT USED**

**END OF SECTION**

## **Part 1        General**

### **1.1            SUMMARY**

- .1        This section of the specification includes the furnishing, installation and connection of a microprocessor controlled, addressable, intelligent fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein and elsewhere in Division 28.

### **1.2            REFERENCES**

- .1        NBC, National Building Code of Canada
- .2        CSA C22.1-2015, Canadian Electrical Code.
- .3        Underwriters Laboratories of Canada (ULC)
  - .1        CAN/ULC-S524-14, Installation of Fire Alarm Systems.
  - .2        ULC-S525-07, Audible Signal Appliances for Fire Alarm.
  - .3        ULC-S526-07, Visual Signal Appliances For Fire Alarm Systems.
  - .4        CAN/ULC-S527-11, Control Units For Fire Alarm Systems.
  - .5        CAN/ULC-S528-14, Manual Pull Stations.
  - .6        CAN/ULC-S529-09, Smoke Detectors For Fire Alarm Systems.
  - .7        CAN/ULC-S530-M91, Fire Detectors, Heat Actuated, For Fire Alarm Systems.
  - .8        CAN/ULC-S536-13, Inspection and Testing of Fire Alarm Systems.
  - .9        CAN/ULC-S537-13, Verification of Fire Alarm Systems.

### **1.3            REGULATORY REQUIREMENTS**

- .1        Installation subject to approval, inspection and test of the Departmental Representative and fire marshal for final acceptance.
- .2        All equipment to be listed by Underwriters Laboratories of Canada, compatible for forming an integrated fire alarm system.
- .3        Verification and testing shall conform to the requirements of CAN/ULC-S537, latest edition.
- .4        Comply with requirements of Alberta Building Code and authorities having jurisdiction.
- .5        System installers shall be qualified to perform electrical work pursuant to the Electrical Protection Act and Manpower Development Act of Alberta.

### **1.4            GENERAL REQUIREMENTS**

- .1        System to be complete with all necessary components to provide functions required whether or not each and every item is necessarily mentioned. All components to be production proven models. Custom designed units will only be considered for those items that are not currently available on commercial market.

- .2 Before proceeding with equipment ordering, submit to the Departmental Representative for approval a complete detailed proposal as outlined in Clause 1.4, Shop Drawings.
- .3 Provide all conduit, pullboxes, junction boxes, device boxes and terminal panels required.
- .4 Under no circumstances will Electrical Contractor be allowed to reduce conduit and panel sizes or revise layouts without prior written approval of the Departmental Representative.
- .5 All wiring for systems to be PVC insulated, shielded, twisted pair, multi-conductor or coaxial, as called for or as required. All wiring for system to be installed in conduit.
- .6 Selection of type of cable to be at discretion of system installer but the system shall meet all code requirements when complete, and must perform to the complete satisfaction of the Departmental Representative. All wiring to be terminated in terminal panels, junction boxes, etc. on suitable terminal strips or blocks, and to be neatly installed, laced and tagged where required. All terminals in terminal panels and junction boxes to be made with solderless connectors to terminal blocks with separate terminal for each conductor.

### **1.5 PANEL INSTALLATION SCOPE OF WORK**

- .1 New fire alarm panel to replace existing fire alarm panel in same location. Remove existing panel and install new panel. Reconnect existing zones to new panel, provide modules for new panel to communicate with existing devices. A fire watch will be required while this work is on going.
- .2 Verify new panel is communicating with existing zones.
- .3 To limit the need for Fire Watch remove devices and replace one zone at a time. Verify zone once it is completed.

### **1.6 TECHNICAL REQUIREMENTS**

- .1 Equipment to be ULC approved at time of tender.
- .2 System to be electrically supervised as required by ULC and specified herein.
- .3 System operation shall not require personnel with special computer operation skills. User operating language to be based on English type commands.
- .4 The system shall be completely addressable and shall use remote monitor and control modules to interface with conventional monitor or alarm devices on the floor areas such as sprinkler tamper switches, and flow switches.
- .5 System to be fully addressable, zoned, annunciated, non-coded, two stage, microprocessor based, employing multiplexing for data acquisition, utilizing end devices, distribution and control. System shall be complete with all necessary hardware, software and memory, specifically tailored for this installation.

### **1.7 SYSTEM SUPERVISION**

- .1 Fire alarm pullstations, detectors, sprinkler circuits, pre-action sprinkler circuits, and kitchen hood extinguishing system, network lines to be fully supervised utilizing a Data Communication Link Class B (DCLB).
- .2 Communication lines between annunciators, panels and the main fire alarm panel to be fully supervised utilizing Data Communication Link Class A (DCLA).

- .3 Complete system to be supervised against failure of operating power, open circuits, and ground. Supervision to be maintained on all circuits even in the event of a power failure, when the system is on battery standby. Any of the above shall cause trouble buzzer to sound at the main control panel and at the annunciator and also light a common trouble lamp in the same panels. Trouble on system to produce a tone distinct from the tone of the alarm signals.

System to incorporate a silencing switch in the main control panel and at the main graphic annunciator, which when operated, silences the trouble bell but caused the trouble lamp to remain illuminated until the trouble is cleared and the system returned to normal. Upon return to normal, trouble signal lamp shall be automatically reset to normal.

- .4 Provide loop isolators to maintain system integrity. Loop isolators shall automatically disconnect any part of the detection loop on which a short-circuit or other condition is detected which would adversely affect reliability of the entire loop. Loop isolators are to be placed to divide detection loops as per fire zone divisions shown on the drawings. Stair and elevator zones do not require loop isolators but may be included in the adjacent zones.

## **1.8 SYSTEM OPERATION – PRESIGNAL STAGE**

- .1 Operation of any fire alarm signal initiating device to automatically perform the following functions:
  - .1 Activate presignal to sound signals throughout the building for not less than one minute.  
Signal rate of chime tone and visual signal to be at the rate of 20 signals per minute for single stage in a temporal pattern.  
Presignal may be silenced after one minute of presignal sounding throughout the building.
  - .2 Activate visual signal appliances throughout the building.
  - .3 Provide visual indication to all building fire alarm annunciator panels of fire condition and location.
  - .4 Provide visual indication to local smoke annunciation panel indicating location of room in alarm.
  - .5 Transmit alarm signal to central station.
  - .6 Disconnect power supply to electromagnetic doorholders associated with smoke doors.
  - .7 Release all electrically locked doors.
  - .8 Release panic hardware on all automatically and power assisted doors.
  - .9 Provide operation of zone smoke control relays (to control supply air at presignal stage).
  - .10 Provide resound signal into operation after acknowledgement has been initiated at the fire command station, and/or at local field panels.
  - .11 Provide hard copy of event, time, date, alarm, area and action taken.
  - .12 Provide fan shutdowns as required. Exact requirement to be determined during construction period.

