Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Canada

Respect ◆ Integrity ◆ Excellence ◆ Leadership

Serving GOVERNMENT, Serving CANADIANS.

SPECIFICATION (Issued for Tender)
26 November 2020

Feed Mill (116) – Building Upgrades
Public Works and Government Services Canada (PWGSC)
Project No. R.097511.001

AAFC LeRDC
Lethbridge, Alberta

www.pwgsc-tpsgc.gc.ca

REPUBLIC ARCHITECTURE INC.
PERMIT No. AC 13827
ISSUED PURSUANT TO THE
ARCHITECTS ACT OF ALBERTA

SHANE SOLOMON
REGISTERED
ARCHITECT
ALBERTA

Mechanical	Electrical/Civil	Structural
PROFESSIONAL ENGINEER ALBERTA DALLIN S. BULLOCK	PROFESSIONAL ENGINEER ALBERTA PETER GOERTZEN	PROFESSIONAL ENGINEER ALBERTA DAN R. CHRONK
November 26, 2020	November 26, 2020	November 26, 2020

PERMIT TO PRACTICE
MPE ENGINEERING LTD.
Signature
Date November 26, 2020
PERMIT NUMBER: P 3680
The Association of Professional Engineers and Geoscientists of Alberta

END OF SECTION

Pages

Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 01 - GENERAL REQUIREMENTS

Division 02 – EXISTING CONDITIONS

Division 03 - CONCRETE

Division 05 – METALS

Division 06 – WOOD, PLASTICS, AND COMPOSITES

Division 07 – THERMAL AND MOISTURE PROTECTION

Division 08 – OPENINGS

Division 09 – FINISHES

Division 10 – SPECIALTIES

Division 21 - FIRE SUPPRESSION

Division 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

Division 26 - ELECTRICAL

Division 27 - COMMUNICATIONS

Division 28 – ELECTRONIC SAFETY AND SECURITY

Division 31 - EARTHWORK

APPENDIX

END OF TABLE

END OF TABLE

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises renovation of a feed mill located at the Lethbridge Research and Development Centre, Lethbridge, Alberta.

1.2 CONTRACT METHOD

.1 Construct Work under single stipulated price contract.

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 continued use of premises during construction.

.2 Co-ordinate Progress Schedule and co-ordinate with occupancy during construction.

.3 Maintain fire access/control.

1.5 CONTRACTOR USE OF PREMISES

.1 Limit use of premises for Work, for storage, and for access.

.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 that remain.

.5 Repair or replace portions of existing work that 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 OCCUPANCY

.1 Premises will be occupied during entire construction period for execution of normal operations.

.2 Co-operate with Departmental Representative in scheduling operations to minimize conflict and to facilitate continued usage.

1.7 EXISTING SERVICES

.1 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.

.2 Submit schedule to and obtain approval from Departmental Representative for shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.3 Provide temporary services where required to maintain critical building and tenant systems.

.4 Provide adequate bridging over trenches that cross sidewalks or roads to permit normal traffic.

.5 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.6 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.7 Record locations of maintained, re-routed and abandoned service lines.

.8 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.8 DOCUMENTS REQUIRED

.1 Successful bidding Contractor is to obtain required sets of Contract Documents for construction purposes, which includes two (2) sets for "as-built" and record purposes.

.1 Contractor is responsible for costs of printing, handling, and shipping of Contract Documents.

.2 Maintain at job site, one copy of 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, System Components List complete with Commissioning Verification Forms and Check Sheets and Commissioning Issues/Resolution Log.

.9 Copy of Approved Work Schedule.

.10 Health and Safety Plan and Other Safety Related Documents.

.11 Other documents as specified.

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, 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 building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

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

.3 Closures: Protect work temporarily until permanent enclosures are completed.

1.3 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.

.3 Prevent overloading of parts of building.

1.4 EXISTING SERVICES

.1 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.

.2 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.3 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours' notice for necessary interruption of mechanical or electrical service. Keep duration of interruptions to a minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.4 Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian, vehicular traffic, and tenant operations.

.5 Provide alternative routes for personnel, pedestrian, and vehicular traffic.

1.5 SPECIAL REQUIREMENTS

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

1.6 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to project site.

1.7 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions.

.2 Smoking is not permitted inside building.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting 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; transmit to Departmental Representative, meeting participants, and affected parties not in attendance.

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

1.2 PRECONSTRUCTION MEETING

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

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

.3 Establish time and location of meeting and notify parties concerned minimum five 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 16.19 - 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 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.7 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

.8 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.9 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

.10 Monthly progress claims, administrative procedures, photographs, hold backs.

.11 Appointment of inspection and testing agencies or firms.

.12 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and two weeks prior to project completion, schedule progress meetings every two weeks.

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

.3 Notify parties minimum three days prior to meetings.

.4 Record minutes of meetings; circulate to attending parties and affected parties not in attendance within three 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 that 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 and expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on construction schedule and on completion date.

.12 Other business.

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 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 ten 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 SUBMITTALS

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

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

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

1.4 MASTER PLAN

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

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

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

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

1.5 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.5 Interior Architecture (Walls, Floors and Ceiling).
.6 Plumbing.
.7 Lighting.
.8 Electrical.
.9 Piping.
.10 Controls.
.11 Heating, Ventilating, and Air Conditioning.
.12 Millwork.
.13 Fire Systems.

.14 Testing and Commissioning.

1.6 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.

1.7 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.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Provide submittals listed for review to Departmental Representative. 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 for 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 are 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 at time of submission, in writing, identifying deviations from requirements of Contract Documents, stating reasons for deviations.

.7 Allow ten working days for Departmental Representative's review of each submission.

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

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

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

.11 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 that are to be provided by Contractor to illustrate details of a portion of Work.

.2 Where required, submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta.

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

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

.6 Accompany submissions with transmittal letter, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.7 Submissions include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.8 After Departmental Representative's review, distribute copies.

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

.10 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental

Representative where shop drawings will not be prepared due to standardized manufacture of product.

.11 Submit electronic copies of test reports for requirements requested in specification Sections, and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory, indicating 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 performed within 3 years of date of contract award for project.

.12 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.13 Submit electronic copies of manufacturers' instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards, and safety precautions.

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

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

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

.16 Delete information not applicable to project.

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

.18 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.

.19 The review of shop drawings by Public Services and Procurement Canada (PSPC) is for sole purpose of ascertaining general conformance with design intent.

.1 This review shall not mean that PSPC 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 SAMPLES

.1 Submit samples for review in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's business address.

.3 Notify Departmental Representative in writing, at time of submission, of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern, or texture is criterion, submit full range of samples.

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

.6 Make changes in samples that Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of quality of work and material against which installed Work will be verified.

1.4 PHOTOGRAPHIC DOCUMENTATION

.1 Submit construction photographs in accordance with procedures and requirements specified in this Section.

.2 Submit progress photographs in digital format:

.1 Format: .jpg (quality: 80% minimum).

.2 Resolution: 2048 x 1536 pixels.

.3 Compatibility: Microsoft Windows.

.4 Identification - file name to include:

.1 date of exposure (year-month-day)

.2 project name, room number

.3 cardinal direction

.4 Example: “yymmdd – Utilities Installation – Demil Facility Annex2 – Looking Northwest.jpg”

.5 Viewpoints: interior and exterior locations: viewpoints determined by Departmental Representative. Number of viewpoints: Minimum 24.

.6 Frequency: weekly - e-mail digital photos to Departmental Representative.

.7 Ensure photographs are focused and legible, with correct light exposure. Use a flash where necessary.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Province of Alberta

.1 Occupational Health and Safety Act, SA 2017 Chapter O-2.1.

.2 Occupational Health and Safety Regulation, Alberta Reg. 62/2003.

.3 Occupational Health and Safety Code, Alberta Reg. 87/2009, with amendments.

1.2 SAFETY PLAN

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

1.3 RESPONSIBILITY

.1 The "Prime Contractor" according applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

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

1.4 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan within seven 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.

.3 Applicable health and safety requirements regarding COVID-19 for workplaces as required by Federal and Provincial authorities having jurisdiction.

.3 Submit electronic copies of Contractor's authorized representative's work site health and safety inspection reports bi-weekly to Departmental Representative.

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

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS SDS - Safety Data Sheets for products used on project.

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

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

.9 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

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

1.5 FILING OF NOTICE

.1 Where required, file Notice of Project with Provincial authorities prior to beginning of Work.

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

1.6 SAFETY ASSESSMENT

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

1.7 MEETINGS

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

1.8 REGULATORY REQUIREMENTS

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

1.9 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Lead-containing paint.

.1 Refer to Sections 02 83 10 and 02 83 11 for lead abatement.

.2 Silica.

.1 Silica is the primary component of many construction materials, including brick, concrete, cement and mortar. Disturbance of the above-noted construction materials must be in accordance with Alberta Construction Association Silica Best Practices, current edition.

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Regulation, Alberta Reg. 62/2003.

1.11 UNFORESEEN HAZARDS

.1 When unforeseen or peculiar safety-related factors, hazards, or conditions occur during performance of Work, advise Health and Safety co-ordinator, follow procedures in accordance with Acts and Regulations of Province of Alberta, and advise Departmental Representative verbally and in writing.

1.12 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.
- .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.
- .5 Be on site during execution of Work.

1.13 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.

1.14 WHMIS

.1 Ensure that products used in project comply with Workplace Hazardous Materials Information System (WHMIS) Regulations and Chemical Substances of the OH&S Act and Regulations regarding use, handling, labelling, storage, and disposal of hazardous materials.

.2 Deliver copies of relevant Safety Data Sheets (SDS) to job site and Departmental Representative. SDS to be acceptable to Labour Canada and Health and Welfare Canada for controlled products that will be used in performance of this work. Locate SDS in accessible locations for workers and visitors throughout the site, bound and organized in binders.

.3 Train workers required to use or to work in close proximity to controlled products in accordance with OH&S Act and Regulations.

.4 Label controlled products at jobsite in accordance with OH&S and Regulations and WHMIS.

.5 Provide appropriate emergency facilities as specified in the SDS where workers might be exposed to contact with chemicals, including eye-wash facilities, emergency shower.

.1 Workers are to be trained in use of such emergency equipment.

.6 Provide appropriate personal protective equipment as specified in the SDS where workers are required to use controlled products.

.1 Properly fit workers for personal protective equipment

.2 Train workers in care, use, and maintenance of personal protective equipment.

.7 No controlled products are to be brought on-site without prior approved SDS.

.8 SDS are to remain on site at all times.

1.15 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.

1.16 POWDER ACTUATED DEVICES

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

1.17 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.

1.18 FIRE PROTECTION

.1 Comply with requirements of the local Fire Commissioner's Office.

.2 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

.3 Burning rubbish and construction waste materials is not permitted on site.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: Presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally, or historically.

.2 Environmental Protection: Prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2 ENVIRONMENT

.1 Perform work in accordance with the Canadian Environmental Protection Act, the Fisheries Act, the Canadian Wildlife Act, the Transportation of Dangerous Goods Act, and other relevant legislation, guidelines, or codes of practice.

1.3 SUBMITTALS

.1 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and acceptance by Departmental Representative. Plan is to present a comprehensive overview of known or potential environmental risks and detail how they will be mitigated.

.2 Submit Spill Response Plan within 10 working days of award of contract to Departmental Representative for review and acceptance.

.1 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

1.4 FIRES

.1 Fires and burning of rubbish on site are not permitted.

1.5 DISPOSAL OF WASTES

.1 Do not dispose of waste or volatile materials, such as mineral spirits, oil, or paint thinner into waterways, storm, or sanitary sewers.

1.6 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer, or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.7 SITE CLEARING AND PROTECTION

.1 Minimize stripping of topsoil and vegetation.

.2 Restrict vehicle movement to the project work area to limit impact to surrounding soil and vegetation.

.3 Store construction materials in existing hard packed areas, where possible, to avoid impacting soils and vegetation.

.4 Clearing and removal of grassland type vegetation/topsoil to use low impact equipment that will allow separation of topsoil. Equipment is to be acceptable to Departmental Representative.

1.8 EROSION AND SEDIMENT CONTROL

.1 Implement sediment and erosion control measures prior to and during the construction phase to prevent entry of sediment into sewers.

.2 Stabilize and restore disturbed areas upon completion of the works.

.3 Conduct activities, including maintenance procedures, to prevent entry of petroleum products, debris, rubble, concrete, and other deleterious substances into storm sewers and waterways.

.4 Conduct vehicular refueling and maintenance minimum 30 metres from water and storm sewers.

.5 Monitor weather conditions to ensure works are being completed under stable conditions.

1.9 DUST CONTROL

.1 Maintain sufficient watering equipment on site throughout duration of the Contract to control construction dust.

.2 In case of failure to control dust emissions or loose debris, Departmental Representative may order operations to cease until adequate measures have been taken.

1.10 CONSTRUCTION WASTE

.1 Provide sufficient suitable refuse containers throughout site to receive and control construction wastes. Keep containers closed to prevent contents from blowing around site and surrounding properties.

1.11 ENVIRONMENTAL MANAGEMENT

.1 Protect downstream areas from negative impact due to construction activities. Protect areas downstream from damage due to siltation, run-off, and dewatering procedures from construction site.

.2 During periods of heavy precipitation, avoid construction activities that could cause soil compaction, rutting, or admixing.

.3 Vehicles and equipment not in use in the project areas are not to be left idling.

1.12 ENVIRONMENTAL INCIDENT OR EMERGENCY

.1 In the event of an environmental incident or emergency:

.1 Notify the Contractor's job superintendent.

.2 Call Departmental Representative, and give type of emergency.

.2 Reportable events include:

.1 Chemical spill or petroleum spill.

.2 Poisonous or caustic gas emission.

.3 Biological or chemical explosion.

.4 Hazardous material spill.

.5 Sewage spill.

.6 Contaminated water into waterways.

.3 If soil contamination or archaeological artifacts are encountered during the project, cease activities and contact Departmental Representative for direction. Recommendation for remediation will be provided through Departmental Representative. Adhere to recommendations.

1.13 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial, or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 After receipt of notice, inform Departmental Representative of proposed corrective action, and take action as approved by Departmental Representative.

.3 Departmental Representative will issue stop work order until satisfactory corrective action has been taken.

.1 No time extensions will be granted, nor equitable adjustments will be allowed for such suspensions.

END OF SECTION

Part 1 General

1.1 REFERENCES TO REGULATORY REQUIREMENTS

.1 Perform Work in accordance with National Building Code – 2019 Alberta Edition, including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code

.1 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. 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 BUILDING SMOKING ENVIRONMENT

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

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: Except as otherwise specified, Constructor shall apply for, obtain, and pay fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:

.1 Regulatory requirements and fees in force on date of Bid submission, and

.2 A change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission

Part 2 Products

2.1 EASEMENTS AND NOTICES

.1 Departmental Representative will obtain permanent easements and rights of servitude that may be required for performance of Work.

.2 Contractor shall give notices required by regulatory requirements.

2.2 PERMITS

.1 Building Permit:

.1 Contractor shall apply for, obtain, and pay for building permit on behalf of Owner, and other permits required for Work and its various parts.

.2 Contractor will require that specific Subcontractors obtain and pay for permits required by authorities having jurisdiction, where their Work is affected by Work requiring permits including asbestos abatement and control permits.

.3 Display building permit and other permits in a conspicuous location at Place of Work.

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. If such Work is found in accordance with Contract Documents, Departmental Representative will pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Material testing required to meet specifications is Quality Control (QC) to be conducted by certified material testing laboratory, to be engaged and paid by Contractor.

.2 Independent Inspection/Testing Agencies may be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.

.1 Departmental Representative may engage independent material testing for conducting random Quality Assurance (QA) testing.

.3 Provide equipment required for executing inspection and testing by appointed agencies.

.4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.5 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 reinspection.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

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

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

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

1.5 REJECTED WORK

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

.2 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, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.6 REPORTS

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

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

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

1.8 MOCK-UPS

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

.2 Construct in locations acceptable to Departmental Representative.

.3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups 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.

.5 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.

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

.7 Mock-ups may remain as part of Work.

.8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.9 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.10 EQUIPMENT AND SYSTEMS

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

.2 Refer to Section 01 91 13 – General Commissioning Requirements for definitive requirements.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 WATER SUPPLY

.1 Departmental Representative will provide continuous supply of potable water for construction use.

.2 Arrange for connection with building manager and pay costs for installation, maintenance and removal.

1.4 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance, and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation, and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10°C in areas where construction is in progress.

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours, or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system after cessation of work process to ensure removal of harmful contaminants.

.6 Permanent heating system of building may be used when available. Be responsible for damage to heating system if use is permitted.

.1 On completion of Work for which permanent heating system is used, replace filters, and clean added and altered ductwork.

.2 Clean existing ductwork that is connected to added and altered ductwork, up to the nearest main branch or terminal unit.

.7 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.

.8 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.5 TEMPORARY POWER AND LIGHT

.1 Departmental Representative will provide temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts, 30 amps.

.2 Arrange for connection with building manager. Pay costs for installation, maintenance, and removal.

.3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.

.4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

.5 Existing electrical power and lighting systems and those installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative, provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps that have been used for more than 3 months.

1.6 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.

.2 CAN/CSA Z321-96 (R2006), Signs and Symbols for the Workplace.

1.2 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 that 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 CSA S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, temporary stairs.

1.5 HOISTING

.1 Provide, operate and maintain hoists as required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists to be operated by qualified operator.

1.6 OFFICES

.1 Provide office heated to 22°C, lighted 750 lx, ventilated, and 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.

1.7 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.

1.8 SANITARY FACILITIES

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

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

1.9 CONSTRUCTION SIGNAGE

.1 Signs and notices for safety and instruction in both official languages; graphic symbols to CAN/CSA Z321.

.2 Maintain approved signs and notices in good condition for duration of project and dispose off site on completion of project, or earlier if directed by Departmental Representative.

1.10 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.3 Provide measures for protection, control, and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor is responsible for repair of damage to roads caused by construction operations.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary controls to execute Work expeditiously.

.2 Remove from site all such work after use.

1.2 SITE ENCLOSURE

.1 Erect temporary site enclosure using steel wire mesh temporary fencing.

- .1 Minimum height: 1800 mm.
- .2 Mesh size: 50 x 100 mm, 3.5 mm thickness.
- .3 Frame: 25 x 25 mm x 1.2 mm thickness.
- .4 Provide feet blocks and bracing as required for stable installation.
- .5 Erect fence at perimeter of site to fully enclose the site.
- .6 Construct fence to deter entry by unauthorized persons.
- .7 Maintain fence in good repair.

.2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

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 until they are permanently enclosed.

.2 Erect enclosures to allow access for the installation of materials and to allow for work inside enclosure.

.3 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.4 Design enclosures to withstand wind pressure and snow loading.

.5 Ensure that upon final construction, and during construction, the work is executed to prevent the entry of water, snow, and air into the interior of the building and to accept the responsibility to correct any deficient work. Bring to the attention of the Departmental Representative, prior to construction, details that may compromise weather tightness.

.6 Provide weather enclosures or other means as necessary to protect foundation excavations to maintain soil bearing capacity.

1.5 DUST TIGHT SCREENS

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

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

.3 Coordinate location and security measures with Departmental Representative on Site.

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, and 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 locations and installation schedule with Departmental Representative, minimum 3 days prior to installation.

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Within text of each specifications section, reference may be made to reference standards.

.2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.3 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.

.4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

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

1.4 STORAGE, HANDLING AND PROTECTION

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

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

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

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

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

1.5 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 LOCATION OF FIXTURES

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

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.12 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.

1.13 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.

1.14 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.

1.15 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, building occupants, and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Owner's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Departmental Representative.

1.3 SURVEY REFERENCE POINTS

.1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.2 Make no changes or relocations without prior written notice to Departmental Representative.

.3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.4 Require surveyor to replace control points in accordance with original survey control.

1.4 SURVEY REQUIREMENTS

.1 Establish two permanent benchmarks on site, referenced to established benchmarks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation column locations and floor elevations.

.8 Establish lines and levels for mechanical and electrical work.

1.5 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Remove abandoned service lines within 2 metres of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.6 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.7 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.8 SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying [and noting] those elevations and locations of completed Work that conform [and do not conform] with Contract Documents.

1.9 SUBSURFACE CONDITIONS

.1 Promptly notify Departmental Representative in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should Departmental Representative determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

END OF SECTION

Part 1 General

1.1 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 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 separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 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.

1.3 EXECUTION

.1 Execute cutting, fitting, and patching, including excavation and fill, 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 experienced 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 Provide firestopping in accordance with Section 07 84 00 - Firestopping to maintain integrity of fire separations, including:

.1 Protecting penetrations at fire-resistance rated wall, ceiling or floor construction.

.2 Using construction joint fire stops and building perimeter fire stops to protect gaps at fire separations and between fire separations and other construction assemblies.

.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.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner 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. Refer to Section 01 74 19 - Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

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

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

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

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

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

1.2 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 Owner or other Contractors.

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

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

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

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

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

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

.14 Remove dirt and other disfiguration from exterior surfaces.

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

.16 Sweep and wash clean paved areas.

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

.18 Clean roofs, downspouts, and drainage systems.

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

.20 Remove snow and ice from access to building.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for management of construction waste and disposal, which forms the Contractor's commitment to reduce and divert waste materials from landfill and includes the following:

.1 Preparation of a Draft Construction Waste Management Plan that will be used to track the success of the Construction Waste Management Plan against actual waste diversion from landfill.

.2 Preparation of a Construction Waste Management Plan that provides guidance on a logical progression of tasks and procedures to be followed in a pollution prevention program to reduce or eliminate the generation of waste, the loss of natural resources, and process emissions through source reduction, reuse, recycling, and reclamation.

.3 Preparation of monthly progress reports indicating cumulative totals representing progress towards achieving diversion and reduction goals of waste materials away from landfill and identifying any special programs, landfill options or alternatives to landfill used during construction.

.4 Preparation of a Construction Waste Management Report containing detailed information indicating total waste produced by the project, types of waste material and quantity of each material, and total waste diverted and diversion rates indicated as a percentage of the total waste produced.

.2 Owner has established that this project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors be employed by the Contractor.

1.2 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.

.2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, re-modeling, repair and demolition operations.

.3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity or reactivity.

.4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.5 Non-toxic: Not poisonous to humans either immediately or after a long period of exposure.

.6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

.7 Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

.8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

.9 Return: To give back reusable items or unused products to vendors for credit.

.10 Reuse: To reuse a construction waste material in some manner on the project site.

.11 Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

.12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.

.13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

.14 Toxic: Poisonous to humans either immediately or after a long period of exposure.

.15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

.16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:

.1 Solvents in paints and other coatings.

.2 Wood preservatives; strippers and household cleaners.

.3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.

.4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.

.17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

.18 Construction Waste Management Plan: A project related plan for the collection, transportation, and disposal of the waste generated at the construction site; the purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the project and ensure that requirements of the Construction Waste Management Plan are followed.

.2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 – Project Meetings before starting any Work of the Contract attended by the Owner, Contractor, affected Subcontractors and Departmental Representative to discuss the Contractor's Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.4 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Provide the following submittals before starting any work of this Section:

.1 Draft Construction Waste Management Plan (Draft CWM Plan): Submit to Departmental Representative a preliminary analysis of anticipated site generated waste by listing a minimum of five construction or demolition waste streams that have potential to generate the most volume of material indicating methods that will be used to divert construction waste from landfill and source reduction strategies; Departmental Representative will provide commentary before development of Contractor's Construction Waste Management Plan.

.2 Construction Waste Management Plan (CWM Plan): Submit a CWM Plan for this project prior to any waste removal from site and that includes the following information:

.1 Material Streams: Analysis of the proposed jobsite waste being generated, including material types and quantities forming a part of identified material streams in the Draft CWM Plan; materials removed from site destined for alternative daily cover at landfill sites and land clearing debris cannot be considered as contributing to waste diversion and will be included as a component of the total waste generated for the site.

.2 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials and incorporate into CWM Plan.

.3 Alternative Waste Disposal: Prepare a listing of each material proposed to be salvaged, reused, recycled, or composted during the course of the project, and the proposed local market for each material.

.4 Landfill Materials: Identify materials that cannot be recycled, reused or composted and provide explanation or justification; energy will be considered as a viable alternative diversion strategy for these materials where facilities exist.

.5 Landfill Options: The name of the landfill where trash will be disposed of; landfill materials will form a part of the total waste generated by the project.

.6 Materials Handling Procedures: A description of the means by which any recycled waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

.7 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site separated and self hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.

1.5 PROJECT CLOSEOUT SUBMISSIONS

.1 Record Documentation: Submit as constructed information in accordance with Section 01 78 00 – Closeout Submittals as follows:

.1 Construction Waste Management Report (CWM Report): Submit a CWM Report for this project in a format acceptable to submittal requirements and that includes the following information:

.1 Accounting: Submit information indicating total waste produced by the project.

.2 Composition: Submit information indicating types of waste material and quantity of each material.

.3 Diversion Rate: Submit information indicating total waste diverted from landfill as a percentage of the total waste produced by the project.

.4 Transportation Documentation: Submit copies of transportation documents or shipping manifests indicating weights of materials, and other evidence of disposal indicating final location of waste diverted from landfill and waste sent to landfill.

.5 Alternative Daily Cover (ADC): Submit quantities of material that were used as ADC at landfill sites, and that form a part of the total waste generated by the project.

.6 Multiple Waste Hauling: Compile all information into a single CWM Report where multiple waste hauling and diversion strategies were used for the project.

.7 Photographs: Submit photographs of waste diversion facilities documenting location and signage describing usage of waste separation containers.

1.6 QUALITY ASSURANCE

.1 Resources for Development of Construction Waste Management Report (CWM Report): The following sources may be useful in developing the Draft Construction Waste Management Plan:

.1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials and incorporate into CWM Plan.

.2 Waste-to-Energy Systems: Investigate local waste-to-energy incentives where systems for diverting materials from landfill for reuse or recycling are not available.

.2 Certifications: Provide proof of the following during the course of the Work:

.1 Compliance Certification: Provide proof that recycling center is third party verified and is listed as a Certified Facility through the registration and certification requirements of the Recycling Certification Institute.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the project waste and the available recycling and reuse programs in the project area.

.2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:

.1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

.2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.

.3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

Part 2 Products

Not Used.

Part 3 Execution

3.1 CWM PLAN IMPLEMENTATION

.1 Manager: Contractor is responsible for designating an on site party or parties responsible for instructing workers and overseeing and documenting results of the CWM Plan for the project.

.2 Distribution: Distribute copies of the CWM Plan to the job site foreman, each Subcontractor, the Owner, the Departmental Representative and other site personnel as required to maintain CWM Plan.

.3 Instruction: Provide on site instruction to Subcontractors of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the project at appropriate stages of the project.

.4 Separation Facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:

.1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local regulations.

.5 Progressive Documentation: Submit a monthly summary of waste generated by the project to ensure that waste diversion goals are on track with project requirements:

.1 Submission of waste summary can coincide with application for progress payment, or similar milestone event as agreed upon between the Owner, Contractor and Departmental Representative.

.2 Monthly waste summary shall contain the following information:

.1 The amount in tonnes or m^3 and location of material landfilled,

.2 The amount in tonnes or m^3 and location of materials diverted from landfill, and

.3 Indication of progress based on total waste generated by the project with materials diverted from landfill as a percentage.

3.2 SUBCONTRACTOR'S RESPONSIBILITY

.1 Subcontractors shall cooperate fully with the Contractor to implement the CWM Plan.

3.3 SAMPLE CONSTRUCTION WASTE MANAGEMENT FORMS

.1 Sample waste tracking form as appended to this section can be used by the Contractor to establish their own forms for recording management of construction waste:

END OF SECTION

Project Name:

Prime Contractor Name:

Contact Person:

Telephone:

PWGSC Project Number:

Fax:

Material Category	Re-use		Recycling		Landfill		Material Destination	Responsible Sub-Contractor
	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Provide company name, address, contact person and phone number	
Division 2 - Existing Conditions								
Asphalt Paving Removal								
Fencing:								
Chain Link								
Wood								
Hazardous Materials:								
Contaminated Soil Removal								
Division 3 - Concrete								
Cast in Place Concrete								
Concrete Reinforcing								
Division 4 - Masonry								
Brick Masonry								
Clay Tile Masonry								
Concrete Unit Masonry								
Glass Unit Masonry								
Misc. Masonry								
Division 5 - Metals								
Structural Steel								
Steel Decking								
Metal Studs								
Aluminum								
Copper								
Cast Iron								
Stainless Steel								

Project Name:

Prime Contractor Name: **Contact Person:**

Telephone:

PWGSC Project Number: **Fax:**

Material Category	Re-use		Recycling		Landfill		Material Destination	Responsible Sub-Contractor
	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Provide company name, address, contact person and phone number	
Metal Fabrications								
Misc. Metals								
Division 6 - Wood, Plastics and Composites								
Lumber:								
Untreated								
Treated								
Plywood:								
Untreated								
Treated								
Trim, Moulding								
Cabinets/Counters								
Plastic Laminates								
Misc. Wood								
Misc. Plastics								
Misc. Composites								
Division 7 - Thermal and Moisture Protection								
Insulation:								
Fibreglass Batt								
Rigid								
Asbestos Containing								
Roofing Materials:								
Shingles								
Membrane								
Felt & Gravel								
Asbestos Containing								
Siding:								
Regular								
Asbestos Containing								

Project Name:

Prime Contractor Name: **Contact Person:**

Telephone:

PWGSC Project Number: **Fax:**

Material Category	Re-use		Recycling		Landfill		Material Destination	Responsible Sub-Contractor
	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Provide company name, address, contact person and phone number	
Flashing/Trim:								
Regular								
Asbestos Containing								
Other								
Division 8 - Openings								
Steel Doors & Frames								
Aluminum Doors & Frames								
Overhead Doors								
Door Hardware								
Windows								
Glazing								
Louvres and Vents								
Other								
Division 9 - Finishes								
Ceramic Tile								
Quarry Tile								
Acoustical Tile								
Wood Flooring								
Carpet								
Resilient Flooring								
Vinyl Flooring								
Acoustical Suspention								
Gypsum Board								
Plaster/Lath								
Wood Panelling								
Metal Ceilings								
Asbestos Containing Finishes								
Lead Containing Finishes								
Other								

Project Name:

Prime Contractor Name: **Contact Person:**

Telephone:

PWGSC Project Number: **Fax:**

Material Category	Re-use		Recycling		Landfill		Material Destination	Responsible Sub-Contractor
	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Provide company name, address, contact person and phone number	
Division 10 - Specialties								
Chalkboards								
Toilet Partitions								
Toilet Accessories								
Metal Lockers								
Metal Shelving								
Other								
Division 11 - Equipment								
Food Service Equipment								
Parking Control Equipment								
Other								
Division 12 - Furnishings								
Desks								
Chairs								
Tables								
Bookcases								
Filing Cabinets								
Horizontal Blinds								
Other								
Division 14 - Conveying Systems								
Elevators								
Wheelchair Lifts								
Other								

Project Name:

Prime Contractor Name: **Contact Person:**

Telephone:

PWGSC Project Number: **Fax:**

Material Category	Re-use		Recycling		Landfill		Material Destination	Responsible Sub-Contractor
	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Provide company name, address, contact person and phone number	
Division 22 - Plumbing and Division 23 - HVAC								
Piping								
Ducting								
Valves								
Water Heaters								
Heating Units								
Air Handling Units								
Sinks								
Toilets								
Showers								
Controls								
Furnace Oil Tanks								
Furnace Oil Collected								
Other								
Division 26 - Electrical								
Wires & Cables								
Conduits								
Cable Tray, Raceways								
Receptacle Outlets								
Receptacle Switches								
Switch Boxes								
Junction Boxes								
Smoke Detectors								
Misc. Electrical Controls								
Motors								
Generating Equipment								
Panelboards								
Transformers								
Batteries								
Uniterruptible Power Systems								
Lighting:								
Incandescent Light Fixtures								
Flourescent Light Fixtures								
PCB Containing:								
Wires & Cables								
Transformers								
Lighting								

Project Name:

Prime Contractor Name: **Contact Person:**

Telephone:

PWGSC Project Number: **Fax:**

Material Category	Re-use		Recycling		Landfill		Material Destination	Responsible Sub-Contractor
	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Estimated (tonnes)	Actual (tonnes)	Provide company name, address, contact person and phone number	
Smoke Detectors								
Misc. Electrical Controls								
Other								
Division 27 - Communications								
Communication Equipment:								
Regular								
PCB Containing								
Other								
Division 33 - Utilities								
Manhole Structures								
Catchbasin Structures								
Site Water Distribution Piping								
Public Sanitary Utility Sewerage Piping								
Septic Tanks								
Storm Utility Drainage Piping								
Above Ground Fuel Storage Tanks								
Underground Fuel Storage Tanks								
Other								

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Departmental Representative inspection.

.2 Departmental Representative Inspection:

.1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates, in English, that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, adjusted and balanced and fully operational.

.4 Certificates required by Fire Commissioner, Utility companies: submitted.

.5 Operation of systems: demonstrated to Owner's personnel.

.6 Commissioning of mechanical systems: completed in accordance with 01 91 13 – General Commissioning Requirements and copies of final Commissioning Report submitted to Departmental Representative.

.7 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.

.2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be

date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment:

.1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 When Work deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

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 and Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify Project requirements.

.2 Review manufacturer's installation instructions and warranty requirements.

.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 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, three 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 format on CD or DVD.

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 Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: Mark each sheet to 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.

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

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 Report, System Components List complete with Commissioning Verification Forms and Check Sheets, and Commissioning Issues/Resolution Log.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

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

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

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

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

.3 Record information concurrently with construction progress.

.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 Referenced Standards to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, 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 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 and 01 91 13 -General Commissioning 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.

.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 Extra Stock Materials:

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to [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.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.3 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; 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 Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.8 Conduct joint 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 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.3 Contractor's plans for attendance at 9 month post-construction warranty inspections.

.4 Procedure and status of tagging of equipment covered by extended warranties.

.5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

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

.11 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

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.

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 for which 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 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 three hours in length.

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

1.6 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities.
.2 Coordination among instructors.
.3 Quality of training, training materials.

.2 Departmental Representative will evaluate training and materials.

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

END OF SECTION

Part 1 General

1.1 GENERAL

.1 Cx is a planned program of tests, procedures, and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, and functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems, and integrated systems operate in accordance with Contract Documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: Per client's requirements or determined by designer. To meet Project functional and operational requirements.

.4 Acronyms:

.1 BMM - Building Management Manual.

.2 Cx - Commissioning.

.3 EMCS - Energy Monitoring and Control Systems.

.4 O&M - Operation and Maintenance.