- .13 Provide signal to release rolling grills and shutters on a zoned and adjacent Zone basis.
- .14 Close smoke dampers on a zone and adjacent zone basis.

### **1.9 SYSTEM OPERATION – SECOND STAGE**

- .1 Operation of key switch at any manual station location, selector at the fire command station or if presignal alarm has not been acknowledged within the set time the following to occur in the alarmed zone:
  - .1 Sound the audible signalling device in a temporal pattern.
  - .2 Activate visual signalling devices throughout the facility.
  - .3 Activate general alarm signal to the whole building.
  - .4 Provide visual annunciation at the fire command centres, main CPU and all remote annunciators of fire status of alarmed zones.

### **1.10 SYSTEM OPERATION FROM FIRE ALARM CONTROL PANEL**

- .1 Fire Alarm Control Panel to be located at Main Entrance.
- .2 The Fire Alarm Control Panel is to incorporate the following operational features and information:
  - .1 Indication of fire alarm status in any zone or area.
  - .2 Indication of any trouble or circuit supervision fault in system.
  - .3 Acknowledge presignal alarm after 1 minute of operation.
  - .4 and facility to resound pre-signal alarm.
  - .5 Silence general alarm audible signal after 1 minute of signalling.
  - .6 Maintain zone smoke evacuation mode after general alarm audible signals have been silenced.
  - .7 Reset system after all alarm devices have been restored to their normal condition.
  - .8 To include features specified under Section 2, Products.
  - .9 Individual toggle style bypass switches for each of the auxiliary functions.

### **1.11 LABELLED SYSTEM OPERATION PRE-ACTION SPRINKLER**

- .1 located as shown on the drawings. All wiring, initiating and monitoring devices in association with these systems shall be supplied and installed by Electrical Contractor. Alarm valves, solenoid valves and pressure switches shall be supplied and installed by Mechanical Contractor and connected by Electrical Contractor. Wiring to pre-action solenoid valves shall be fully supervised. Activation of high pressure monitoring switches and/or tamper valves shall cause a Trouble to appear on the system. Activation of the alarm pressure switch shall cause a system alarm condition to be initiated on the system.
- .2 Sequence of operation shall be as follows:
  - .1 Multi room protection:

- .1 Activation of any of the automatic initiating devices located in the protected area will cause the building alarm to sound, initiate the sequence of operation as described elsewhere in specifications and activate the pre-action solenoid valve.
- .2 Activation of a normal breakglass station located within the protected area will initiate the normal fire alarm sequence of operation, cause building alarm to sound, and activate the pre-action solenoid valve.
- .2 Single room protection:
  - .1 Activation of first products-of-combustion detector will cause the building alarm to sound and the sequence of operation as described elsewhere to be initiated.
  - .2 Activation of second products-of-combustion detector and/or any thermal detector will cause building alarm to sound and sequence of operation as described elsewhere to be initiated and the pre-action solenoid valve to be actuated.
  - .3 Activation of a manual pull station within area will initiate and cause building alarm to sound and normal sequence of operation as described elsewhere to be initiated and shall activate the pre-action solenoid valve.

**1.12 CONNECTION OF WORK SUPPLIED AND INSTALLED UNDER OTHER SECTIONS**

- .1 Connect via relays or otherwise, the following auxiliary equipment:
  - .1 Door hardware:
  - .2 Elevator Controls
  - .3 Supply and exhaust fan control:
  - .4 Sprinkler system:
    - .1 Flow and gate valves.
    - .2 Low pressure switches.
  - .5 Emergency generator supervision:
    - .1 Engine start control circuit.
    - .2 Engine start power circuit.
  - .6 Transfer switch to indicate emergency power on:
  - .7 Fire pump suppression:
    - .1 Fire pump run.
    - .2 Fire pump trouble.

**1.13 PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Section 26 05 00 to request for approvals.

**1.14 SUBMITTALS**

- .1 Shop drawings to be submitted as outlined in 28 05 00.
- .2 Shop drawings to include the following diagrams:

- .1 Equipment panel elevations for each panel or panel group. Elevations to indicate component layouts, cable routing and terminal blocks.
  - .2 Detail drawings of all control panels and annunciator panels indicating material, finish component models, housing requirements and mounting details.
  - .3 Complete engineering drawings of all custom made components indicating all materials, gauges, finishes and wiring diagrams.
  - .4 Complete system block diagrams indicating all components, interconnection and cabling.
  - .5 Complete detailed system circuit and riser diagrams indicating:
    - .1 Main control panel
    - .2 Alarm devices
    - .3 Main graphic annunciator
    - .4 Alphanumeric annunciators
    - .5 Auxiliary interconnections
    - .6 Component layout
    - .7 Identification schedules
    - .8 Zone wiring designations
    - .9 Panel interconnect wiring
    - .10 Detailed wiring connections and wire designations
  - .6 Complete wiring diagram showing terminal identification, cable type and cable designation.
- .3 Provide factory data sheets for the following:
- .1 Main panel, annunciator panels, and control units, indicating:
    - .1 All materials,
    - .2 Finishes,
    - .3 Layouts,
    - .4 Proposed labelling.
  - .2 All system devices indicating:
    - .1 Typical wiring connections,
    - .2 Installation instructions,
    - .3 Control settings,
    - .4 Component limitations.
- .4 Riser diagrams and detail drawings to be AutoCAD format. At completion of the project, update all riser diagrams and provide Departmental Representative with printed copy as well as an electronic copy.
- .5 Provide factory data sheets for the following:
- .1 Main Panel, Control Panel, Annunciator Panels, indicating:

- .1 Materials.
- .2 Finishes.
- .3 Layouts.
- .4 Proposed labelling.
- .2 System devices, indicating:
  - .1 Typical wiring connection.
  - .2 Installation instructions.
  - .3 Control settings.
  - .4 Component limitations.
- .6 If requested by the Departmental Representative, submit samples of following components:
  - .1 Products-of-combustion detector.
  - .2 Thermal detector.
  - .3 Manual alarm station.
  - .4 Graphic annunciator panel.
  - .5 Special cables.
  - .6 Visual signalling devices.