.5 PI - Product Information.

.6 PV - Performance Verification.

.7 TAB - Testing, Adjusting and Balancing.

1.2 COMMISSIONING OVERVIEW

.1 Section 01 91 13.13 - Commissioning (Cx) Plan.

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

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

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

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

.6 Departmental Representative will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability, and approved by Departmental Representative.

.2 Equipment, components, systems, and integrated systems have been fully commissioned and functional to design intent, to meet project functional and operational requirements.

.3 Training to operation and maintenance staff has been completed.

.4 Final O&M Manual and Training Manual have been received, reviewed, and accepted by Departmental Representative for suitability.

.5 Successful completion of integrated systems tests, life safety support systems tests and after meeting requirements of authority having jurisdiction.

1.3 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

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

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

1.4 PRE-CX REVIEW

.1 Before Construction:

.1 Review Contract Documents, and confirm in writing to Departmental Representative:

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location, and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems are complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Departmental Representative.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 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.

1.5 CONFLICTS

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

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

1.6 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.

1.7 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 13.16 - 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.

1.8 COMMISSIONING SCHEDULE

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

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

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

.4 Training.

1.9 COMMISSIONING MEETINGS

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

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

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

.4 At 60% construction completion stage. Section 01 32 16.19 - Construction Progress Schedules - Bar (GANTT) Chart. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities, and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

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

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

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

1.10 STARTING AND TESTING

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

1.11 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

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

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

1.12 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval by Departmental Representative.

.3 Arrange for Departmental Representative to witness tests.

.4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.

.2 Obtain manufacturers installation, start-up, and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.13 PROCEDURES

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

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

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

.4 Document required tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by 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 acceptable to Departmental Representative.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.

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

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

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

1.14 START-UP DOCUMENTATION

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

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.15 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

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

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

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

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

1.16 TEST RESULTS

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

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

1.17 START OF COMMISSIONING

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

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

1.18 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.19 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual or 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.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.20 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.21 AUTHORITIES HAVING JURISDICTION

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

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

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

1.22 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 acceptable to Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.23 EXTENT OF VERIFICATION

.1 Provide labour 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, and instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies are found in more than 20% of reported results.

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

1.24 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.

1.25 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.

1.26 DEFICIENCIES, FAULTS, DEFECTS

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

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

1.27 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.

1.28 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.

1.29 TRAINING

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

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 TAB and 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 OWNER'S PERFORMANCE TESTING

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE Guideline 0-2013 – The Commissioning Process.

.2 Canadian Standards Association (CSA)

.1 CSA Z320-11 (R2016), Building Commissioning.

.3 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 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 BMM - Building Management Manual.

.2 Cx - Commissioning.

.3 EMCS - Energy Monitoring and Control Systems.

.4 PI - Product Information.

.5 PV - Performance Verification.

.6 SDS - Safety Data Sheets.

.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 to be 95% completed before added into Project Specifications.

.2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:

.1 Approved shop drawings and product data.

.2 Approved changes to contract.

.3 Contractor's project schedule.

.4 Cx schedule.

.5 Contractor's, sub-contractor's, suppliers' requirements.

.6 Project construction team's and Cx team's requirements.

.3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.4 REFINEMENT OF CX PLAN

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

.1 Changes resulting from Client program modifications.

.2 Approved design and construction changes.

.2 Revise, refine, and update every 6 weeks during construction phase. At each revision, indicate revision number and date.

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

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

1.5 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

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

.2 Project Manager will select Cx Team consisting of following members:

- .1 Departmental Representative Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
- .2 Departmental Representative Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
  - .1 Review of Cx documentation from operational perspective.
  - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
  - .3 Protection of health, safety and comfort of occupants and O&M personnel.
  - .4 Monitoring of Cx activities, training, development of Cx documentation.
  - .5 Work closely with members of Cx Team.
- .3 Departmental Representative is responsible for:
  - .1 Organizing Cx.
  - .2 Monitoring operations Cx activities.
  - .3 Witnessing, certifying accuracy of reported results.
  - .4 Witnessing and certifying TAB and other tests.
  - .5 Developing BMM.
  - .6 Ensuring implementation of final Cx Plan.
  - .7 Performing verification of performance of installed systems and equipment.
  - .8 Implementation of Training Plan.
- .4 Construction Team: contractor, subcontractors, suppliers, and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
  - .1 Testing.
  - .2 TAB.
  - .3 Performance of Cx activities.
  - .4 Delivery of training and Cx documentation.
  - .5 Assigning one person as point of contact with Departmental Representative and Cx Manager for administrative and coordination purposes.
- .5 Contractor's Cx agent implements specified Cx activities including:
  - .1 Demonstrations.
  - .2 Training.

.3 Testing.

.4 Preparation, submission of test reports.

.6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:

.1 Receiving facility.

.2 Day-to-day operation and maintenance of facility.

1.6 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:

.1 Installation contractor/subcontractor:

.1 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.

.1 To include performance verification.

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Specialist Cx agency:

.1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.

.5 Client: Responsible for intrusion and access security systems.

.6 Ensure that Cx participant:

.1 Could complete work within scheduled time frame.

.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.

.7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.7 EXTENT OF CX

.1 Cx Structural and Architectural Systems:

- .1 Architectural and structural:
  - .1 Accessibility.
  - .2 Doors and related hardware.

.2 Commission mechanical systems and associated equipment:

- .1 Plumbing systems:
  - .1 Domestic CWS.
- .2 HVAC and exhaust systems:
  - .1 HVAC systems.
  - .2 Loading chutes.
  - .3 Make up air unit.
  - .4 Exhaust systems.
  - .5 Boiler combustion air and relief air requirements.
  - .6 Interlock of makeup system with existing dust collection systems.
- .3 Fire and life safety systems:
  - .1 Fire pump.
  - .2 Standpipe and hose systems.
  - .3 Fire extinguishers.
- .4 PLC:
  - .1 Equipment stand-alone controls.

.3 Commission electrical systems and equipment:

- .1 Lighting systems:
  - .1 Lighting equipment.
  - .2 Emergency lighting systems, including battery packs.
  - .3 Fire exit emergency signage.
- .2 Fire alarm systems, equipment:
  - .1 Annunciators.
  - .2 Control panels.
  - .3 Horn/Strobe devices.
  - .4 Fire and smoke alarm systems.
  - .5 Battery packs for all the above.
- .3 Emergency power systems:
  - .1 Emergency diesel generator.

1.8 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:

- .1 Compile English documentation.

.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:

.1 Warranties.
.2 Project record documentation.
.3 Inventory of spare parts, special tools and maintenance materials.
.4 Maintenance Management System (MMS) identification system used.
.5 WHMIS information.
.6 WHMIS Safety Data Sheets (SDS).
.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.
.8 Preventative maintenance program.
.9 Standard operating procedures.
.10 Contractor's and sub-contractors' 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 Training Plans.
.10 Cx Reports.
.11 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 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 inspections and tests.

.7 Include completed documentation in Cx report.

.2 Pre-Cx activities - MECHANICAL:

.1 HVAC equipment and systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 At this time, complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.4 Perform TAB on systems. TAB reports to be approved by Departmental Representative.

.2 Stand-alone Controls:

.1 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of 30 day Final Acceptance Test period.

.2 Perform final Cx and operational tests during demonstration period and 30 day test period.

.3 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

.3 Pre-Cx activities - LIFE SAFETY SYSTEMS

.1 Include equipment and systems identified above.

.1 Fire suppression

.2 Reports of test results to be witnessed and certified by Departmental Representative before verification.

.4 Pre-Cx activities - ELECTRICAL:

.1 Lighting systems:

.1 Emergency lighting systems:

.2 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Departmental Representative has witnessed and certified report, demonstrate devices and zones to Departmental Representative.

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, following equipment, systems:

.3 Departmental Representative to monitor 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 to witness and certify reported results using approved PI and PV forms.

.4 Departmental Representative to approve completed PV reports.

.5 Departmental Representative reserves right to verify up to 30% of reported results at random.

.6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.12 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx by specified Cx agency using procedures acceptable to Departmental Representative.

.2 Departmental Representative to monitor Cx activities.

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

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

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

1.13 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

.1 Cx to be performed by specified Cx specialist, using procedures developed by Departmental Representative and approved by Departmental Representative.

.2 Tests to be witnessed by Departmental Representative and documented on approved report forms.

.3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Departmental Representative and submitted to Departmental Representative for review.

.4 Departmental Representative reserves right to verify percentage of reported results.

.5 Integrated systems to include:

.1 Fire alarm systems.
.2 Fire pumps and controllers.
.3 Emergency generator.
.4 Emergency lighting systems.

.6 Identification:

.1 In later stages of Cx, before hand-over and acceptance Departmental Representative, Contractor, Project Manager, Property Manager and Cx Manager to co-operate to complete inventory data sheets and provide assistance to Departmental Representative in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.14 INSTALLATION CHECK LISTS (ICL)

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

1.15 PRODUCT INFORMATION (PI) REPORT FORMS

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

1.16 PERFORMANCE VERIFICATION (PV) REPORT

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

1.17 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.

1.18 CX SCHEDULES

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

.1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems, and integrated systems, including:

.1 Design criteria, design intents.

.2 Pre-TAB review: 28 days after contract award, and before construction starts.

.3 Cx agents' credentials: 60 days before start of Cx.

.4 Cx procedures: 3 months after award of contract.

.5 Cx Report format: 3 months after contract award.

.6 Discussion of heating/cooling loads for Cx: 3 months before start-up.

.7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.

.8 Notification of intention to start TAB: 21 days before start of TAB.

.9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.

.10 Notification of intention to start Cx: 14 days before start of Cx.

.11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.

.12 Identification of deferred Cx.

.13 Implementation of training plans.

.14 Cx of smoke management/control systems: after Cx of related systems is completed and 7 days before proposed date of Cx these systems.

.15 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.

.3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.

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

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

1.19 CX REPORTS

.1 Submit reports of tests, witnessed and certified by Departmental Representative 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.

1.20 ACTIVITIES DURING WARRANTY PERIOD

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

.1 Fine tuning of HVAC systems.

.2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.

.3 Full-scale emergency evacuation exercises.

1.21 TESTS TO BE PERFORMED BY OWNER/USER

.1 None is anticipated on this project.

1.22 FINAL SETTINGS

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

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 92 00 – Facility Operation.

1.7 LANGUAGE

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

END OF SECTION

Bldg. & Tag No. EF-1 Dwg. No. _____ File No. _____

GENERAL INFO:			
Manufacturer:		Location:	
Model Number:			
Serial Number:			
Fan Type:		Drive Type:	
MOTOR DATA:			
Manufacturer:		Panel No.:	
Model:		Power (V/Ph/Hz):	
H.P.:		Thermal Protection:	
Type:		Fuse Rating:	

Static Verification:	**YES**	**NO**	**N/A**		**YES**	**NO**	**N/A**
Flexible Connections (Durodyne) Installed:				Unit Cleaned:			
Vibration Isolation Specified:				Power Wiring Complete:			
Vibration Isolation Installed & Checked:				Direction of Rotation Correct:			
Ductwork Installation Complete:				Abnormal Vibrations:			
Alignment Complete (if belt drive):				Backdraft Damper Specified:			
Belt Drive Tension Adjusted (if belt drive):				Backdraft Damper Installed:			

Functional Performance Verification:	**YES**	**NO**	**N/A**		**YES**	**NO**	**N/A**
Fan interlocked with gas monitoring control box. Fan operates on elevated gas levels:							

Ventilation Data		**Design**	**Measured**	**Remarks**
Flow (L/s)				
Outlet Velocity (m/s)				
Ext. Static Pres. (Pa.)				
Fan RPM				
Voltage	A-B			
	A-C			
	B-C			
Amperage	A-B			
	A-C			
	B-C			

COMMENTS: _____

Bldg. & Tag No. EF-1 Dwg. No. _____ File No. _____

Witnessed By: _____ Company: _____ Date: _____

Departmental Representative: _____ Date: _____

Bldg. & Tag No. EF-2 Dwg. No. _____ File No. _____

GENERAL INFO:			
Manufacturer:		Location:	
Model Number:			
Serial Number:			
Fan Type:		Drive Type:	
MOTOR DATA:			
Manufacturer:		Panel No.:	
Model:		Power (V/Ph/Hz):	
H.P.:		Thermal Protection:	
Type:		Fuse Rating:	

Static Verification:	**YES**	**NO**	**N/A**		**YES**	**NO**	**N/A**
Flexible Connections (Durodyne) Installed:				Unit Cleaned:			
Vibration Isolation Specified:				Power Wiring Complete:			
Vibration Isolation Installed & Checked:				Direction of Rotation Correct:			
Ductwork Installation Complete:				Abnormal Vibrations:			
Alignment Complete (if belt drive):				Backdraft Damper Specified:			
Belt Drive Tension Adjusted (if belt drive):				Backdraft Damper Installed:			

Functional Performance Verification:	**YES**	**NO**	**N/A**		**YES**	**NO**	**N/A**
Fan operates continuously:							

Ventilation Data		**Design**	**Measured**	**Remarks**
Flow (L/s)				
Outlet Velocity (m/s)				
Ext. Static Pres. (Pa.)				
Fan RPM				
Voltage	A-B			
	A-C			
	B-C			
Amperage	A-B			
	A-C			
	B-C			

COMMENTS: _____

Bldg. & Tag No. EF-2 Dwg. No. _____ File No. _____

Witnessed By: _____ Company: _____ Date: _____

Departmental Representative: _____ Date: _____

Bldg. & Tag No. EF-3 Dwg. No. _____ File No. _____

GENERAL INFO:			
Manufacturer:		Location:	
Model Number:			
Serial Number:			
Fan Type:		Drive Type:	
MOTOR DATA:			
Manufacturer:		Panel No.:	
Model:		Power (V/Ph/Hz):	
H.P.:		Thermal Protection:	
Type:		Fuse Rating:	

Static Verification:	**YES**	**NO**	**N/A**		**YES**	**NO**	**N/A**
Flexible Connections (Durodyne) Installed:				Unit Cleaned:			
Vibration Isolation Specified:				Power Wiring Complete:			
Vibration Isolation Installed & Checked:				Direction of Rotation Correct:			
Ductwork Installation Complete:				Abnormal Vibrations:			
Alignment Complete (if belt drive):				Backdraft Damper Specified:			
Belt Drive Tension Adjusted (if belt drive):				Backdraft Damper Installed:			

Functional Performance Verification:	**YES**	**NO**	**N/A**		**YES**	**NO**	**N/A**
Fan operates continuously:							

Ventilation Data		**Design**	**Measured**	**Remarks**
Flow (L/s)				
Outlet Velocity (m/s)				
Ext. Static Pres. (Pa.)				
Fan RPM				
Voltage	A-B			
	A-C			
	B-C			
Amperage	A-B			
	A-C			
	B-C			

COMMENTS: _____

Bldg. & Tag No. EF-3 Dwg. No. _____ File No. _____

Witnessed By: _____ Company: _____ Date: _____

Departmental Representative: _____ Date: _____

Bldg. & Tag No. EMB & RH Dwg. No. _____ File No. _____

A. GENERAL INFORMATION

1. LOCATION: _____ SPEC. REF: _____
2. MODEL NO.: _____
3. MANUFACTURER: _____
4. VOLTS: _____ 8. NO. OF HEADS: _____
5. FED FROM: _____ 9. HEAD TYPE: _____
6. OUTPUT VOLTS: _____ 10. HEAD WATTAGE: _____
7. BATTERY CAPACITY: _____

B. STATIC VERIFICATION:

	Test OK	Nonconformance
1. Unit clean and secure	☐	☐
2. Test switch functions	☐	☐
3. Heads aimed as specified	☐	☐
4. Heads operate when AC power interrupted	☐	☐
5. Remote Heads as shown	☐	☐
6. Feeder breaker locked ON	☐	☐
7. DC Lamp in Exit Signs is lit when unit operating	☐	☐

B. FUNCTIONAL PERFORMANCE VERIFICATION:

	Test OK	Nonconformance
1. Full Head output at 30 minutes	☐	☐

Nonconformance descriptions: _____

Disposition: _____

COMMENTS: _____

Witnessed By: _____ Company: _____ Date: _____

Departmental Representative: _____ Date: _____

Bldg. & Tag No. FS Dwg. No. _____ File No. ____

STATIC VERIFICATION

DEVICE	DESCRIPTION	TYPE	MODEL NO.	ACCEPTED	
				YES	NO
PS	Manual Pull Station				
HD-F	Heat Detector, Fixed - Temperature				
HD-R	Heat Detector, Rate-of-Rise				
SD	Smoke Detector				
SD-D	Smoke Detector - Duct				
FS-S	Flow Switch - Sprinkler				
TS-S	Tamper Switch - Sprinkler				
B	Bell				
H	Horn, Klaxon Type				
C	Chime				
V	Visual Alarm Appliance				
S P	Loudspeaker				
H/SP	Loudspeaker - Horn				
ET	Emergency Telephone				
AD	Ancillary Devices				
TX	Transponder				

This commissioning form contain the required static verification ONLY. **FUNCTIONAL PERFORMANCE VERIFICATION TO FOLLOW BUILDING CODE REQUIREMENTS.**

COMMENTS: _____

_____

_____

_____

_____

Witnessed By: _____ Company: _____ Date: _____

Departmental Representative: _____ Date: _____

Bldg. & Tag No. FP-1 Dwg. No. _____ File No. _____

GENERAL INFO:			
Manufacturer:		Location:	
Model Number:			
Serial Number:		Water Supply:	
Make of Controller:			
Semi-Automatic:		Automatic:	
Auto Start Set At:		Auto Stop Set At:	
Timer Set At:			

Static Verification:	YES	NO	N/A		YES	NO	N/A
Valves in Proper Position				Emergency Power Provided			
Valves Equipped with Temper Switches				Valves Locked or Sealed in Open Position			

Functional Performance Verification:	YES	NO	N/A		YES	NO	N/A
Pump activates on Pressure Drop				Pump provides flow rate of 6.3 l/s at 690 kPa.			
Pump activation triggers Fire Alarm				Fire Pump panel heater EUH-1 operates on integral T-stat			

Performance Data:	Specified	Actual	Remarks
Rating of Fire Pump (L/s):			
Rating of Fire Pump (kPa)			
RPM			
Head (m)			
HP			

COMMENTS: _____

Bldg. & Tag No. FP-1 Dwg. No. _____ File No. _____

Witnessed By: _____ Company: _____ Date: _____

Departmental Representative: _____ Date: _____

Bldg. & Tag No. 50KW Generator Dwg. No. _____ File No. _____

GENERAL INFO:			
Manufacturer:		Location:	
Model Number:		Spec. Reference:	
Serial Number:		Full Load Amps:	
kW Rating:		Voltage:	

Static Verification:	YES	NO	N/A		YES	NO	N/A
Mounting: Fastners in Place and				Oil System: Drain Valve Closed:			
Motor Mounts Aligned:				Drain Pipe & Cap Secure:			
Ground Strap in Place:				No Oil Leaks:			
Alt. Coupling Bolts Secure:				Alternator: Connections, Screen, &			
Alt. Flywheel Housing				Accessory Panel Bolts			
Engine: Starter, Solenoid Secure				Wire Markers:			
Pulleys & Belts Aligned and				Control Panel: Connections Secure			
Belt Guard Secure:				Wire Markers:			
Shutdown Solenoid Secure				Battery: Cable Ends Tight & Secure			
Duct Flange Secure:				Documentation: Drawing Revisions			
Air Filter & Clamps Secure:				Test Report Complete:			
Coolant System Complete				Work Order Complete:			
Engine Wiring Check				Packing List Complete:			
Exhaust: Engine Manifold				General: Manuals Complete:			
Fuel System: Fuel Lines Secure				Labelling & Identification:			

Functional Tests:	Design		Measured	Remarks
Crank Time 1 Attempt	Time	30 s (68 Hz)		
Cranking Voltage	DC Volts			
Voltage High Limits	Volts	110%		
Voltage Low Limits	Volts	90%		
Freq High Limit	Frequen	63 Hz		
Freq Low Limit	Frequen	57 Hz		
Crank Disconnect	Frequen	20 Hz 600 RPM		
Overspeed	Frequen	66Hz 1980 RPM		
Low Oil Pressure	Pressure	PSI		
High Engine Cool/Temp	Temp	C		
High Oil Temp	Temp	C		
Start-up Inhibit	Time	10 Sec (205) HZ)		
TD Engine Start	Time	2.5 Sec (1638 Hz)		
TD Emerg. to Normal	Time	720 Sec (11.38		
TD Cool Down	Time	300 Sec (27 Hz)		
TD Contractor Fail	Time	2 Sec (1024 Hz)		
TD Speed Signal Fail	Time	30 Sec (68.26 Hz)		

Bldg. & Tag No. 50KW Generator Dwg. No. _____ File No. _____

Low Cool Shutdown				
Blockheater & Lockout				
Manual Bypass Switch				
Gauge/Meter Calib.				
Battery Charge Settings	DC	Amps		
Current Limit	DC Volts	Volts		
Float Level	DC Volts	Volts		
Equalize Level				

Load Test Report:							
Time							
Frequency Hz							
Power % of FI							
L1-L2 Volts							
L2-L3 Volts							
L3-L1 Volts							
L1 Amps							
L2 Amps							
L3 Amps							
Coolant Temp							
Oil Pressure							
Ambient Deg C							
Alt In Deg C							
Eng In Deg C							
Eng Out Deg C							
Panel Deg C							
Charger Volts							
Charger Amps							

Alternator Resistance & Megger Readings:			
Resistance:	Cold		
	L1-L2	L2-L3	L1-L3
	L1-N	L2-N	L3-N
Resistance:	Hot		
	L1-L2	L2-L3	L1-L3
	L1-N	L2-N	L3-N

Megger:	Cold		
	L1-G	L2-G	L1-G

Bldg. & Tag No. 50KW Generator Dwg. No. _____ File No. _____

	L1-N	L2-N	L3-N
Megger:	Hot		
	L1-G	L2-G	L3-G
	L1-N	L2-N	L3-N

List spare parts received and where stored.
Notes: All alternators 150 kW and below are to be meggered at 500 Volts. All alternators above 150 kW are to be meggered at 1000 Volts.

Functional Performance Verification:	**YES**	**NO**	**N/A**		**YES**	**NO**	**N/A**
Generator Activates upon loss of power:				Load bank test by Manufacturer:			
Generator is able to provide required load for emergency power demands, including fire pump:							

COMMENTS: _____

Witnessed By: _____ Company: _____ Date: _____

DCC Site Engineer: _____ Date: _____

Bldg. & Tag No. MUA-1 Dwg. No. _____ File No. _____

GENERAL INFO:			
Manufacturer:		Location:	
Model Number:			
Serial Number:		Type of Service:	
Fan Type:			
MOTOR DATA:			
Manufacturer:		Panel No.:	
Model:		Power (V/Ph/Hz):	
H.P.:		Thermal Protection:	
Type:		Fuse Rating:	
BURNER DATA:			
Manufacturer:		Model No:	
MOTOR DATA:			
Manufacturer:		Panel No:	
Model:		Power (V/Ph/Hz):	
H.P.:		Thermal Protection:	

Static Verification:	YES	NO	N/A		YES	NO	N/A
Flexible Connections (Durodyne) Installed:				Unit Cleaned:			
Vibration Isolation Installed & Checked:				Power Wiring Complete:			
Piping & Ductwork Installation Complete:				Belt Drive Tension Adjusted:			
Alignment Complete:				Abnormal Vibrations:			
Filters Checked and/or Changed:				Direction of Rotation Correct:			
Lubrication Complete:				Air Mixing Dampers:			

Ventilation Data		Design	Measured	Remarks
Flow (L/s)				
Outlet Velocity (m/s)				
Ext. Static Pres. (Pa.)				
Fan RPM				
Voltage	A-B			
	A-C			
	B-C			
Amperage	A-B			
	A-C			
	B-C			
Burner Data		Design	Measured	Remarks
Air Temp (□C)	Entering			
	Leaving			

Functional Performance Verification:	**YES**	**NO**	**N/A**		**YES**	**NO**	**N/A**
Supply fan is interlocked with dust collectors				Dust collector system operates properly with			

Bldg. & Tag No. MUA-1 Dwg. No. _____ File No. _____

				new makeup air unit.			

COMMENTS: _____

Witnessed By: _____ Company: _____ Date: _____

Departmental Representative: _____ Date: _____

Point To Point

Check List

Project: ______________________ **Contractor:** ______________________

Job Number: ______________ **Contractor Rep:** ______________________

Date: ______________ Print Name

General Information: ______________________

Control Panel: ______________________ **Page:** ____ **of** ____

Device	Wiring Tag	I/O Type	PLC CARD (R1S1I1)	Confirmed

Instrumentation Ready for Service: Yes: ☐ No: ☐

Comments: ______________________

____

Manufacturers Technical Representative:

______________ Print Name ______________ Signature ______________ Qualifications

** Manufacturers Technical Representative may or may not be required based on type of instrumentation device.

** Manufacturers Technical Representative is assumed to be required to startup all instrumentation. Exceptions to this are to be at the

** If Manufacturers Technical Representative not required by Owners Representative to be retained to startup device Contractor to fill in

Part 1 General

1.1 DEFINITIONS

.1 Acronyms:

.1 BMM - Building Management Manual.
.2 Cx - Commissioning.
.3 HVAC - Heating, Ventilation and Air Conditioning.
.4 PI - Product Information.
.5 PV - Performance Verification.
.6 TAB - Testing, Adjusting and Balancing.
.7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

.1 Standard letter size paper 216 mm x 279 mm.

.2 Methodology used to facilitate updating.

.3 Drawings, diagrams and schematics to be professionally developed.

.4 Electronic copy of data to be in a format accepted and approved by Departmental Representative.

1.3 APPROVALS

.1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Departmental Representative.

1.4 GENERAL INFORMATION

.1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:

.1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.
.2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.
.1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.
.3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.
.4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.

.5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.

.6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.

.7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.

.8 Operating and maintenance manual - Section 3.2 of BMM.

.9 Final commissioning plan as actually implemented.

.10 Completed commissioning checklists.

.11 Commissioning test procedures employed.

.12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.

.13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

.1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.

.2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.

.3 Include original manufactures brochures and written information on products and equipment installed on this project.

.4 Record and organize for easy access and retrieval of information contained in BMM.

.5 Include completed PI report forms, data and information from other sources as required.

.6 Inventory directory relating to information on installed systems, equipment and components.

.7 Approved project shop-drawings, product and maintenance data.

.8 Manufacturer's data and recommendations relating manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.

.9 Inventory and location of spare parts, special tools and maintenance materials.

.10 Warranty information.

.11 Inspection certificates with expiration dates, which require on-going re-certification inspections.

.12 Maintenance program supporting information including:

.1 Recommended maintenance procedures and schedule.

.2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

.1 Samples of LSC Manual will be available from Departmental Representative.

.2 Content of Manual:

.1 All possible Emergency situations modes, including: presence of fire and smoke, power failure, lose of water or pressure, chemical spills and refrigerant release.

.2 Failure of elevators and escalators.

.3 HVAC emergencies and fuel supply failures.

.4 Intrusion and security breach.

.5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.

.6 Dedicated emergency generators for high security projects, medical facilities and computer systems.

.7 Emergency control procedures for fire, power and major equipment failure.

.8 Emergency contacts and numbers.

.9 Manual to be readily available and comprehensible to non- technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

.1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:

.1 General:

.1 Finalized commissioning plan.

.2 WHMIS information manual.

.3 Approved "as-built" drawings and specifications.

.4 Procedures used during commissioning.

.5 Cross-Reference to specification sections.

.2 Architectural and structural:

.1 Inspection certificates, construction permits.

.2 PV reports.

.3 Fire prevention, suppression and protection:

.1 Test reports.

.2 Smoke test reports.

.3 PV reports.

.4 Mechanical:

.1 Installation permits, inspection certificates.

.2 Piping pressure test certificates.
.3 Ducting leakage test reports.
.4 TAB and PV reports.
.5 Charts of valves and steam traps.
.6 Copies of posted instructions.

.5 Electrical:
.1 Installation permits, inspection certificates.
.2 TAB and PV reports.
.3 Electrical work logbook.
.4 Charts and schedules.
.5 Locations of cables and components.
.6 Copies of posted instructions.

.2 Assist Departmental Representative with preparation of BMM.

1.8 LANGUAGE

.1 English and French Language to be in separate binders.

1.9 USE OF CURRENT TECHNOLOGY

.1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.

.2 Obtain Departmental Representative's acceptance before starting Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group:

.1 CAN/CSA S269.2-M87, Access Scaffolding for Construction Purposes.

.2 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.2 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 2012

.2 Canadian Environmental Protection Act (CEPA), 2012

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.2 Hazardous Materials Information Review Act, 1985.

.3 National Fire Protection Association (NFPA)

.1 NFPA 241-13, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.2 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative.

.3 Remove and Reinstall: Detach items from existing construction, prepare them for re-use, and re-install them where indicated.

.4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.

.5 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

.2 Coordination: Coordinate with Departmental Representative for the material ownership as follows:

.1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Departmental Representative's property, demolished materials shall become Contractor's property and shall be removed from Project site.

.2 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Departmental Representative that may be encountered during selective demolition remain Departmental Representative's property:

.1 Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Departmental Representative.

.2 Coordinate with Departmental Representative's historical adviser, who will establish special procedures for removal and salvage.

.3 Pre-demolition Meeting: Conduct a pre-demolition meeting at Project site, in accordance with requirements listed in Section 01 31 19 – Project Meetings, to confirm extent of salvaged and demolished materials; and to review Contractor's demolition plan prepared by a professional engineer.

1.4 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Schedule of Selective Demolition Activities: Coordinate with Section 01 32 16.19 – Construction Progress Schedule – Bar (GANTT) Chart, and indicate the following:

.1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

.2 Coordinate with Departmental Representative's building manager and user group regarding on-going site operations, and limit the number of interruptions during regular business hours.

.3 Interruption of utility services.

.4 Coordination for shutoff, capping, and continuation of utility services.

.5 Use of elevator and stairs.

.6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.

.7 Coordination with continuing occupancy of portions of existing building.

.2 Demolition Plan: Submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:

.1 Proposed Dust Control and Noise Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Departmental Representative reserves the right to make modifications where proposed methods interfere with the Departmental Representative's ongoing operation

.2 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.

.3 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

.4 Pre-demolition photographs: Submit photographs indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.

.2 Informational Submittals: Provide the following submittals when requested by the Departmental Representative:

.1 Qualification Data: Submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including; but not limited to, lists of completed projects with project names and addresses, names and addresses of architects and owners, for work of similar complexity and extent.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Comply with governing environmental notification requirements and regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction and in accordance with the following:

.1 Federal Workers' Compensation Service and Provincial Workers' Compensation Boards/Commissions.

.2 Government of Canada, Labour Program: Workplace Safety and Provincial Occupational Health and Safety Standards and Programs.

.2 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project:

.1 Conform to the provincial Occupational Health and Safety Act and Regulations.

.2 Conform to provincial Workers' Compensation Board Regulations.

.3 Conform to the local municipal bylaws and regulations governing this type of work.

1.6 SITE CONDITIONS

.1 Portions of building immediately adjacent to selective demolition area will be occupied.

.1 Conduct selective demolition so that operations will not be disrupted.

.2 Provide not less than 72 hours' notice to Departmental Representative of activities that will affect operations.

.2 Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities and as follows:

.1 Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

.3 Departmental Representative assumes no responsibility for condition of areas to be selectively demolished:

.1 Conditions existing at time of Pre Bid Site Review will be maintained by Departmental Representative as far as practical.

.4 Hazardous Materials: Hazardous materials are present in building to be selectively demolished. A report on the presence of hazardous materials is attached as an information document to this project manual for review and use:

.1 Examine report to become aware of locations where hazardous materials are present.

.2 Coordinate with Section 02 83 10, 02 83 11, and _____

.3 Do not disturb hazardous materials or items suspected of containing hazardous materials.

.5 Storage or sale of removed items or materials on site will not be permitted.

.6 Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

.7 Maintain fire protection facilities in service during selective demolition operations.

Part 2 Products

2.1 MATERIALS

.1 Temporary Support Structures: Design temporary support structures required for demolition work and underpinning, and other foundation supports necessary for the project using a qualified professional engineer registered or licensed in province of the Work.

.2 Repair Materials: Use repair materials identical to existing materials:

.1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

.2 Use materials whose installed performance equal or surpasses that of existing materials.

.3 Comply with material and installation requirements specified in individual technical specification Sections.

.3 Retained Materials: Retain items identified for re use in new construction.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that utilities have been disconnected and capped.

.2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

.3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

.4 Notify the Departmental Representative where existing mechanical, electrical, or structural elements conflict with intended function or design:

.1 Investigate and measure the nature and extent of conflict and submit a written report to Departmental Representative.

.2 Departmental Representative will issue additional instructions or revise drawings as required to correct conflict.

.5 Engage a professional engineer to survey condition of building when removing elements that may result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

.6 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

.1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.

.2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

.1 Arrange to shut off affected utilities with utility companies.

.2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

.3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

.4 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound.

.3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.

.4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

.5 Existing Utilities:

.1 Abandon existing utilities and below grade utility structures; cut utilities flush with grade.

.2 Demolish existing utilities and below grade utility structures that are within 1500 mm outside of footprint indicated for new construction; abandon utilities outside this area, fill abandoned utility structures with satisfactory soil materials.

.1 Piping: Disconnect piping at unions, flanges, valves, or fittings.

.2 Wiring Ducts: Disassemble into unit lengths and remove plug in and disconnecting devices.

.3 Demolish and remove existing utilities and below grade utility structures.

.1 Piping: Disconnect piping at unions, flanges, valves, or fittings.

.2 Wiring Ducts: Disassemble into unit lengths and remove plug in and disconnecting devices.

3.3 PREPARATION

.1 Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

.2 Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities:

.1 Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Departmental Representative and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

.2 Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

.3 Protect existing site improvements, appurtenances, and landscaping to remain.

.4 Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

.3 Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain in accordance with Section 01 56 00 – Temporary Barriers and Enclosures, and as follows:

.1 Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

.2 Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

.3 Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

.4 Cover and protect furniture, furnishings, and equipment that have not been removed.

.4 Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities in accordance with Section 01 52 00 - Construction Facilities.

.1 Provide temporary weather tight enclosure for building exterior.

.2 Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures.

.3 Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

.5 Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise in accordance with Section 01 52 00 – Construction Facilities.

.6 Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished:

.1 Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

.1 Dust Control: Provide water mist, temporary enclosures, or other suitable methods reviewed and accepted by the Departmental Representative to limit spread of dust and dirt. Comply with governing environmental protection regulations, and as limited below:

.1 Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

.2 Wet mop floors to eliminate tracking of dirt, wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

.2 Remove and transport debris to prevent spillage on adjacent surfaces and areas.