**1.15 OPERATION AND MAINTENANCE DATA**

- .1 Comply with requirements of Section 26 05 00.

**1.16 SPARE PARTS AND MAINTENANCE MATERIALS**

- .1 Comply with requirements of Section 26 05 00.26.

**1.17 SUPPLIER QUALIFICATIONS**

- .1 System supplier, that is, manufacturer or manufacturer's authorized agent, shall have an office in Alberta established for a minimum of ten-year, with full in-house technical service and maintenance capabilities. Suppliers utilizing third party or subcontracted maintenance services are not acceptable.

**1.18 SOURCE OF SUPPLY**

- .1 Complete fire alarm system shall be supplied by a single manufacturer.

**1.19 SYSTEM MAINTENANCE AND TESTING FACILITY**

- .1 At the Fire Alarm Control Panel provide facilities to perform the following functions:
  - .1 Silent test.
  - .2 Central station disconnect.
  - .3 Fan shutdown bypass.
  - .4 Bypass door holders, rolling shutter and automatic doors.
  - .5 Master switch to bypass all auxiliary functions.
- .2 Activation of any or all of these functions shall place a trouble signal on the system.

- .1 Facilities described above shall be through the use of toggle or pushbutton type switches. Each switch to be equipped with a red LED to indicate switch has been activated.

## **1.20 WARRANTY**

- .1 Guarantee
  - .1 System installer to include with his base tender price a guarantee stating:
    - .1 Service to be provided on system within 24 hours of call origination during the warranty period.
    - .2 Full warranty on new system to be provided for a period of 12 months.
    - .3 During warranty period the system installer at his expense to repair and replace all such defective work and other work to the new system damaged thereby which fails or becomes defective during the term of the warranty, provided that such failure is not caused by improper usage or physical damage.
    - .4 Should the system installer fail to comply with Sub-item 1.1, work will be performed by others at system installer's expense.
    - .5 Warranty date to commence from date substantial completion certificate.

## **Part 2 Products**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Edwards.
- .2 Siemen.
- .3 Simplex.
- .4 Notifier.

### **2.2 MAIN FIRE ALARM CONTROL PANEL**

- .1 The main FACP Central Console shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, local and remote operator terminals, printers, annunciators, and other system controlled devices.
- .2 Of code gauge construction with full viewing windows, hinged key locked front cover and painted panels in colours as selected by Departmental Representative.
- .3 System Capacity and General Operation
  - .1 The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 80 character liquid crystal display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
  - .2 All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

- .3 System to be sized to accommodate all functions and devices as shown on the drawings and in the specifications. Provide additional 50% spare capacity. System to incorporate all printed circuit boards, etc. required to provide spare capacity. Spare capacity to be evenly divided across addressable device loops.
- .4 In control panel install main CPU and associated modules to operate the system. System construction to be modular with solid state, microprocessor based electronics.
- .5 System to be complete with digital style auto dialler to notify monitoring agency of the occurrence of a fire condition. Auto dialler to be complete with line seizure feature.
- .6 Central Processing Unit
  - .1 The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the Central Processing Unit.
  - .2 The Central Processing Unit shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
  - .3 The Central Processing Unit shall also provide a real-time clock for time annotation of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
  - .4 The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
  - .5 The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL864 standards.
  - .6 Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.
- .7 Display
  - .1 The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
  - .2 The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
  - .3 The system display shall provide an 80-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide five Light-Emitting Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, DISPLAY TROUBLE, and SIGNAL SILENCE.

- .4 The system display shall provide a 25-key touch keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.
- .5 The system display shall include the following operator control switches: SIGNAL SILENCE, LAMP TEST, RESET, SYSTEM TEST, and ACKNOWLEDGE.
- .8 The system to provide following features:
  - .1 The system to be capable of on site programming to accommodate and facilitate expansion, building parameter changes or changes required by the Departmental Representative and/or local codes. System programming to be software based. The software shall have the ability to do ladder logic programming for custom relay and signal control.
  - .2 To accommodate and facilitate scope changes, initiation circuits shall be individually configured on site to provide either ALARM/TROUBLE operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit, or an alarm verification circuit.
  - .3 System to incorporate an alarm, and trouble log. System shall have the capability to store a minimum of 300 alarms and 300 troubles in a historical data file, which can be recalled via system keyboard.
  - .4 Control panel to have a chronological display of multiple events for trouble shooting and system history.
  - .5 Control panel to have a dedicated:
    - .1 alarm LED with acknowledge switch.
    - .2 supervisory LED with acknowledge switch.
    - .3 trouble LED with acknowledge switch.
  - .6 The control panel to have the capability of annunciating a trouble reminder audibly and visually. This feature is to be programmable at specific time intervals, thus reminding the Departmental Representative that a trouble has been silenced and should be serviced.
  - .7 Four levels of password protection shall be provided in addition to a key-lock cabinet.
  - .8 The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.
  - .9 The system shall come complete with the monitor and control points indicated in these documents plus fifty percent spare points (both monitor and control) in place. All spare points shall be evenly divided over all addressable loops.
  - .10 The system shall be complete with battery standby, of sufficient capacity to operate the system in standby mode for a period of 24 hours, and have sufficient capacity to sound the signals for 30 minutes at the end of the standby period.
  - .11 The system shall be complete with power supplies, batteries and battery chargers to accommodate all requirements for system power to meet ULC standards.