.3 Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

.4 Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

.1 Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

.1 Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

.2 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

.3 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

.4 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain [fire watch and] portable fire suppression devices during flame cutting operations.

.5 Maintain adequate ventilation when using cutting torches.

.6 Remove decayed, vermin infested, or otherwise dangerous or unsuitable materials and promptly dispose of off site.

.7 Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

.8 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

.9 Dispose of demolished items and materials promptly.

.10 Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

.2 Comply with Departmental Representative's requirements for using and protecting stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

.3 Removed and Salvaged Items:

.1 Clean salvaged items.

.2 Pack or crate items after cleaning.

.3 Identify contents of containers.

.4 Store items in a secure area until delivery to Departmental Representative.

.4 Removed and Reinstalled Items:

.1 Clean and repair items to functional condition adequate for intended re use. Paint equipment to match new equipment.

.2 Pack or crate items after cleaning and repairing.

.3 Identify contents of containers.

.4 Protect items from damage during transport and storage.

.5 Reinstall items in locations indicated.

.6 Comply with installation requirements for new materials and equipment.

.7 Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

.5 Existing Items to Remain:

.1 Protect construction indicated to remain against damage and soiling during selective demolition.

.2 Items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

.6 Concrete:

.1 Demolish in small sections.

.2 Cut concrete full depth at junctures with construction to remain and at regular intervals, using power driven saw, then remove concrete between saw cuts.

.3 Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition.

.4 Neatly trim openings to dimensions indicated.

.7 Concrete Slab Reinforcing:

.1 Locate location of reinforcing steel in concrete slabs prior to cutting or coring using non-destructive, non-ionizing radio frequency locators.

.2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with Departmental Representative where slab features interfere with core drilling.

.3 Notify the Departmental Representative immediately for further instructions where coring or cutting will damage existing slab features.

.8 Concrete Slabs on Grade: Saw cut perimeter of area to be demolished, then break up and remove.

3.6 CLOSEOUT ACTIVITIES

.1 Patching and Repairs: Promptly repair damage to adjacent construction caused by selective demolition operations and as follows:

.1 Patch to produce surfaces suitable for new materials where repairs to existing surfaces are required,

.2 Completely fill holes and depressions in remaining existing masonry walls remain with an approved masonry patching material applied according to manufacturer's written recommendations.

.3 Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

.2 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle

centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction and as follows:

.1 Promptly dispose of demolished materials.

.2 Do not allow demolished materials to accumulate onsite.

.3 Do not burn demolished materials.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work:

.1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap.

.2 Removal of lead-containing coatings or materials using a power tool with an effective dust collection system equipped with a HEPA filter.

.3 Removal of lead-containing coatings or materials with non-powered hand tool, other than manual scraping and sanding.

1.2 REFERENCE STANDARDS

.1 Department of Justice Canada

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.2 Health Canada

.1 Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.3 Human Resources and Social Development Canada (HRSDC)

.1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.4 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 U.S. Environmental Protection Agency (EPA)

.1 EPA 747-R-95-007-1995, Sampling House Dust for Lead.

.6 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)

.1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).

.7 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances

.1 Lead in Construction Regulation - 29 CFR 1926.62-1993.

.8 Underwriters' Laboratories of Canada (ULC)

.9 Province of Alberta

.1 Lead at Work Site, Occupational Health and Safety, November 2013.

1.3 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representatives.

.3 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.

.4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic metre of air (50 $\mu g/m^3$) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic metre of air for removal of lead based paint by methods noted.

.6 Competent person: individuals capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.

.7 Lead dust: wipe sampling on vertical surfaces and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

1.4 SUBMITTALS

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

.2 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.

.3 Provide proof of Contractor's General and Environmental Liability Insurance.

.4 Quality Control:

.1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that lead based paint waste has been received and properly disposed.

.2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial, Territorial and local requirements pertaining to lead paint, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Perform construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers and visitors in work Area include:

.2 Eating, drinking, chewing, and smoking are not permitted in work area.

.3 Ensure workers wash hands and face when leaving work area. Facilities for washing are located.

.4 Visitor Protection:

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

.1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this project manual.

.2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.8 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify following in writing:

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Provincial Ministry of Labour.

.3 Disposal Authority.

.4 Environment Council of Ontario (EACO).

.2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

1.9 PERSONNEL TRAINING

.1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators.

.2 Instruction and training related to respirators includes, at minimum:

.1 Proper fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Supervisory personnel to complete required training.

Part 2 Products

2.1 MATERIALS

.1 Polyethylene: 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.

.2 Tape: fibreglass-reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.3 Slow-drying sealer: non-staining, clear, water-dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual lead paint residue.

.4 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm thickness sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

Part 3 Execution

3.1 SUPERVISION

.1 One Supervisor for every ten workers is required.

.2 Supervisor must remain within work area during disturbance, removal, or handling of lead based paints.

3.2 PREPARATION

.1 Remove and store items to be salvaged or reused.

.1 Protect and wrap items and transport and store in area specified by Departmental Representative.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.2 Pre-clean fixed casework and equipment within work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.

.3 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.

.4 Seal off openings with polyethylene sheeting and seal with tape.

.5 Protect floor surfaces covered from wall to wall with polyethylene sheets.

.6 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.

.7 Where water application is required for wetting lead containing materials, provide temporary water supply appropriately sized for application of water as required.

.8 Provide electrical power and shut off [for operation of powered tools and equipment]. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment.

.3 Do not start work until:

.1 Arrangements have been made for disposal of waste.

.2 Tools, equipment, and materials waste containers are on site.

.3 Arrangements have been made for building security.

.4 Notifications have been completed and preparatory steps have been taken.

3.3 LEAD ABATEMENT

.1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap; or removal equipped with HEPA filters; or removal with using power tools non-powered hand tool, other than manual scraping and sanding.

.2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean entire work area, and equipment used in process. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of work area. Do not disturb work area for 8 hours no entry, activity, ventilation, or disturbance during this period.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Owner.

.2 Departmental Representative will inspect work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

.1 Final lead surface sampling to be conducted as follows:

.1 After work area has passed a visual inspection for cleanliness approved and accepted by Departmental Representative. Apply coat of lock-down agent to surfaces within enclosure, and appropriate setting period of 8 hours has passed, Departmental Representative will perform lead wipe sampling.

.1 Final lead wipe sampling results from horizontal and vertical surfaces must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples collected and analyzed in accordance with EPA 747-R-95-007.

.2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's

expense and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

3.6 FINAL CLEANUP

.1 Following cleaning and when lead wipe surfaces sampling are below acceptable concentrations, proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.

.3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work:

.1 Removal of lead based paint by scraping or sanding using non-powered hand tools.

.2 Manual demolition of lead-painted plaster walls or building components by striking wall with sledgehammer or similar tool.

1.2 REFERENCE STANDARDS

.1 Department of Justice Canada

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.2 Health Canada

.1 Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.3 Human Resources and Social Development Canada (HRSDC)

.1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.4 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 U.S. Environmental Protection Agency (EPA)

.1 EPA 747-R-95-007-1995, Sampling House Dust for Lead.

.6 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)

.1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).

.7 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances

.1 Lead in Construction Regulation - 29 CFR 1926.62-1993.

.8 Underwriters' Laboratories of Canada (ULC)

.9 Province of Alberta

.1 Lead at Work Site, Occupational Health and Safety, November 2013.

1.3 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representatives and representatives of regulatory agencies.

.3 Occupied Area: areas of building or work site that is outside Work Area.

.4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.5 Airlock: ingress or egress system, without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 metres apart.

.6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows:

.1 Place two overlapping polyethylene sheets over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway, and secure other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings 1.5 metres on each side.

.7 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic metre ($\mu g/m^3$) of air calculated as 8 hour time-weighted average (TWA). Intermediate precautions for lead abatement are based on airborne lead concentrations greater than 0.05 milligrams per cubic metre (mg/m^3) of air within Work Area.

.8 Competent person: individuals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.9 Lead in Dust: wipe sampling on vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot ($\mu g/ft^2$).

1.4 SUBMITTALS

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

.2 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.

.3 Provide: Provincial and local requirements for Notice of Project Form.

.4 Provide proof of Contractor's General and Environmental Liability Insurance.

.5 Quality Control:

.1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that it has been received and properly disposed.

.2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.

.3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.6 Product data:

.1 Provide documentation including test results, fire and flammability data, and WHMIS Safety Data Sheets (SDS) for chemicals or materials including:

.1 Encapsulants.

.2 Amended water.

.3 Slow drying sealer.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial, and local requirements pertaining to lead paint, in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Perform construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers and visitors in Work Area includes:

.2 Requirements for workers:

.3 Eating, drinking, chewing, and smoking are not permitted in Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.

.5 Ensure workers wash hands and face when leaving Work Area.

.6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.7 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

.1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this project manual.

.2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.8 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify the following in writing, where appropriate:

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Provincial Ministry of Labour.

.3 Disposal Authority.

.4 Environment Council of Ontario (EACO).

.2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

Part 2 Products

2.1 MATERIALS

.1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass-reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.4 Slow-drying sealer: non-staining, clear, water-dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.

.5 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary WARNING LEAD clearly visible when ready for removal to disposal site.

Part 3 Execution

3.1 SUPERVISION

.1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead based paints.

3.2 PREPARATION

.1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.2 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.

.4 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.5 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.

.6 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.

.7 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:

CAUTION LEAD HAZARD AREA (25 mm).

NO UNAUTHORIZED ENTRY (19 mm).

WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).

BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).

.8 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.

.9 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.

.10 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.3 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:

.1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.

.2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.4 Construction of Decontamination Enclosures:

.1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.

.2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.5 Separation of Work Areas from Occupied Areas

.1 Barriers between Work Area and occupied area to be constructed as follows:

.1 Construct floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting and seal with duct tape. Apply plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.

.2 Cover plywood with polyethylene sheeting and sealed with duct tape.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in clean condition.

.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.

.3 Visually inspect enclosures at beginning of each workday.

.4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

3.3 LEAD-BASE PAINT ABATEMENT

.1 Removal of lead based paint to be performed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted plaster walls or building components by striking a wall with sledgehammer or similar tool.

.2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean work area including equipment and access room, and equipment used in process. After inspection by Departmental Representative, apply continuous coat of slow drying sealer to surfaces. Do not disturb work for 8 hours with no entry, activity, ventilation or disturbance during this period.

.6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Owner.

.2 Departmental Representative will inspect work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When lead dust leakage from Work Area occurs, Departmental Representative may order Work shutdown.

.1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

.1 Final lead surface sampling to be conducted as follows:

.1 After Work Area has passed a visual inspection for cleanliness approved by Departmental Representative and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed. Departmental Representative will perform lead wipe sampling in Work Area.

.1 Final lead wipe sampling results from horizontal and vertical surfaces where lead based paints have been removed must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples must be collected and analyzed in accordance with EPA 747-R-95-007.

.2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

3.6 FINAL CLEANUP

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Clean-up Work Areas, Equipment and Access Room, and other contaminated enclosures.

.5 Clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A1064 / A1064M - 16b Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.2 CSA Group

.1 CSA-A23.1/A23.2-14 , Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A3000-13 , Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.3 CAN/CSA-G30.18-09(R2014) , Billet-Steel Bars for Concrete Reinforcement.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS.

1.3 QUALITY ASSURANCE

.1 Provide to Departmental Representative 2 weeks minimum prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.5 AMBIENT CONDITIONS

.1 Placing concrete during rain or weather events damaging to concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.

.2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.

.3 Placing concrete upon or against surface at temperature below 5°C is prohibited.

.4 Hot weather protection:

.1 Protect concrete from direct sunlight when ambient temperature above 27°C.

.2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.

.5 Protect from drying.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.2 MATERIALS

.1 Portland Cement: GU.

.2 Supplementary cementing materials: with minimum fly ash replacement , by mass of total cementitious materials to CSA A3001.

.3 Water: to CSA A23.1/A23.2.

.4 Reinforcing bars:

.1 Billet steel, grade 300 , deformed bars to CSA-G30.18, unless indicated otherwise.

.5 Other concrete materials: to CSA A23.1/A23.2.

2.3 MIXES

.1 Concrete mix in accordance with CSA A23.1.

.1 Ensure materials used in concrete mix have been submitted for testing and meet requirements of CSA A23.1.

.2 Departmental Representative to proportion concrete mix for HVSCM including:

.1 Class of exposure: A-1.

.2 Intended application: Exterior equipment pads

.3 Aggregate: normal-density

.4 Admixture: air-entraining, chemical to ASTM C 494/C 494M kg/m^{3}of concrete.

.5 Supplementary cementing materials: with minimum fly ash replacement , by kg/m^{3}of total cementitious material.

.6 Air content category: 4-7%.

.7 Slump: at time and point of discharge 75mm

Part 3 Execution

3.1 PREPARATION

.1 Provide Departmental Representative 72 hours notice before each concrete pour.

.2 Place concrete reinforcing in as noted on drawings.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Concrete delivery and handling to facilitate placing with minimum of rehandling, and without damage to existing structure or Work.

.4 Protect previous Work from staining.

.5 Clean and remove stains prior to application of concrete finishes.

3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.

.2 Sleeves and inserts:

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required built-in.

.2 Sleeves and openings minimum 100 mm x 100 mm not indicated, reviewed by Departmental Representative.

3.3 FINISHES

.1 Pavements, walks, curbs and exposed site concrete:

.1 Screed to plane surfaces and use magnesium floats.

.2 Provide round edges and joint spacings using standard tools.

.3 Trowel smooth and provide lightly brushed non-slip finish.

3.4 CONTROL JOINTS

.1 Cut control joints in slabs on grade at locations indicated, to CSA A23.1/A23.2 and install specified joint sealer/filler.

3.5 CURING

.1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

3.6 SEALING APPLICATION

.1 After curing complete, apply poly-siloxane resin blend sealer at 4 m^2/L.

3.7 SITE TOLERANCES

.1 Concrete floor slab finishing tolerance to CSA A23.1/A23.2.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 00- Cleaning.

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate cleaning area for tools to limit water use and runoff.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A 53/A 53M-12 , Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 CSA Group

.1 CSA G40.20-13 /G40.21-13 , General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA S16-14 , Design of Steel Structures.

.4 CSA W48-14 , Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59-13 , Welded Steel Construction (Metal Arc Welding).

.3 Green Seal Environmental Standards (GS)

.1 GS-11-2011 , Paints and Coatings.

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual.

.5 ULC Standards

.1 UL 2768-2011, Architectural Surface Coatings.

.2 UL 2760-2011, Surface Coatings - Recycled Water-borne.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sections and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures.

.1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:

.1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.3 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W.

.2 Steel pipe: to ASTM A53/A53M standard weight galvanized finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Exposed welds continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^{2}to CAN/CSA-G164.

.2 Shop coat primer: in accordance with chemical component limits and restrictions requirements.

.3 Zinc primer: zinc rich, ready mix to MPI-EXT 5.2C

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum to UL 2768.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Paint when temperature minimum 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

2.6 ANGLE LINTELS

.1 Steel angles: galvanized, sizes indicated for openings. Provide 150 mm minimum bearing at ends.

.2 Weld or bolt back-to-back angles to profiles as indicated.

2.7 PIPE RAILINGS

.1 Steel pipe: 41mm diameter Sch40, shop primed, field finish painted.

2.8 ACCESS LADDERS

.1 Stringers: Steel as noted on drawings to PIP standards.

.2 Steel Rungs: 20 mm diameter , welded to stringers at PIP standards

.3 Brackets: sizes and shapes as indicated, weld to stringers at PIP standards

2.9 CHANNEL FRAMES

.1 Fabricate frames from steel, sizes of channel and opening as indicated.

.2 Weld channels together to form continuous frame for jambs and head of openings, sizes as indicated.

.3 Weld strap anchors to channel jamb frame.

.4 Finish: prime coat and finish painted.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of DCC Representative.

3.2 ERECTION - GENERAL

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Weld field connection.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.1 Primer: maximum VOC limit 250g/L to GS-11.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 250 g/L to GS-11.

3.3 PIPE RAILINGS

.1 Install pipe railings as indicated.

.2 Set railing standards in concrete. Grout to fill hole. Trowel surface smooth and flush with adjacent surfaces.

3.4 ACCESS LADDERS

.1 Install access ladders in locations as indicated.

3.5 CHANNEL FRAMES

.1 Install steel channel frames to openings as indicated.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by the Hot-Dip Process.

.3 ASTM F1667-13, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.

.3 Canadian Standards Association (CSA)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.2 CSA O80-Series-08, Wood Preservation.

.3 CSA O112.9-10 (R2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.4 CSA O121-08 (R2013), Douglas Fir Plywood.

.5 CSA O141-05 (R2014), Softwood Lumber.

.6 CSA O151-09 (R2014), Canadian Softwood Plywood.

.7 CSA O325-07 (R2012), Construction Sheathing.

.4 National Lumber Grades Authority (NLGA)

.1 NLGA Standard Grading Rules for Canadian Lumber (2014 edition).

1.2 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB, and wood based composite panels in accordance with CSA and ANSI standards.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

.1 Lumber: Softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 Use S2S or S4S materials.

.2 Board sizes: "Standard" or better grade.

.3 Dimension sizes: "Standard" light framing or better grade.

.3 Plywood, OSB and wood based composite panels: CSA O325.

.4 Douglas fir plywood (DFP): CSA O121, standard construction.

.5 Canadian softwood plywood (CSP): CSA O151, standard construction.

.6 Treated wood products: To CSA O80 Series.

2.2 ACCESSORIES

.1 Sealants: In accordance with Section 07 92 00 - Joint Sealants.

.2 General purpose adhesive: CSA O112.9.

.3 Nails, spikes and staples: ASTM F1667.

.4 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.5 Proprietary fasteners: Toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.6 Fasteners: Hot dipped galvanized steel to ASTM A123/A123M or ASTM A653/A653M for high humidity and treated wood locations, unfinished steel elsewhere.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 FURRING AND BLOCKING

.1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, electrical equipment mounting boards, architectural hardware, bathroom accessories, fire extinguisher brackets, and other work as required.

.2 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.

.3 Install wood cants, nailers, curbs, and other wood supports as required and secure using galvanized steel fasteners.

.4 Install sleepers as indicated.

3.3 EQUIPMENT/ELECTRICAL MOUNTING BOARD

.1 Equipment/Electrical mounting board:

.1 Douglas Fir plywood, good one side.

.2 Size: 1220 x 2440 mm x 19 mm (48 x 96 x ¾ inch).

.3 Finish: Fire retardant paint finish, refer to Section 09 91 00 – Painting; white or to match wall colour unless otherwise specified; finish on all six surfaces prior to installation to ensure proper sealing.

.4 Fastening: Exposed stainless steel fasteners, at 400 mm (16 inches) o.c. unless otherwise specified.

3.4 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Leave Work area clean at end of each day.

.3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M-10 (2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.3 ASTM F1667-13, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual, current edition.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 Architectural Sheet Metal Manual, 2012.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications, and datasheets; and include product characteristics, performance criteria, physical size, finishes, and limitations.

.2 Submit WHMIS SDS - Safety Data Sheets for products used on the project.

.3 Samples: Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes, and colours.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Acceptable sheet materials:

.1 Zinc coated steel sheet: ASTM A653/A653M, commercial quality, with G90/Z275 designation zinc coating.

.2 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 50 with AZ50 coating, smooth surface.

.2 Finish: Pre-finish sheet metal with factory applied modified polyester paint.

.1 Colour: As selected by Departmental Representative from manufacturer's standard range.

2.2 METAL FLASHINGS

.1 Form flashings, copings, and fascias to profiles indicated of minimum 0.60 mm (24 gauge) thick prefinished sheet steel.

2.3 ACCESSORIES

.1 Sealants: Refer also to Section 07 92 00.

.1 Sealing Tape: Polyisobutylene compound sealing tape with 100% solids and pressure sensitive release-paper backing. Provide non-toxic, non-staining permanent elastic tape.

.2 Elastomeric Sealant: Elastomeric polyurethane polymer sealant to ASTM C920, as required for watertight installation.

.3 Butyl Sealant: Single-component, solvent-release butyl rubber sealant to ASTM C1311, for use in joints with limited movement.

.4 Bituminous Coating: Cold-applied asphalt mastic, compounded for 0.4 mm (15-mil) dry film thickness per coat.

.2 Cleats: Same material and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.3 Fasteners: Same material as sheet metal, to ASTM F1667, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.4 Washers: Same material as sheet metal, 1 mm thick with rubber packings.

.5 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal work as indicated.

.2 Form pieces in 2400 mm maximum lengths.

.1 Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm.

.1 Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

.3 Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

.1 Install starter and edge strips, and cleats before starting sheet metal installation.

3.3 INSTALLATION

.1 Install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.

.2 Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

.3 Fit flashings tightly in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.1 Flash joints using S-joints forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks, and stains.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C612-10 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.2 ASTM E1966-07 (2011) - Standard Test Method for Fire-Resistive Joint Systems.

.3 ASTM E2174-14 – Standard Practice for On-Site Inspection of Installed Firestops.

.4 ASTM G21-15 - Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 Firestop Contractors International Association (FCIA)

.1 FCIA Firestop Industry Manual of Practice, 5th Edition.

.3 FM Global (FM)

.1 FM Approvals 4991 – Approval of Firestop Contractors.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.5 National Fire Protection Association (NFPA)

.1 NFPA 101 – Life Safety Code, 2012 Edition.

.6 UL (formerly Underwriters Laboratories)

.1 UL 1479 – Standard for Fire Tests of Through-Penetration Firestops.

.2 UL 2079 – Standard for Tests for Fire Resistance of Building Joint Systems.

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S101-14 – Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC S102-10 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC S115-11 - Fire Tests of Firestop Systems.

1.2 DEFINITIONS

.1 Fire Stop Material: Device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: Fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: Exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): Penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 PERFORMANCE REQUIREMENTS

.1 Materials, accessories, and application procedures: Listed by ULC, cUL, or tested in accordance with CAN/ULC S115 to comply with applicable building code requirements.

.2 Firestopping materials: To CAN/ULC S101, to achieve fire rating as noted on Drawings and ULC Design Number shown.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications, and datasheets. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit two copies of WHMIS SDS - Safety Data Sheets.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings, and method of installation.

.2 Ensure construction details accurately reflect actual job conditions.

.4 System Design Listings, including illustrations from a qualified testing and inspection agency as applicable for each firestop configuration.

.5 Quality Assurance Submittals: Submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: In accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

.2 Certificates: Signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: Including special handling criteria, installation sequence, and cleaning procedures.

.6 Project Record Documentation: Supply documentation for each single application addressed. Identify each penetration and joint location on entire project. Provide at completion of project.

.1 Include the following for through-penetrations:

.1 Sequential location number.
.2 Project name.
.3 Installation date.
.4 Detailed description of penetration location.
.5 Tested System or Engineered Judgment Number.
.6 Type of assembly penetrated.
.7 Detailed description of size and type of penetrating item.
.8 Size of opening.
.9 Number of sides of assemblies addressed.
.10 Hour rating achieved.
.11 Installer’s name.

.2 Include the following for construction joints:

.1 Sequential location number.
.2 Project name.
.3 Installation date.
.4 Detailed description of construction joint location.
.5 Tested System or Engineered Judgment Number.
.6 Type of construction joint.
.7 Width of joint.
.8 Lineal footage of joint.
.9 Number of sides of assemblies addressed.
.10 Hour rating achieved.
.11 Installer’s name.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacture of Products specified in this Section, and FCIA Manufacturer Membership in good standing.

.2 Contractor: Company specializing in performing the work of this section, and with at least one of the following qualifications:

.1 Approved in accordance with FM Standard 4991.
.2 FCIA Member in good standing.
.3 UL Approved Contractor.
.4 Licensed by the local authority having jurisdiction.
.5 Documented successful completion of at least five comparably scaled projects.

.3 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.

.4 Regulatory Requirements:

.1 Conform to applicable code for fire resistance ratings and surface burning characteristics.

.2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

.5 Pre-Installation Meetings: Convene pre-installation meeting one week prior to beginning work of this Section, with Departmental Representative in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements.

.6 Site Meetings: As part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements, and with manufacturer’s written instructions.

.2 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC or cUL labels.

.3 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.4 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Apply materials within temperature range recommended by manufacturer.

.2 Maintain recommended temperature before, during, and for 72 hours after installation of materials.

1.8 SEQUENCING AND SCHEDULING

.1 Schedule installation of cast-in-place firestop devices after completion of floor formwork, metal form deck, or composite deck, but before placement of concrete.

.2 Schedule installation of drop-in firestop devices after placement of concrete but before installation of pipe penetration.

.3 Schedule installation of other firestopping materials after completion of penetrating item installation, but prior to covering or concealing of openings.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: In accordance with CAN/ULC S115.

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke, and gases in compliance with requirements of CAN/ULC S115 and not to exceed opening sizes for which they are intended.

.2 Ensure firestopping system components are fully compatible with each other, with substrates, and with items penetrating the firestopping.

.3 Mould and mildew resistance to ASTM G21: 0 (Zero).

.2 Service penetration assemblies: Systems tested to CAN/ULC S115.

.3 Service penetration fire stop components: Certified by test laboratory to CAN/ULC S115.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: Elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork, and other mechanical items requiring sound and vibration control: Elastomeric seal.

.7 Primers: To manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): Potable, clean, and free from injurious amounts of deleterious substances.

.9 Insulation: Mineral wool fibre semi-rigid insulation to ASTM C612 – Type IVA, UL 2079, and ASTM E1966; minimum density 64 kg/m^3 (4 lbs/ft^3).

.10 Damming and backup materials, supports, and anchoring devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.11 Sealants for vertical joints: Non-sagging.

.12 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this Section.

.3 Proceed with installation only when unsatisfactory conditions have been corrected.

3.3 PREPARATION

.1 Ensure substrates and surfaces are clean, dry, and frost free.

.2 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.3 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.4 Maintain insulation around pipes and ducts penetrating fire separation, without interruption to vapour barrier.

.5 Mask and use drop cloths where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.4 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.5 LABELLING

.1 Provide and install identification labels for each individual penetration with firestopping.

.1 Install labels in readily visible location, on both sides of penetrated assembly, with permanently bonding adhesive.

.2 Label to include:

.1 Warning indicating that system is firestopping installation to be left undisturbed.

.2 Installing Contractor name and contact information.

.3 System designation of testing organization.

.4 Installation date.

.5 Manufacturer.

3.6 FIELD QUALITY CONTROL

.1 Section 01 45 00: Quality Control.

.2 Inspections: Notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.8 SCHEDULE

.1 Fire stop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Edge of floor slabs at curtain wall and precast concrete panels.

.3 Top of fire-resistance rated masonry and gypsum board partitions.

.4 Intersection of fire-resistance rated masonry and gypsum board partitions.

.5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.7 Openings and sleeves installed for future use through fire separations.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 Rigid ducts greater than 129 cm^2: Fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Architectural Aluminum Manufacturers Association (AAMA)

.1 AAMA 812-04 (2012), Voluntary Practice for Assessment of Single Component Aerosol Expanding Polyurethane Foams for Sealing Rough Openings of Fenestration Installations.

.2 ASTM International

.1 ASTM C719-14, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle).

.2 ASTM C834-10, Standard Specification for Latex Sealants.

.3 ASTM C881/C881M-15, Epoxy Resin-Base Bonding Systems for Concrete.

.4 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.

.5 ASTM C920-14, Standard Specification for Elastomeric Joint Sealants.

.6 ASTM C1016-14, Determination of Water Absorption of Sealant Backing (Joint Filler) Material.

.7 ASTM C1184-05, Standard Specification for Structural Silicone Sealants.

.8 ASTM C1193-13, Standard Guide for Use of Sealants.

.9 ASTM C1311-10, Standard Specification for Solvent Release Sealants.

.10 ASTM C1330-02 (2013), Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.11 ASTM C1401-14, Standard Guide for Structural Sealant Glazing.

.12 ASTM D1623-09, Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

.13 ASTM D5249-10(2016), Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.

.14 ASTM E814-13a, Standard Test Method for Fire Tests of Penetration Firestop Systems.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.2 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.3 CAN/CGSB 19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.4 CAN/CGSB 19.21-M87, Sealing and Bedding Compound, Acoustical.

.5 CAN/CGSB 19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Manufacturer's Instructions:

.1 Submit instructions to include installation instructions for each product used.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Submit operation and maintenance data for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Compatibility: Verify sealants used are compatible with their respective joint substrates.

.2 Provide sealants with appropriate expansion and contraction properties for the joints being sealed.

.3 Perform sealant application work to ASTM C1193.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4°C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are within range allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

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

.2 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas that off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers, use only these primers.

.4 Air/vapour barrier sealant and adhesive: To ASTM C920, Type S, Grade NS, Class 35, single component, low odour, moisture cure, medium modulus, low VOC.

.5 Elastomeric Polyurethane Sealant: To CAN/CGSB 19.13, Type 2; and ASTM C920, Type S, Grade NS, Use NT, M, A and O; non-sag, single component, moisture curing hybrid polyurethane.

.1 Typical uses: Expansion and control joints, concrete joints, perimeter caulking of windows and doors.

.6 Spray foam sealant: Spray applied polyurethane, closed cell, low pressure build foam, complying with AAMA 812.

.7 Acoustic and Smoke Sealant: To CAN/CGSB 19.21 and ASTM C919, acoustic grade, single component, non-hardening, non-skinning.

.1 Typical use: Acoustic and smoke sealing of gypsum wall board partitions.

.8 Fire-Resistive Sealant: To ASTM E814, one part fire-stopping sealant.

.1 Typical uses: Penetrations in fire-rated floor and wall assemblies.

.2 Refer to Section 07 84 00 – Fire Stopping.

.9 Silicone, one part: To CAN/CGSB 19.13; and ASTM C920, Type S, Grade NS; mildew resistant, single component, colour white unless otherwise specified.

.1 Typical uses: Around washroom fixtures, lavatories, janitor's sinks, and other wet areas.

.10 Butyl: To CGSB 19-GP-14M and ASTM C1311, single component, butyl rubber sealant.

.1 Typical uses: flashing sealing, roof vents, metal panel joining, between base plates and slabs, bedding thresholds.

.11 Preformed compressible and non-compressible back-up materials:

.1 Polyethylene foam: Extruded closed cell round foam backer rod, to ASTM C1330.

.1 Size: oversize 30 to 50%.

.2 Neoprene or butyl rubber:

.1 Round solid rod, Shore A hardness 70.

.3 High density foam:

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond breaker tape:

.1 Polyethylene bond breaker tape that will not bond to sealant.

.12 Primer: As recommended by sealant manufacturer, where required, for adhesion of sealant to substrate.

2.2 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for joint sealants installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime joint substrates as recommended by sealant manufacturer immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant:

.1 Mask edges of joint where irregular surface or sensitive joint border exists, to provide neat joint.

.2 Apply sealant in continuous beads.

.3 Apply sealant using gun with proper size nozzle.

.4 Use sufficient pressure to fill voids and joints solid.

.5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.6 Tool exposed surfaces before skinning begins to give slightly concave shape.

.7 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

3.7 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A653/A653M-13, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA A440.4-07, Window, Door, and Skylight Installation.

.2 CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.3 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frame Products, 2006.

.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-2013, Standard for Fire Doors and Other Opening Protectives.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

.2 CAN/ULC S105-09, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC S104.

.3 CAN4-S106-M80, Fire Tests of Window and Glass Block Assemblies.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Provide fire labelled frames for openings requiring fire protection ratings.

.2 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 or NFPA 252 for ratings specified or indicated.

.3 Steel fire rated window assemblies: Conform to CAN4-S106.

1.3 SUBMITTALS

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

.2 Shop drawings:

.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, arrangement of hardware, fire ratings, and finishes.

.2 Indicate each type of frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, fire rating, and finishes.

.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, handle, and store doors and frames at the job site in such manner as to prevent damage.

.3 Store doors and frames under cover with doors stored in a vertical position on blocking, clear of floor, and with blocking between doors to permit air circulation.

.4 Waste Management and Disposal: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: To ASTM A653/A653M, CS Type B.

.1 Galvanizing thickness: Z120 (G40).

.2 Reinforcement channel: To CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction: Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum, sanded to required thickness.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Lock-seam doors: Fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

.1 Touch-up primer to CAN/CGSB 1.181.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Section 09 91 00 – Painting. Protect weather strips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door Hardware: Refer to Section 08 71 00 – Door Hardware.

.2 Door silencers: Single stud rubber/neoprene type.

.3 Metallic paste filler: To manufacturer's standard.

.4 Fire labels: Metal riveted.

.5 Sealant: Refer to Section 07 92 00 – Joint Sealing.

.6 Glazing Stops: Formed galvanized steel channel, minimum 16 mm high, accurately fitted, butted at corners and fastened to frame sections with counter-sunk, tamper proof sheet metal screws.

.7 Glass: Refer to Section 08 80 50 – Glazing.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Interior frames: 1.6 mm welded type construction.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cut-outs with steel guard boxes.

.6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Insulate exterior frame components with low pressure foam-in-place polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Shim and anchor new doors in accordance with CAN/CSA A440.4.

.2 Provide appropriate anchorage to floor and wall construction.

.3 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.4 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.5 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails, and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 FRAMES: KNOCKED-DOWN TYPE

.1 Ship knocked-down type frames unassembled.

.2 Provide frames with mechanical joints that inter-lock securely and provide functionally satisfactory performance when assembled and installed in accordance with CSDMA Recommended Installation Guide for Steel Doors and Frames.

.3 Securely attach floor anchors to inside of each jamb profile.

2.11 DOOR FABRICATION GENERAL

.1 Doors: Swing type, flush, with provision for glass openings as indicated.

.2 Form face sheets for interior doors from 1.2 mm sheet steel with honeycomb core laminated under pressure to face sheets.

.3 Fabricate doors with longitudinal edges lock-seamed, adhesive assisted.

.1 Seams: Visible.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.5 Prepare doors for recessed mounting of automatic door bottoms where scheduled in Section 08 71 00 – Door Hardware.

.6 Factory-prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware.

.8 Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.10 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC S104 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.11 Manufacturer's nameplates on doors are not permitted.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level, and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Fill gaps between rough openings and frames with low-pressure foam-in-place polyurethane insulation.

.6 Caulk perimeter of frames between frame and adjacent material.

.7 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor: 13 mm.

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI A117.1-2017, Standard for Accessible and Usable Buildings.

.2 ANSI/BHMA A156.1-2013, Butts and Hinges.

.3 ANSI/BHMA A156.2-2011, Bored and Preassembled Locks and Latches.