- .12 If the second stage switch is activated at the main graphic annunciator, then an evacuation signal shall sound throughout the building.
- .9 The main FACP shall perform the following functions:
  - .1 Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
  - .2 Supervise all initiating signalling and notification circuits throughout the facility by way of connection to monitor and control modules.
  - .3 Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
  - .4 Visually and audibly annunciate any trouble, supervisory, security or alarm condition on operator's terminals, panel display, and annunciators.
    - .1 When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
      - .1 The system alarm LED shall flash.
      - .2 A local piezo-electric audible device in the control panel shall sound a distinctive signal.
      - .3 The 80-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
      - .4 Printing and history storage equipment shall log and print the event information along with a time and date stamp.
      - .5 All system outputs assigned via pre-programmed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
    - .2 When a trouble condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
      - .1 The system trouble LED shall flash.
      - .2 A local piezo-electric audible device in the control panel shall sound a distinctive signal.
      - .3 The 80-character backlit LCD display shall indicate all information associated with the trouble condition, including the type of trouble point and its location within the protected premises.
      - .4 Printing and history storage equipment shall log and print the event information along with a time and date stamp.
      - .5 All system outputs assigned via pre-programmed equations for a particular point in trouble shall be executed, and the associated system outputs (trouble notification appliances and/or relays) shall be activated.
    - .3 When a supervisory condition is detected and reported by one of the

system initiating devices or appliances, the following functions shall immediately occur:

- .1 The system trouble LED shall flash.
- .2 A local piezo-electric audible device in the control panel shall sound a distinctive signal.
- .3 The 80-character backlit LCD display shall indicate all information associated with the supervisory condition, including the type of trouble point and its location within the protected premises.
- .4 Printing and history storage equipment shall log and print the event information along with a time and date stamp.
- .5 All system outputs assigned via pre-programmed equations for a particular point in trouble shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

### **2.3 ADDRESSABLE CONTROL MODULES**

- .1 Addressable control modules shall be provided to supervise and control the operation of fan shutdown and other auxiliary control functions with the control module set to operate as a dry contract relay.
- .2 The control module shall mount in a standard 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box, or to a surface mounted backbox.
- .3 The control module may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay may be energized at the same time on the same pair of wires.
- .4 The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.
- .5 Addressable Control Elements
  - .1 Addressable control elements to meet or exceed the following technical requirements:

- .1 Compatible with main fire alarm system.
- .2 Field programmed.
- .3 Individually identifiable.
- .4 Supervised.
- .5 May be operated by any one or group of identifiable devices.
- .6 May be operated from control center or automatically by system.
- .7 Contact rating: .5 amperes 120 volts AC, 2 amperes at 24 volt DC, with one (1) set of Type C contacts.
- .8 Ambient Temperature: 0°C – 40°C.
- .9 Ambient Humidity: 0 – 93%.
- .10 Complete with lamicoïd identification on cover identifying address and device controlled.

## **2.4 ISOLATOR MODULE**

- .1 Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on a Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the loop segment or branch. Isolator modules shall be provided as indicated on the drawings.
- .2 If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- .3 The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- .4 The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox.

## **2.5 SIGNAL POWER SUPPLY**

- .1 Power Supply as follows:
  - .1 Rectifier and Battery Charger:
    - .1 Designed to automatically maintain battery bank fully charged.
    - .2 Sized to recharge batteries in 24 hours minimum.
    - .3 Designed to operate system when batteries are disconnected.
    - .4 Temperature compensated.
    - .5 Provide battery connection supervision.
  - .2 Battery Bank: Gel-cell type.
  - .3 Capacity: Designed to operate system under supervisory load condition for 24 hours and then have sufficient power to provide 30 minutes of continuous operation of the signal appliances without recharging.
  - .4 Mounting integral with Fire Command Panel.

## **2.6 WIRE AND CABLE**

- .1 Conductors: Copper, to CSA C22.2 and No.75-M1983 and as follows:
  - .1 Conductor Insulation: Minimum rating 300 volts.
  - .2 Single conductor RW90 X-link.
  - .3 Multi-conductor cables shall be FAS Type cable, 105°C with outer PVC jacket, color coded.
  - .4 Conductor sizes as follows:
    - .1 Minimum conductor size for alarm initiating circuits shall be #18 AWG.
    - .2 Minimum conductor size for audible signal circuits shall be #14 AWG.
    - .3 Minimum conductor size for AC circuits shall be #12 AWG.
    - .4 Minimum conductor size for auxiliary 24V circuits shall be #14 AWG.
    - .5 Size all fire alarm wiring for maximum 3% voltage drop at maximum load at last device in run.
    - .6 Visual signal appliance minimum #12 AWG.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 System installation shall conform to CAN4-S524-Standard for the Installation of Fire Alarm Systems, Latest Edition.
- .2 Install addressable control module at motor control centres and at all locations as shown on drawings.
- .3 Provide 19 mm conduit and 2#14 conductors to telephone backboard for central station tie-in.

### **3.2 WIRING**

- .1 Make conductor terminations in panel on terminal strips with separate terminal for each conductor.
- .2 Neatly install all wiring, clamped with nylon cable straps or laced with jute cord.
- .3 Identify all conductors, cables and terminal strips as indicated on shop drawings.
- .4 Attach wiring diagram to inside of panel door.
- .5 Provide separate fire alarm zone (and graphic annunciation) for each duct mounted products-of-combustion detector for mechanical pressurization and recirculation units.
- .6 It is acceptable to provide motor control center connection from nearest fire alarm transponder, or from control modules mounted inside control terminal section.
- .7 All wiring to be installed in conduit.
- .8 All backboxes in exposed installations to be as provided by system manufacturer.
- .9 Conductors: Copper, to CSA C22.2 and No.75-M1983 and as follows:
  - .1 Conductor Insulation: Minimum rating 300 volts.

- .2 Single conductor RW90 X-link.
- .3 Multi-conductor cables shall be FAS Type cable, 105°C with outer PVC jacket, color coded.
- .4 Conductor sizes as follows:
  - .1 Minimum conductor size for alarm initiating circuits shall be #18 AWG.
  - .2 Minimum conductor size for audible signal circuits shall be #14 AWG.
  - .3 Minimum conductor size for AC circuits shall be #12 AWG.
  - .4 Minimum conductor size for auxiliary 24V circuits shall be #14 AWG.
  - .5 Size all fire alarm wiring for maximum 3% voltage drop at maximum load at last device in run.
  - .6 Visual signal appliance minimum #12 AWG.