.4 ANSI/BHMA A156.3-2014, Exit Devices.

.5 ANSI/BHMA A156.4-2013, Door Controls - Closers.

.6 ANSI/BHMA A156.5-2014, Auxiliary Locks and Associated Products.

.7 ANSI/BHMA A156.6-2010, Architectural Door Trim.

.8 ANSI/BHMA A156.8-2010, Door Controls – Overhead Stops and Holders.

.9 ANSI/BHMA A156.13-2012, Mortise Locks.

.10 ANSI/BHMA A156.21-2014, Thresholds.

.11 ANSI/BHMA A156.22-2012, Door Gasketing and Edge Seal Systems.

.2 ASTM International

.1 ASTM E90-09, Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 ASTM E283-04 (2012), Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

.3 Canadian Standards Association (CSA)

.1 CSA B651-18 – Accessible Design for the Built Environment.

.4 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

.5 National Fire Protection Association (NFPA)

.1 NFPA (Fire) 80-2013, Standard for Fire Doors and Other Opening Protectives.

.2 NFPA (Fire) 252 - Fire Tests of Door Assemblies, 2012 edition.

.6 Underwriter’s Laboratories of Canada (ULC)

.1 CAN/ULC S104-M80, Fire Tests of Door Assemblies.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Hardware List:

.1 Submit contract hardware list.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.4 Manufacturer's Instructions: Submit manufacturer's installation instructions.

.5 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Submit operation and maintenance data for door hardware for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.

.2 Store and protect door hardware from nicks, scratches, and blemishes.

.3 Protect prefinished surfaces with wrapping or strippable coating.

.4 Replace defective or damaged materials with new.

Part 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Cylindrical locks: To BHMA A156.2, Series 4000, Grade 2 and ANSI A117.1; through-bolt style.

- .1 Latchbolt: Minimum 13 mm throw.
- .2 Levers: Solid cast.
- .3 Roses: Heavy wrought.
- .4 Strikes: Curved lip, 124 mm height, complete with wrought boxes.
- .5 Cylinders: To BHMA A156.5, brass, 6-pin.
- .6 Function: As scheduled.

.2 Hinges: To BHMA A156.1, five-knuckle.

- .1 Standard weight: 0.134 gauge steel.
- .2 Heavy weight: 0.180 gauge steel.
- .3 Provide hinges with non-removable pins where scheduled.
- .4 Provide pre-wired hinges where scheduled.

.3 Exit devices: To BHMA A156.3, Grade 1, to NFPA 80 and NFPA 101, push rail devices listed and labelled by UL.

- .1 Projection from face of door: Maximum 75 mm (3 inches).
- .2 Trim: Through-bolted.

.4 Door closers: To BHMA A156.4, Grade 1, and ANSI A117.1, rack and pinion operation, aluminum case, adjustable backcheck intensity.

- .1 Arms: Heavy duty forged steel; standard and parallel, as scheduled.

.5 Sweeps: BHMA A156.22, extruded aluminum retainer, with replaceable neoprene insert, mechanically attached.

.6 Overhead stops: To BHMA A156.8, Grade 1 and 2; low-profile, concealed mounting; UL listed for fire doors.

.7 Floor stops: To BHMA A156.16, dome style, solid cast brass, heavy duty casting with solid pin, complete with rubber bumper.

.8 Wall stops: To BHMA A156.16; brass, bronze, and stainless steel with convex rubber bumper, 63 mm diameter, 25 mm projection, concealed mounting.

.9 Flush bolts: To BHMA A156.16; cast brass, 19 mm bolt throw, 19 mm backset.

- .1 Dust proof strike: Brass; compatible with flush bolt; adjustable height, barrel 22 mm diameter x 51 mm depth.

.10 Astragal: Extruded clear anodized aluminum with black sponge neoprene insert.

.11 Threshold: To BHMA A156.21, saddle-style threshold, extruded tempered aluminum, alloy 6063-T6, fluted surface.

.12 Perimeter gasketing: To BHMA A156.22, extruded tempered aluminum retainer, alloy 6063-T6; with black sponge silicone seal, heavy duty type; stainless steel fasteners.

.13 Bulb gasketing: Silicone extrusion, compression bulb style, with stabilizer flange, and adhesive backing; meets NFPA 105.

.1 Air infiltration: 0.09 cfm/foot to ASTM E283.

.14 Kick plates: To BHMA A156.6, 1.27 mm thick stainless steel, No. 4 finish.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Contact Departmental Representative for Keying Strategy.

.2 Provide keys in duplicate for every lock.

.3 Provide four master keys for each master key group.

.4 Stamp keying code numbers on keys and cylinders.

Part 3 Execution

3.1 INSTALLATION

.1 Manufacturer's Instructions: Comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction) and CSA B651.

.5 Where doorstop contacts door pulls, mount stop to strike bottom of pull.

.6 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.7 Remove construction cores when directed by Departmental Representative.

.1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

.1 Progress Cleaning: in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

.4 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by door hardware installation.

3.5 DOOR HARDWARE SCHEDULE

.1 Set 1: (D001 - New door and frame, 45 min FRR)

.1 Hinges x 3

.2 Exit device

.3 Passage set lever on pull side (no lock)

.4 Closer

.5 Wall stop

.6 Kickplate

.2 Set 2: (D002, D005 - New door and frame, existing opening, 45 min FRR)

.1 Hinges x 3

.2 Passage set or storeroom set (not sure if needs to lock; mechanical room)

.3 Closer

.3 Set 3: (D003, D004 - New double doors and frame, 60 min FRR)

.1 Hinges x 3

.2 Passage set

.3 Closer

.4 Kickplates x 2
.5 Perimeter gasketing
.6 Flush bolt
.7 Astragal

.4 Set 4: (EX001, EX003, EX006, EX007, EX008 - Existing exterior door)

.1 Exit device
.2 Lockable lever on pull side (exterior)
.3 Kickplate
.4 Perimeter gasketing
.5 Sweep
.6 Closer

.5 Set 5: (EX002, EX005, EX010, EX011 - Existing door into exit)

.1 Exit device
.2 Passage set lever on pull side
.3 Kickplate
.4 Closer

.6 Set 6: (EX009 - existing exterior double door, mechanical room)

.1 Exit device
.2 Lockable lever on pull side
.3 Kickplate
.4 Weatherstrip & sweep
.5 Closer

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI Z97.1-2015, Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.

.2 Glass Association of North American (GANA)

.1 GANA Glazing Reference Manual.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN4-S106-M80, Fire Tests if Window and Glass Block Assemblies.

.4 United States Consumer Product Safety Commission (CPSC)

.1 CPSC 16CFR1201 – Safety Standard for Architectural Glazing Materials.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories; include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Show layout, profiles, and product components, including anchorage, accessories, finishes.

.2 Include detailed plans, elevations, details of framing members, sealants, fasteners, anchors, thicknesses.

.4 Samples:

.1 Submit duplicate manufacturer samples, minimum 75 x 75 mm, of each type of glass specified for installation.

.5 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Maintenance Data: Submit maintenance data for glazing for incorporation into O&M manual.

1.4 QUALITY ASSURANCE

.1 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect glazing and frames from nicks, scratches, and blemishes.

.3 Protect prefinished aluminum surfaces with strippable coating.

.4 Replace defective or damaged materials with new.

1.6 AMBIENT CONDITIONS

.1 Ambient Requirements:

.1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.

.2 Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

Part 2 Products

2.1 MATERIALS

.1 Ceramic fire-rated glass: To CAN/ULC S106.

.1 Thickness: 8 mm.

.2 Fire rating: As scheduled.

.3 Impact safety rating: ANSI Z97.1 and CPSC 16CFR1201 CAT I and II.

.4 Provide glazing compounds and tapes as recommended by ceramic glass manufacturer.

.2 Glazing tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent.

.3 Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression; Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.

.4 Setting blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for glazing installation in accordance with manufacturer's written instructions.

.1 Verify openings for glazing are correctly sized and within tolerance.

.2 Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

.3 Visually inspect substrate.

.4 Inform Departmental Representative of unacceptable conditions.

.5 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION – CERAMIC FIRE-RATED GLAZING

.1 Comply with instructions of manufacturers of glass, glazing sealants, and glazing compounds.

.2 Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

.3 Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.

.4 Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.

.5 Place setting blocks located at quarter points of glass with edge block no more than 150 mm from corners.

.6 Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.

.7 Place glazing tape on free perimeter of glazing in same manner described above.

.8 Install removable stop and secure without displacement of tape.

.9 Install with appropriate UL markings permanently visible.

3.4 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.1 Remove traces of primer, caulking.

.2 Remove glazing materials from finish surfaces.

.3 Remove labels.

.4 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect glass from contact with contaminating substances resulting from construction operations. Remove such substances by method approved by glass manufacturer.

.3 Repair damage to adjacent materials caused by glazing installation.

.4 Wash glass by method recommended by glass manufacturer.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM B69-13, Standard Specification for Rolled Zinc.

.2 ASTM C475/C475M-15, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C557-03 (2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.4 ASTM C645-18, Non-Structural Steel Framing Members.

.5 ASTM C754-11, Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.6 ASTM C840-13, Standard Specification for Application and Finishing of Gypsum Board.

.7 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.8 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.9 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.10 ASTM C1178/C1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.

.11 ASTM C1280-13a, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.

.12 ASTM C1396/C1396M-14, Standard Specification for Gypsum Wallboard.

.13 ASTM C1629/C1629M-14a, Standard Classification for Abuse-Resistant Nondecorated Gypsum Panel Products and Fiber-Reinforced Cement Panels.

.2 Gypsum Association (GA)

.1 GA-214-15, Recommended Levels of Finish for Gypsum Board, Glass Mat, and Fiber-Reinforced Gypsum Panels.

.2 GA-216-13, Application and Finishing of Gypsum Panel Products.

.3 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S102-10, Standard Method of Fire Endurance Tests of Building Construction and Materials.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies; include product characteristics, performance criteria, physical size, finish, and limitations.

1.3 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire rated assemblies in conjunction with Section 09 22 16 as follows:

.1 Fire resistance classifications to CAN/ULC S102.

.2 Fire rated Design Assembly No. as listed on Drawings.

1.4 MOCK-UPS

.1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Construct wall assembly, full height by 1200 mm wide, illustrating materials installation and interface.

.3 Locate where directed.

.4 Accepted mock-up may remain as part of finished work.

.5 Allow for inspection of mock-up by Departmental Representative before proceeding with gypsum wall partition Work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original packaging, labelled with manufacturer's name and identification.

.3 Storage and Handling Requirements:

.1 Store gypsum board materials level, off ground, and indoors in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect gypsum board materials from nicks, scratches, and blemishes.

.3 Protect from weather, elements and damage from construction operations.

.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.

.5 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

.6 Replace defective or damaged materials with new.

1.6 AMBIENT CONDITIONS

.1 Maintain temperature 10°C minimum, 21°C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost-free surfaces.

.3 Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Products

2.1 MATERIALS

.1 Standard gypsum board: ASTM C1396/C1396M, Type X, thickness as shown on Drawings, 1200 mm wide x maximum practical length, ends square cut, edges square.

.2 Glass mat water-resistant gypsum backing board: ASTM C1178/C1178M, thickness as shown on Drawings, 1220 mm wide x maximum practical length.

.1 Mould resistance to ASTM D3273: 10.

.3 Abuse-Resistant Gypsum Board: ASTM C1629/C1629M, paper-faced, impact resistant, Type X, thickness as shown on Drawings; maximum available length in place; tapered edges, ends square cut.

.4 Carrying Channels: Cold rolled steel to ASTM C645, galvanized.

.5 Tie Wire: To ASTM C754.

.6 Hangers: To ASTM C754, galvanized.

.7 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.8 Steel drill screws: ASTM C1002.

.9 Stud adhesive: ASTM C557.

.10 Laminating compound: As recommended by manufacturer, asbestos-free.

.11 Casing beads, corner beads, and edge trim: to ASTM C1047, metal, zinc-coated by hot-dip process, [0.5] mm base thickness, perforated flanges, one piece length per location.

.12 Control joints: To ASTM C1047 and ASTM B69, zinc, 0.33 mm (0.013 inch) thickness, perforated flanges, 2.4 mm (3/32 inch) ground.

.13 J-Trims: ASTM C1047, galvanized, minimum thickness 0.30 mm (0.012 inches).

.14 Sealants: In accordance with Section 07 92 00 - Joint Sealants.

.15 Joint tape: ASTM C475, 52 mm wide fibre paper tape.

.16 Joint compound: ASTM C475, asbestos-free.

2.2 SHAFTWALL ASSEMBLY

.1 Studs and Runners: ASTM C645; hot-dip galvanized sheet steel, base metal thickness to suit design assembly requirements.

.1 Studs: CH shape, with knurled faces.

.2 Runners: J shape

.3 Jamb Struts: J-shape.

.2 Shaftwall panels: ASTM C1396/C1396M, 25 mm thick, UL Classified for fire resistance; water and mould resistant core; double-beveled edges; 610 mm wide, length to suit.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for installation of gypsum board assemblies in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

.1 Apply and finish gypsum board to ASTM C840 or GA-216 except where specified otherwise.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, electrical work, and mechanical work have been approved.

.2 Apply single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.

.3 Double layer gypsum board:

.1 Base layer application:

.1 Apply gypsum board with long dimension parallel to studs.

.2 Position board with abutting edges located in centre of stud flanges.

.3 Stagger joints on opposite sides of partition so that joints occur on different studs.

.4 Screw-fasten base layer gypsum board to steel studs with 25 mm screws.

.2 Face layer application:

.1 Apply gypsum board with long dimension parallel to studs.

.2 Position board with abutting edges located in centre of stud flanges.

.3 Stagger joints from base layer joints, and on opposite sides of the partition.

.4 Screw-fasten face layer to steel studs with screws that are minimum 10 mm longer than the total thickness of the material being attached to the studs.

.4 Install fire rated gypsum board in accordance with applicable ULC design number.

.5 Apply water-resistant gypsum board [where [wall tiles] [coating] to be applied] [adjacent to [sinks] [janitors closets]]. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. [Do not apply joint treatment on areas to receive tile finish.]

.6 Apply board using stud adhesive on furring or framing.

.7 Use laminating adhesive on base layer of gypsum board in multi-layer application.

.8 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.9 Install gypsum board with face side out.

.10 Do not install damaged or damp boards.

.11 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION - GENERAL

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.6 Locate control joints at approximate 9 m spacing on long corridor runs.

.1 Place control joints consistent with lines of building spaces as indicated.

.2 Install control joints straight and true.

.7 Construct expansion joints, at building expansion and construction joints. Provide continuous dust barrier.

.1 Install expansion joints straight and true.

.8 Splice corners and intersections together and secure to each member with 3 screws.

.9 Install access doors to electrical and mechanical fixtures as specified in their respective sections.

.1 Rigidly secure frames to furring or framing systems.

.10 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape, and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.11 Place corner beads at external corners.

.1 Use longest practical length.

.2 Place edge trim where gypsum board abuts dissimilar materials [and as indicated].

.12 Finish gypsum board walls and ceilings to following levels in accordance with GA-214:

.1 Levels of finish:

.1 Concealed areas - Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.2 Exposed - Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.13 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.14 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.15 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.16 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.17 Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.5 TOLERANCES

.1 Maximum variation of finished gypsum board surface from true flatness: 3 mm in 3 m, in any direction.

3.6 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning. 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 00 - Cleaning.

.3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by installation of gypsum board assemblies.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C645-14, Standard Specification for Nonstructural Steel Framing Members.

.2 ASTM C754-11, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Zinc-Rich Coating.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

1.2 SUBMITTALS

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

.2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for metal framing. Include product characteristics, performance criteria, physical size, finish, and limitations.

1.3 QUALITY ASSURANCE

.1 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal framing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: To ASTM C645, stud size as shown on drawings, roll formed from hot dipped galvanized steel sheet, for screw attachment of gypsum board.

.1 Steel minimum thickness unless otherwise indicated on drawings:

.1 0.84 mm (0.033 inches).

.2 Knock-out service holes at 460 mm centres.

.3 Floor and ceiling tracks: In widths to suit stud sizes, 32 mm flange height.

.2 Metal channel stiffener: 13 x 38 mm size, 1.4 mm (16 gauge) thick cold rolled steel, coated with rust inhibitive coating.

.3 Deflection track: To ASTM C645, 1.14 mm (0.043 inches) thick, with one slotted leg and one solid leg; complete with 2 mm thick adhered intumescent material.

.4 Touch-up primer for galvanized surfaces: CAN/CGSB 1.181.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that conditions of substrate are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

.1 Align partition tracks at floor and ceiling and secure at maximum 600 mm on centre.

.2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.3 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.

.1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.4 Erect metal studding to tolerance of 1:1000.

.5 Attach studs to bottom track using screws.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.

.1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.9 Install heavy gauge single jamb studs at openings.

.10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.

.1 Secure track to studs at each end, in accordance with manufacturer's instructions.

.2 Install intermediate studs above and below openings in same manner and spacing as wall studs.

.11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.12 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.13 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.14 Extend partitions to ceiling height except where noted otherwise on drawings.

.15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

.1 Use double track slip joint as indicated.

.16 Install continuous insulating strips to isolate studs from uninsulated surfaces.

3.3 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Leave Work area clean at end of each day.

.3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.3 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual.

.2 MPI Maintenance Repainting Manual.

.3 MPI Approved Products List.

.4 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) for products used in the project.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate 200 x 200 mm sample panels of each paint, stain, and finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.2 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's application instructions.