### **3.3 CONNECTION OF WORK SUPPLIED AND INSTALLED UNDER OTHER SECTIONS**

- .1 Provide outputs for control of the following auxiliary equipment supplied and installed under other Sections.
  - .1 Door Hardware Division 8
  - .2 Supply and Return Air Fan Control Mechanical Contractor
  - .3 Sprinkler Systems Mechanical Contractor

### **3.4 FIRE SYSTEM INSPECTION**

- .1 Prior to requesting performance verification of the Fire Alarm System by Departmental Representative's Verification Agent, Electrical Contractor and the system manufacturer's technical staff shall:
  - .1 Inspect system to ensure that fire alarm system is correctly installed, connected and fully operational in accordance with requirements of the Contract Documents and Manufacturers recommendations. This shall include all auxiliary equipment connected to fire alarm system such as elevators, central station tie-in, fan shut-down, sprinklers, door hold-open devices, etc.
  - .2 Ensure that any subsequent work remaining to be performed on the above-noted items will not invalidate examinations and tests performed during verification procedure.
  - .3 Ensure that operation and maintenance data has been submitted.
  - .4 Ensure that spare parts and maintenance materials have been delivered.
- .2 Advise the Departmental Representative's Verification Agent in writing that the above prerequisites have been fulfilled and list known exceptions in the form of a list of items to be completed or corrected, prior to proceeding with the verification.
- .3 The Departmental Representative's Verification Agent will proceed with verification, or advise Contractor that prerequisites are not adequately fulfilled.

### **3.5 FIRE ALARM VERIFICATION**

- .1 Assist and cooperate with the Departmental Representative's Verification Agent in the verification procedure. Provide the following:

- .1 Velometer
- .2 Artificial Smoke
- .3 Rate of Rise Heat Detector Tester
- .4 Minimum of four portable communication devices
- .2 Do not proceed with verification unless the following parties are present at all times during verification procedures:
  - .1 Electrical Contractor
  - .2 Fire Alarm System Manufacturer's Representative
  - .3 Departmental Representative's Representative
  - .4 Departmental Representative
- .3 Disassemble and reassemble system components.
- .4 Disconnect and reconnect wiring.
- .5 Perform required field adjustments.
- .6 Repair defective work and replace defective components.
- .7 Perform all other work on system required by verification procedure.
- .8 Electrical Contractor to include in his base bid all costs for fire alarm system verification and any additional costs to change or alter operation or installation to meet the intent of the specification or regulatory code.
- .9 Engineering fees for fire alarm system verification will be paid directly by the Departmental Representative.

### **3.6 SOFTWARE PROGRAMMING**

- .1 This Contract to include four (4) software generations for the complete system. These software generations shall include all memory storage devices and burn-in based on devices and control points established by contract documents. Final operational programming as specified in Clauses 1.11, 1.12 and 1.13 will be customized during construction period.

### **3.7 FIRE RATING**

- .1 Life-safety system conduit shall be rated as required by the Alberta Building Code. Suitable rating shall be obtained by encasing the conduit in concrete or behind required number of layers of fire rated wallboard.

### **3.8 PROTECTION OF COMPLETED WORK**

- .1 Protect equipment in areas of construction to prevent the entry of dust, paint and any other foreign matter into the devices or panels.

### **3.9 TRAINING**

- .1 System installer to conduct training program for designated maintenance and operating personnel. Program to include but not be limited to the following:
  - .1 Operation: designated personnel to be trained to accomplish and understand all aspects of the system operation.

- .2 Maintenance: designated personnel to be trained to perform routine maintenance on the system.
- .2 Training period schedule to be established by the Departmental Representative. Training periods to take place after building completion system verification and prior to building occupancy.
- .3 Allow one full day minimum for training seminars.

**END OF SECTION**



- .9 Building Annunciator to include an LCD display and to indicate zone and device alarms in English language.
- Unit shall not display trouble or supervisory conditions.  
LCD display to display a minimum of eight (8) alarm conditions simultaneously. Provide eight lines of display of 40 characters per line.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install Annunciator Panels where shown on the drawings.
- .2 Coordinate locations with architectural components.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1            This section of the specification includes the furnishing, installation, connection and testing of fire detection sensors associated with fire alarm systems.

**1.2                REGULATORY REQUIREMENTS**

- .1            Installation subject to approval, inspection and test of the Departmental Representative and Fire Marshall for final acceptance.
- .2            All equipment to be listed by Underwriters Laboratories of Canada, compatible for forming an integrated fire alarm system.
- .3            Installation to comply with Installation of Fire Alarm Systems, CAN/ULC-S524-14 and the Canadian Electrical Code, latest editions and to comply with the following standards:
  - .1            CAN/ULC S530-M91:            Heat activated fire detectors, fire alarm.
- .4            Verification and testing of these devices shall conform to requirements of Verification of Fire Alarm Systems, CAN/ULC-S537, latest edition.

**Part 2            Products**

**2.1                APPROVED MANUFACTURERS**

- .1            All devices specified and supplied under this section must be of the same manufacture as the fire alarm system supplied though sections 28 31 01 or 28 31 02.

**2.2                SYSTEM COMPONENTS - CONVENTIONAL**

- .1            Thermal Detectors
  - .1            Construction – nylon.
  - .2            Addressable.
  - .3            Ambient temperature 0°C to 40°C.
  - .4            Ambient Humidity – 10% to 95% R.H.
  - .5            Thermal detectors to operate on the dual thermistor principle.
  - .6            Plug-in type base and head.
  - .7            Built-in LED for alarm indication.
  - .8            Shielded electronics to limit noise interference.
  - .9            Rate of rise to be automatic reset type.
  - .10          Fixed temperature element to be automatic reset type.
- .2            Thermal Detectors – High Temperature
  - .1            Construction: metal.
  - .2            Mounting: Standard base semi-flush, trim ring.
  - .3            Contacts: rated at 3 A from 6 to 125 V AC, 1 A from 6 to 28 V DC.

- .4 Operation:
  - .1 Projecting centre disk shall indicate when alarmed.
  - .2 Fixed Temperature Type: Resettable, shall operate at 88°C.
- .3 Ultraviolet Flame Detector:
  - .1 Open-area ultraviolet type to be designed to operate on 24 volt DC complete with encapsulated electronic circuitry and to operate on the geiger mueller principle. Spectral sensitivity range shall be between 1600 to 3000 angstrom, with peak response at approximately 2100 angstrom. Detector shall be capable of responding to a 12 inch diameter gasoline fire within 6 seconds when viewed head-on from a distance of 30 feet. Normal ambient light conditions such as sunlight, incandescent or fluorescent lighting shall not affect operation of the detector. Units shall be ULC approved. Explosion-proof units require classification suitable for area in which they are being installed. Units shall be complete with remote LED indicating detector activation. Exact placement of detectors shall be verified on site in conjunction with the Departmental Representative and the Manufacturer.

## 2.3 SYSTEM COMPONENTS – INTELLIGENT

- .1 Addressable Devices – General
  - .1 Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the FACP signaling line circuit.
  - .2 Addressable thermal detectors shall provide alarm and power/polling LED indication. LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
  - .3 The fire alarm control panel shall permit detector sensitivity adjustment through field programming. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
  - .4 Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
  - .5 The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
  - .6 The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel. Use of the magnetic switch will not be acceptable for the initial verification procedure.
  - .7 Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

- .8 Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
- .9 Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
- .10 Addressable Detector Bases
  - .1 Addressable detector bases to meet or exceed following technical requirements:
    - .1 Compatible with main fire alarm system.
    - .2 Field programmable.
    - .3 Supervised, including removal of specified plug-in detector devices.
    - .4 Designed to accept ionization, photo-electric, heat detectors and electronic heat detectors.
    - .5 Designed for remote LED output and base mounted LED.
    - .6 Operation on system data loop.
    - .7 Ambient temperature 0 to 90°C.
    - .8 Ambient humidity: 0 – 93%.
- .2 Intelligent Multi-Detector
  - .1 The intelligent multi-detector shall be an addressable device which is designed to monitor photoelectric, ionization, and thermal technologies in a single sensing device. This detector shall utilize advanced electronics which react to smaller products of combustion found in fast flaming fires (ionization), slow smoldering fires (photoelectric), and heat (thermal) all within a single sensing device.
  - .2 The multi-detector shall include LEDs which flash green in normal operation and turn on steady red in alarm.
- .3 Intelligent Thermal Detectors
  - .1 Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees Fahrenheit (9.4 degrees Celsius) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.
- .4 Thermal Detectors
  - .5 Construction – nylon.
  - .6 Addressable.
  - .7 Ambient temperature 0°C to 40°C.
  - .8 Ambient Humidity – 10% to 95% R.H.
  - .9 Thermal detectors to operate on the dual thermistor principle.
  - .10 Plug-in type base and head.

- .11 Built-in LED for alarm indication.
- .12 Shielded electronics to limit noise interference.
- .13 Rate of rise to be automatic reset type.
- .14 Fixed temperature element to be automatic reset type.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Fire detectors shall be installed in full compliance with S524-Installation of Fire Alarm Systems.
- .2 Fire detectors shall not be installed until all trade work has been completed and/or shall be adequately protected from dust and paint.
- .3 Do not install fire detectors within 450mm from supply, return, or exhaust outlet.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        This section of the specification includes the furnishing, installation, connection and testing of smoke detection sensors associated with fire alarm systems.

**1.2                REGULATORY REQUIREMENTS**

- .1        Installation subject to approval, inspection and test of the Departmental Representative and Fire Marshall for final acceptance.
- .2        All equipment to be listed by Underwriters Laboratories of Canada, compatible for forming an integrated fire alarm system.
- .3        Installation to comply with Installation of Fire Alarm Systems, CAN/ULC-S524 and the Canadian Electrical Code, latest editions and to comply with the following standards:
  - .1        CAN/ULC S529-02:
- .4        Verification and testing of these devices shall conform to requirements of Verification of Fire Alarm Systems, CAN/ULC-S537, latest edition.

**Part 2            Products**

**2.1                APPROVED MANUFACTURERS**

- .1        All devices specified and supplied under this section must be of the same manufacture as the fire alarm system supplied though sections 28 31 01 or 28 31 02.

**2.2                SYSTEM COMPONENTS – INTELLIGENT**

- .1        Addressable Devices – General
  - .1        Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the FACP signaling line circuit.
  - .2        Addressable smoke and thermal detectors shall provide alarm and power/polling LED indication. LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
  - .3        The fire alarm control panel shall permit detector sensitivity adjustment through field programming. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
  - .4        Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
  - .5        The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.

- .6 The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel. Use of the magnetic switch will not be acceptable for the initial verification procedure.
- .7 Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
- .8 Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
- .9 Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
- .10 Addressable Detector Bases
  - .1 Addressable detector bases to meet or exceed following technical requirements:
    - .1 Compatible with main fire alarm system.
    - .2 Field programmable.
    - .3 Supervised, including removal of specified plug-in detector devices.
    - .4 Designed to accept ionization, photo-electric, heat detectors and electronic heat detectors.
    - .5 Designed for remote LED output and base mounted LED.
    - .6 Operation on system data loop.
    - .7 Ambient temperature 0 to 90°C.
    - .8 Ambient humidity: 0 – 93%.
  - .2 Intelligent Photoelectric Smoke Detector
    - .1 The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
  - .3 Products-Of-Combustion Detectors
    - .1 Photo-electronic products-of-combustion (POC) sensors complete with addressable base shall be provided in all areas except electrical rooms where ionization type detectors are to be utilized. Units to be unaffected by changes in environmental temperature, humidity and pressure. Surface mounted, screw connection separate field wiring base, indicator lamp, provision for remote mounting, design and function based on dual chamber principle.
    - .2 POC sensors shall communicate actual chamber values to system control panel. Sensors shall not have a self contained sensitivity setting, sensitivity setting to be determined at control panel. In all areas initially, alarm set point will be set at 1% obscuration during evening hours, and 3.7% obscuration during daytime hours.

- .3 The control panel shall be programmed to automatically compensate for environmental changes at the remote sensors. Where the smoke detector chamber is contaminated with dust, or other particles, the control panel must still alarm at the prescribed alarm set point.
  - .4 The POC sensor shall be stable withstanding air-gusts up to 10 m/sec velocity. The detector shall have a 30 mesh insect screen and have a completely sealed back to prevent entry of dust, moisture and air turbulence. The electronics of the unit shall be totally shielded to protect against false alarms due to EMI and RFI. The detector head shall be easily disassembled to facilitate cleaning. All wiring to the smoke detector shall be wired to the base only, thus when removing the head for maintenance or cleaning no wiring is disturbed. The detector head shall contain an LED which shall glow continuously to indicate alarm, or a sensor trouble condition. The detector head shall contain a locking screw to prevent an authorized removal of the head from the base.
  - .5 Ceiling units to be attractive design, easy to clean, chamber accessible without special tools, chamber to be provided with anti-static protection, overall tapered geometry with no flare-outs to collect dust. Chamber port open 360°.
  - .6 Where units are mounted in the ceiling space, provide remote pilot lamp complete with lamicoid identification.
  - .7 Provide terminals and output for individual annunciation as required.
  - .8 Duct mounting POC detectors to be complete with addressable module, duct casting, sampling tubes for installation in air systems and pilot lamp.
- .4 Intelligent Ionization Smoke Detector
- .1 The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

### 2.3 PRODUCTS-OF-COMBUSTION DETECTORS

- .1 Photo-electronic products-of-combustion (POC) sensors complete with addressable base shall be provided in all areas except electrical rooms where ionization type detectors are to be utilized. Units to be unaffected by changes in environmental temperature, humidity and pressure. Surface mounted, screw connection separate field wiring base, indicator lamp, provision for remote mounting, design and function based on dual chamber principle.
- .2 POC sensors shall communicate actual chamber values to system control panel. Sensors shall not have a self contained sensitivity setting, sensitivity setting to be in control panel. In all areas initially, alarm set point will be set at 1% obscurity during evening hours, and 3.7% obscurity during daytime hours.
- .3 The control panel shall be programmed to automatically compensate for environmental changes at the remote sensors. Even if the smoke detector chamber is contaminated with dust, or other particles, the control panel will still alarm at the prescribed alarm set point.

- .4 The POC sensor shall be stable even withstanding air-gusts up to 10 m/sec velocity. The detector shall have a 30 mesh insect screen and have a completely sealed back to prevent entry of dust, moisture and air turbulence. The electronics of the unit shall be totally shielded to protect against false alarms due to EMI and RFI. The detector head shall be easily disassembled to facilitate cleaning. All wiring to the smoke detector shall be wired to the base only, thus when removing the head for maintenance or cleaning no wiring is disturbed. The detector head shall contain an LED which shall pulse at 6 second intervals to indicate it has power and shall glow continuously to indicate alarm, or a sensor trouble condition. The detector head shall contain a locking screw to prevent unauthorized removal of the head from the base. The POC detector shall be automatically tested each day for operation by the control panel.
- .5 Ceiling units to be attractive design, easy to clean, chamber accessible without special tools, chamber to be provided with anti-static protection, overall tapered geometry with no flare-outs to collect dust. Chamber port open 360°.
- .6 Provide terminals and output for individual annunciation as required.

#### **2.4 DUCT SMOKE DETECTORS**

- .1 Duct smoke detectors shall be a 24 VDC type with visual alarm. Each detector shall be installed in the composite supply air ducts(s), with properly sized air sampling tubes.
- .2 Duct mounting POC detectors to be complete with addressable module, duct casting, sampling tubes for installation in air systems and pilot lamp. Provide remote mounted pilot lamps in ceiling below where duct detector are concealed in the ceiling space.
- .3 Smoke detection sensors shall be installed in accordance with ULC S524 Latest Edition.
- .4 Smoke detection sensor shall be installed only after all construction and tradework is finished and the area is free from dust contamination.
- .5 Testing of detectors shall be accomplished by means of artificial smoke released in the vicinity of the detector. Devices such as caps or masks that seal smoke in the detector and disturb the normal airflow during testing are not permissible.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Smoke detector sensors shall be installed with ULC S524, latest edition.
- .2 Smoke detector sensors shall be installed only after all construction and trade work activities are finished and the area is free from contamination.
- .3 Testing of the detectors shall be by means of artificial smoke released in the vicinity of the smoke detector. Testing devices that use cups or masks to seal the test medium in the sensor and distort the normal flow of air around the detector are not permissible.
- .4 Where smoke and/or duct detectors are mounted in the ceiling space, provide remote pilot lamp complete with lamicoïd identification.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 This section of the specification includes the furnishing, installation, connection and testing fire alarm initiation devices.

**1.2 REGULATORY REQUIREMENTS**

- .1 Installation subject to approval, inspection and test of the Departmental Representative and Fire Marshall for final acceptance.
- .2 All equipment to be listed by Underwriters Laboratories of Canada, compatible for forming an integrated fire alarm system.
- .3 Installation to comply with Installation of Fire Alarm Systems, CAN/ULC-S524 and the Canadian Electrical Code, latest editions and to comply with the following standards:
  - .1 CAN/ULC S528-14: Manual pull stations.
  - .2 CAN/ULC S548-08: Alarm initiating and supervising devices for water type extinguishing systems.
- .4 Verification and testing of the new system shall conform to requirements of Verification of Fire Alarm Systems, CAN/ULC-S537, latest edition.

**Part 2 Products**

**2.1 APPROVED MANUFACTURERS**

- .1 All devices specified and supplied under this section must be of the same manufacture as the fire alarm system supplied through sections 28 31 01 or 28 31 02.

**2.2 SYSTEM COMPONENTS – INTELLIGENT**

- .1 Addressable Dry Contact Monitor Module
  - .1 Addressable monitor modules shall be provided to connect a conventional alarm initiating device DLC's (any N.O. dry contact device) to one of the fire alarm control panel.
  - .2 The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
  - .3 The zone shall be suitable for Class A or B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
  - .4 Addressable Dry Contact Monitor Modules to meet or exceed the following technical requirements:

- .1 Compatible with main fire alarm system.
  - .2 Field programmed.
  - .3 Individually identifiable.
  - .4 Supervised.
  - .5 Supervises and controls N.O. contact devices on supervised slave line. Supervision in Class B format with end-of-line resistor.
  - .6 Operating Voltage: 24 volts.
  - .7 Slave Line Resistance: 50 ohms maximum.
  - .8 Ambient Temperature: 0°C – 40°C.
  - .9 Ambient Humidity: 0 – 93%.
  - .10 Complete with lamicoïd identification on cover identifying address and device monitored.
- .2 Two Wire Detector Monitor Module
- .1 Addressable monitor modules shall be provided to connect one supervised zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
  - .2 The two-wire monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or with an optional surface backbox.
  - .3 The zone may be wired for Class A or B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- .3 Addressable Manual Fire Alarm Stations
- .4 Manual Fire Alarm Stations are as follows:
- .1 Type: Addressable.
  - .2 Construction: Metal or Lexan.
  - .3 Mounting: Flush or Surface as shown on drawings.
  - .4 Features: means to prevent resetting of station without the use of a key..
  - .5 Operations:
    - .1 First Stage: Manual lever.
    - .2 Second State: Key operated.
  - .6 Ambient temperature: 0°C to 40°C.
  - .7 Ambient humidity: 0 – 93%

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Mount all end-of-line resistors immediately beyond the last device in separate backbox. All end of line devices to be located in service rooms.
- .2 Identification

- .1 Provide lamicoïd identification at each end of line device, control element, addressable element, etc., indicating device address and function.
- .3 Manual fire alarm stations to be mounted in a manufacturer supplied wallbox where surface mounted.
  - .1 Manual Stations shall be installed in close proximity to exit doors:
    - .1 At wall adjacent the door latch where installed adjacent a single leaf door.
    - .2 At the right side of the corridor when facing the door and a minimum of 1200mm from the door frame where installed adjacent dual egress doors.
- .4 Provide monitor modules for the following auxiliary equipment :
  - .1 Provide an individual monitor module for each sprinkler flow switch or alarm pressure switch in the system. Provide an individual monitor module for each supervisory device such as gate valve, pressure switches, etc. These monitor modules to indicate a latching supervisory alarm when the supervisory devices are operated.
  - .2 Provide supervisory monitor modules for each of the following:
    - .1 Generator run; to indicate system power supply from generator source.
    - .2 Generator trouble; to indicate any of the generator pre-alarm or shutdown conditions. This module to also monitor “switch in off”, low fuel level, etc.
    - .3 Fire pump run.
    - .4 Fire pump trouble.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 This section of the specification includes the furnishing, installation, connection and testing of the associated with the fire alarm signalling devices for the fire alarm system.
- .2 Addressable Fire Alarm System Section 28 31 02

**1.2 REGULATORY REQUIREMENTS**

- .1 Installation subject to approval, inspection and test of the Departmental Representative and Fire Marshall for final acceptance.
- .2 All equipment to be listed by Underwriters Laboratories of Canada, compatible for forming an integrated fire alarm system.
- .3 Installation to comply with Installation of Fire Alarm Systems, CAN/ULC-S524-14 and the Canadian Electrical Code, latest editions and to comply with the following standards:
  - .1 CAN/ULC S525-2016: Audible signal devices for fire alarm systems.
  - .2 CAN/ULC S526-2007: Visual signal devices for fire alarm systems.
- .4 Verification and testing of the new system shall conform to requirements of Verification of Fire Alarm Systems, CAN/ULC-S537-13, latest edition.

**Part 2 Products**

**2.1 APPROVED MANUFACTURERS**

- .1 All devices specified and supplied under this section must be of the same manufacture as the fire alarm system supplied though sections 28 31 01 or 28 31 02.

**2.2 AUDIBLE SIGNALLING APPLIANCE**

- .1 Audible signalling appliance shall be programmable electronic sounder capable of operating at 24 VDC. Sounder compliant with ULC CS548 and as follows:
  - .1 White in color.
  - .2 Eight (8) field selectable tone options.
  - .3 Flush mounted to standard backbox.
  - .4 Average sound output minimum 91 dBA at 10 feet.
  - .5 Temporal pattern conforming to ISO 8201 to be synchronized throughout the facility.
- .2 Bells
  - .1 Vibrating 254 mm type for 24 volt DC operation, surface wall mounted, with audio output no less than 97 db.
  - .2 Gongs to produce synchronized temporal sound pattern conforming to ISO 8201 throughout the facility.

### **2.3 VOICE COMMUNICATION APPLIANCES**

- .1 All speakers shall operate on 24 V VRMS with field selectable output taps from 0.5 to 2.0 watts.
  - .2 Speakers in corridors and public spaces shall produce a nominal sound output of 87 dBA at 10 feet (3 m) utilizing a 1 watt tap.
  - .3 Frequency response shall be a minimum of 400 HZ to 4000 HZ.
  - .4 The back of each speaker shall be sealed to protect the speaker cone from damage and dust.
  - .5 An integral 15 candela synchronized strobe (see strobe specification) shall be provided.
- .2 Re-entrant Speaker/Strobes
- .1 All speakers shall operate on 70 VRMS with field selectable output taps from 2.0 to 15.0 watts.
  - .2 Speakers in mechanical spaces shall produce a nominal sound output of 96 dBA at 10 feet (3 m) utilizing a 4 watt tap.
  - .3 Speakers in parkade and other spaces shall produce a nominal sound output of 93 dBA at 10 feet (3 m) utilizing a 2 watt tap.
  - .4 An integral 15 candela synchronized strobe (see strobe specification) shall be provided.

### **2.4 VISUAL SIGNAL APPLIANCES**

- .1 Visual signal appliances: as follows:
  - .1 Voltage: 24 VDC.
  - .2 Mounting: designed for ceiling or wall.
  - .3 Construction:
    - .1 High intensity zircon flasher, intensity minimum 15 candela unless shown otherwise on the drawings..
    - .2 Pyramid shaped.
    - .3 White lexan lens with white print reading "FIRE".
  - .4 Operation: flash rate as per ULC.
  - .5 All visual signal appliances throughout the facility to be synchronized.
  - .6 Visual signal appliance to be an integral part of the audible signal appliance where shown on the drawings.

### **2.5 END-OF-LINE RESISTOR ASSEMBLY**

- .1 End-of-line Resistor Assembly: single gang stainless steel plate, terminal strip on back, resistor, red enamel finish and lamicoïd nametag on front identifying zone and/or device.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Signalling appliances shall be flush wall mounted in finished areas. In mechanical, electrical and similar service spaces devices to be complete with matching back box in red colour.
- .2 Audible signalling appliances in mechanical rooms, loading docks, stairs and similar areas are to be horn type devices for single or dual (bidirections) operation.
- .3 Mount all end-of-line resistors immediately beyond the last device in separate backbox. All end of line devices to be located in service rooms.
- .4 Visual signal appliances to be wired independent from audible signal appliances.
- .5 Use minimum #12 AWG conductor for vibrating bells or gangs and visual signal appliances.
- .6 Identification
  - .1 Provide lamicoid identification at each end of line device, control element, addressable element, etc., indicating device address and function.

**END OF SECTION**