.6 Closeout Submittals: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

1.3 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide one x 4 litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle, and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well-ventilated area within temperature range 7°C to 30°C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide one 9 kg dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:

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

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional, and Municipal regulations.

.3 Ensure emptied containers are sealed and stored safely.

.4 Dispose unused paint and coating materials at official hazardous material collections site.

.5 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.6 Material that cannot be reused is to be treated as hazardous waste and disposed of in an appropriate manner.

.7 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.8 To reduce the amounts of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.9 Set aside and protect surplus and uncontaminated finish materials. Turn over to Departmental Representative for maintenance purposes.

1.5 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 51 00 – Temporary Utilities.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved with written approval by product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10°C.

.2 Substrate temperature is above 32°C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3°C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3°C below the ambient or surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Conform to latest MPI requirements for painting work, including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.5 Linseed oil, shellac, and turpentine: Highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

2.2 COLOURS

.1 Selection of colours to be from manufacturer’s full range of colours.

.2 Where specific products are available in restricted range of colours, selection to be based on limited range.

.3 Second coat in three-coat system to be tinted slightly lighter colour than topcoat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour-tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Mix paste, powder, or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Metal Fabrications: Steel access ladders, railings.

.1 EXT 5.3C – Epoxy over epoxy primer, G5 finish.

.1 Coat 1: Epoxy primer, MPI #101.

.2 Coats 2 and 3: Epoxy, MPI #177.

2.6 INTERIOR PAINTING SYSTEMS

.1 Metal: Doors and frames, ladders.

.1 INT 5.3D – Epoxy over epoxy primer, G5 finish.

.1 Coat 1: Epoxy primer, MPI #101.

.2 Coats 2 and 3; Epoxy, MPI #177.

.2 Gypsum wallboard, include access panels:

.1 INT 9.2B - High performance architectural latex.

.1 Walls: G4 finish.

.1 Coat 1: Latex primer/sealer, MPI #50.

.2 Coats 2 and 3: HIPAC latex, MPI #140.

.2 Ceilings: G3 finish.

.1 Coat 1: Latex primer/sealer, MPI #50.

.2 Coats 2 and 3: HIPAC latex, MPI #139.

.3 Electrical backboards.

.1 INT 6.4PP – Fire retardant coating, pigmented, waterborne, MPI #64.

.1 Apply in accordance with manufacturer's instructions. Apply to all six sides of plywood electrical backboards.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Prior to commencing work, examine site conditions and existing substrates to be painted and repainted. Report to Departmental Representative damages, defects, or unsatisfactory or unfavourable conditions or surfaces that will adversely affect this work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Do not commence until such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to Painting Subcontractor and Inspection Agency.

.4 Assess degree of surface deterioration for areas to be repainted, using MPI identifiers and assessment criteria indicated in MPI Repainting Manual. MPI DSD ratings and descriptions are as follows:

Condition	Description
DSD-0	Sound Surface (includes visual (aesthetic) defects that do not affect film's protective properties).
DSD-1	Slightly Deteriorated Surface (indicating fading; gloss reduction, slight surface contamination, minor pin holes, scratches).
DSD-2	Moderately Deteriorated Surface (small areas of peeling, flaking, slight cracking, and staining).
DSD-3	Severely Deteriorated Surface (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges).
DSD-4	Substrate Damage (repair or replacement of surface required).

.5 Where an assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.

.6 Maximum moisture content as follows:

.1 Gypsum board: 12%.

3.4 PREPARATION

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings, and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.

.2 Protect items that are permanently attached such as fire labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, building occupants, and general public in and about the building.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to be acceptable to Departmental Representative.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual and Maintenance Repainting Manual requirements. Refer to MPI Manual for specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming and wiping with dry, clean cloths.

.2 Wash surfaces with a biodegradable detergent, bleach where applicable, and clean warm water, using stiff bristle brush to remove dirt, oil, and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes and vacuum cleaning.

.6 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.7 Touch up of shop primers with primer as specified.

.8 Do not apply paint until prepared surfaces are acceptable to Departmental Representative.

.9 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.5 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.4 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.8 Repaint top, bottom, and vertical edges of doors to be repainted.

.9 Finish closets and alcoves as specified for adjoining rooms.

.10 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Boiler room, mechanical and electrical rooms: Paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: Leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

.1 Standard of Acceptance:

.1 Walls: No defects visible from 1000 mm at 90 degrees to surface.

.2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.2 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Cooperate with inspection firm and provide access to areas of work.

.4 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

3.8 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Product Data: Manufacturer's data sheets and cutsheets.

.3 Shop Drawings: Show fabrication and installation details for signs.

.1 Show sign mounting heights, locations of supplementary supports, and accessories.

.2 Provide typestyles, graphic elements, and layout for each sign.

.4 Samples:

.1 Materials: Submit duplicate samples of acrylic materials, minimum 50 x 50 mm, for each colour specified for signs.

1.2 QUALITY ASSURANCE

.1 Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

Part 2 Products

2.1 MATERIALS

.1 Base material: Acrylic, single ply, 3.2 mm (1/8 inch) thick, matte finish.

.1 Colour: As selected by Departmental Representative from manufacturer's standard range.

.2 Lettering and pictograms: Self-stick vinyl film: individual letters, numerals, and symbols die cut from 0.1 mm thick integral colour, matte finish, exterior grade PVC film, with self-stick adhesive backing.

.1 Colour: As selected by Departmental Representative from manufacturer's standard range.

.3 Self-stick foam tape: 1.6 mm thick, polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides.

.1 Width: To suit sign sizes.

Part 3 Execution

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

.2 Verify that items are sized and located to accommodate signs.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Locate signs and accessories where indicated, using mounting methods complying with manufacturer's written instructions.

.2 Install using self-stick foam tape.

.3 Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

3.3 CLEANING AND PROTECTION

.1 After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Departmental Representative.

.2 Remove temporary coverings and protection to adjacent work areas.

.3 Repair scratches and other damage that may have occurred during installation. Replace components where repairs were made but are still visible to unaided eye from 3 metres.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)

.1 NFPA 10 - Portable Fire Extinguishers, 2013 Edition.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S503-05 (R2010) – Standard for Carbon Dioxide Fire Extinguishers.

.2 CAN/ULC S504-12 - Dry Chemical Fire Extinguishers.

.3 CAN/ULC S508-02 (R2013) - Rating and Fire Testing of Fire Extinguishers.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature and datasheets; include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, and location.

.4 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.5 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

.6 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 REGULATORY REQUIREMENTS

.1 Conform to National Building Code and NFPA 10 for requirements for extinguishers.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal: Remove waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Stored pressure type with large loop pull pin and shut-off nozzle, ULC labelled, and all metal valve assemblies.

- .1 Size: 2.25 kg.
- .2 Valve assemblies: All metal, with On/Off squeeze grip handles.
- .3 Finish: High gloss polyester powder paint or baked enamel.
  - .1 Colour: Red.
- .4 Allowable types:
  - .1 To CAN/ULC S503, CO_2 type.
    - .1 Carbon dioxide charged.
    - .2 Aluminum tank.
    - .3 Provide CO_2 type extinguishers where proximal to LAN Room and other contamination-sensitive areas.
  - .2 To CAN/ULC S504, ABC type, complete with pressure gauge.
    - .1 Ammonium phosphate powder charged.
    - .2 Drawn steel cylinder.
    - .3 Hose and nozzle.

2.2 CABINETS

.1 Semi-recessed type as indicated, formed sheet steel, minimum 1.6 mm thick with flat trim, 180 degrees opening door.

.2 Cabinets to maintain fire resistive rating of construction in which they occur.

.3 Door Glazing: Glass, clear, 5 mm thick, tempered.

.4 Cabinet Exterior Trim and Door Finish: Baked enamel, colour as selected by Departmental Representative.

2.3 ACCESSORIES

.1 Extinguisher Brackets: Formed steel with metal retainer strap, chromed finish.

2.4 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA 10 and CAN/ULC S508.

.2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

- .1 Languages: To suit language of Contract.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify rough openings for cabinet are correctly sized and located.

3.3 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets as indicated, in accordance with NFPA 10 and manufacturer’s instructions.

.2 Install cabinets plumb and level in wall openings, location as shown on drawings.

.3 Secure rigidly in place to walls.

.4 Position cabinet signage at locations acceptable to authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Contractor is to provide a fully-designed standpipe system that conforms to local requirements. All modifications to the existing system, including the proper selection and replacement of the booster pump, the relocation of the fire hose cabinet at the mezzanine level, and all other requirements for compliance with current codes are to be completed by the contractor as specified by the engineer engaged by the contractor.

1.2 REFERENCE DOCUMENTS

.1 National Fire Protection Association (NFPA):

.1 NFPA 14 Standards for the Installation of Standpipe and Hose Systems

1.3 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Section 20 00 13 – Mechanical General Requirements for requirements pertaining to product options and substitutions.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's product data in accordance with Section 20 00 13 – Mechanical General Requirements.

.1 Submit copies of manufacturer's product literature, specifications and datasheets.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 20 00 13 – Mechanical General Requirements.

.1 Submit shop drawings stamped and signed by a professional engineer registered or licensed in the Province of Alberta, Canada.

.3 Submit the following quality assurance submittals in accordance with Section 20 00 13 – Mechanical General Requirements:

.1 Test Reports: submit certified test reports for packaged fire pumps from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: manufacturer's field reports specified.

.4 Closeout Submittals:

.1 Submit maintenance data for standpipe and hose system for incorporation into manuals specified in Section 20 01 06 – Mechanical Operation and Maintenance Manual.

1.5 REGULATORY REQUIREMENTS

.1 Fire protection equipment and installation shall conform to Alberta Uniform Standards Act, and be approved by fire protection authority having jurisdiction**.**

.2 Equipment and material shall be ULC labelled and installed to NFPA 14.

Part 2 Products

2.1 PIPE AND FITTINGS

.1 Pipe and Fittings: to NFPA 14.

2.2 HOSE CABINET AND ACCESSORIES

.1 Hose Cabinet: surface mounted type with right or left inlet as required, 1.6 mm steel tub with 2.5 mm full opening door in adjustable frame, 4.8 mm thick full glass panel door, latching device, and prime coated RED.

.2 Accessories:

.1 Angle Valve: 40 mm chrome plated cast or forged brass, hydrolator valve.

.2 Hose Rack: swivel type or stationary type with pins and water stop.

.3 Hose and Nozzle: 23 m of 40 mm rubber lined synthetic, mildew and rot resistant hose with chrome plated coupling. Chrome plated combination, fog-straight stream and adjustable fine-spray shut-off nozzle.

.4 Fire Department Connection: 40 mm chrome plated cast or forged brass angle valve suitable for 2 MPa working pressure with local fire department compatible thread, cap and chain. Install 125 mm away from side or bottom of cabinet.

.5 Fire Extinguisher: fully charged 4.5 kg fire extinguisher ABC as per NFPA 10 Code.

3. Execution

3.1 INSTALLATION

.1 Install a complete standpipe and hose system for the building to NFPA 14.

.2 Locate 40 mm angle valve in cabinet, mounted maximum 1.5 m above floor.

.3 Locate cabinet so that open door does not obstruct any other door opening.

.4 Test system to NFPA 14 and requirements of Fire Protection Authority having jurisdiction**.**

.5 Make connection for standpipe system ahead of domestic connection to meter. Provide backflow preventer assembly on branch line serving fire protection system.

.6 Connect standpipe risers at bottom of system.

.7 Standpipe risers to be complete with ULC labelled OS&Y gate control valves. control valve in open position.

.8 Provide NPS 40 mm drain valve at base of each riser; extend pipe to indirect waste connection.

.9 Provide a pressure gauge complete with gauge cock at water supply connection and at highest point of each standpipe riser.

.10 Where the static pressure exceed 690 kPa at hose station, provide ULC labelled pressure reducing valve to prevent pressure on hose from exceeding 620 kPa.

.11 Provide check valve inside the building after the siamese and install ball type drip valve between the siamese and check valve.

END OF SECTION

1. General

1.1 GENERAL REQUIREMEMENTS

.1 Review the existing pump flow characteristics and supply and install the appropriate replacement fire pump to suit the fully-designed standpipe system. Fire pump is to be complete with supply and install of fire pump controls panel and pressure switch required for operation.

1.2 SUBMITTALS

.1 Submit preliminary layout showing only head locations for review by the Departmental Representative. Furnish additional heads which may be required for coordinated ceiling pattern without added cost, even though number of heads may exceed minimum code requirements.

.2 Submit detailed pipe layout, component and hydraulic design calculations, approved by local Fire Commissioner. Include all costs associated with such approval in this work.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 20 00 13 – Mechanical General Requirements.

.1 Submit shop drawings stamped and signed by a professional engineer registered or licensed in the Province of Alberta.

.4 Closeout Submittals:

.1 Submit maintenance and engineering data for incorporation into manuals specified in Section 20 01 06 – Mechanical Operation and Maintenance Manual.

.2 Submit “As-Built” record drawings that include all site revisions to the shop drawing submittals. Submit these documents on Autocad format to the Departmental Representative.

1.3 QUALITY ASSURANCE

.1 Fire protection equipment and installation shall be reviewed and approved by the Code Authority having jurisdiction.

.2 Equipment shall be installed by qualified Contractors licensed and regularly engaged in installation of automatic fire protection equipment.

.3 Equipment, valves and material used in Fire protection systems shall be UL labelled.

.4 Equipment and installation shall meet the requirements of NFPA 20.

1.4 CONTRACTOR DESIGNED FIRE PUMP SYSTEM

.1 A Professional Engineer licensed to practice in Alberta is required to design, review construction, witness, and certify the system testing, and consistent with Alberta Building Code (latest edition).

1.5 HYDRAULICALLY DESIGNED SYSTEMS

.1 Departmental Representative will accept a Contractor designed, hydraulically calculated system provided the following requirements are met:

.1 System design to incorporate Departmental Representative's Insurer's requirements to FM Standards.

.2 Base design on current water supply data from the recent fire flow tests 1391 Liters / Minute, with 70kPa residual pressure, with 448KPA residual pressure.

.3 Make allowance for pressure losses through the backflow preventer assembly installed on the water supply to the standpipe system.

.4 Other requirements specified in this section are met.

2. Products

2.2 FIRE PUMPS - GENERAL

.1 Fire pump to be UL rated and designed to NFPA 20 and ABC requirements.

.2 Intent of design is to supply electric fire pump, complete with all required accessories.

.3 Coordinate supply and installation with other equipment to ensure proper operation of other systems

.1	150 mm diameter	3.40 mm
.2	200 mm diameter	3.78 mm
.3	250 mm diameter	4.78 mm

.4 Threaded or Cut Grooved Pipe Systems: Steel pipe joined by threaded fittings or couplings using cut grooves shall have the following wall thickness:

.1 Up to 200 mm diameter use schedule 40

.2 200 mm diameter and larger use schedule 30

.5 Chlorinated polyvinyl chloride (CPVC) pipe and fittings may be used for wet pipe systems within the limits defined in the Alberta Building Codes, and subject to the requirements of NFPA.

2.4 TRANSFER SWITCH FIRE PUMP CONTROL PANEL

.1 Provide an approved fire pump automatic transfer switch / control panel with two pole flow detectors, pressure transducer, and circuit breakers.

.2 The Fire Pump Controller and Automatic Transfer Switch combination shall meet the requirements of the latest edition of NFPA 20 and shall be listed by Underwriters Laboratories and approved by Canadian Standards Association (CSA) and Factory Mutual System for fire pumps. The transfer switch shall meet UL 1008 and shall be regularly subjected to Endurance, Interrupting Capacity, and Dielectric Voltage-Withstand test as outlined by UL489 standards. The complete assembly, consisting of Fire Pump Controller and Automatic Transfer Switch to be factory assembled, wired, tested and shipped as a single unit.

.3 The Fire Pump Controller shall be a microprocessor-based design and have separate and independent adjustable pressure settings with minimum run timing capable of a setting of 10 minutes. Pressure shall be sensed by a solid state 4-20mA pressure sensor. The pressure Start and Stop points shall be adjustable in 1 PSI increments. Provisions shall be included to allow manual or automatic shut-down in the field. The Fire Pump Controller shall include a built-in pressure recorder for review of Max, Min Pressures.

.4 The Fire Pump Controller shall have two sets of Form “C” contacts for Pump Running, Phase Reversal, Power/Phase Failure, and one set of Form “C” contacts for Trouble. The Trouble contacts shall be activated by the following conditions: Invalid Configuration Memory, Emergency Manual Start, Pump Running, Phase Failure, Phase Reversal, Overload, Locked Rotor, Fail-to-Start, Low Temperature, and Lockout.

.5 Automatic Transfer Switch:

.1 The transfer switch to be fully automatic electrically operated, mechanically held, for all load classes with normal and emergency supply as defined below. Switch to be complete with auxiliary engine starting contacts, full phase relay protection to operate on normal power voltage drop to 70 per cent on any phase. Detects when all three phases are present, have the correct sequence and detects if voltage or phase angle asymmetry is below set value.

.2 The transfer switch shall transfer the load in delayed transition: break – delay position (no connection) - make mode. Transfer is accomplished with a user-defined interruption period in both directions adjustable from 1 second to 5 minutes in a maximum of 15 second increments.

.3 The transfer switch shall have an ampere rating not less than 200% of the motor full-load current.

.4 The automatic transfer switch controller shall be a microprocessor-based design. The controller shall provide adjustable time delays for the following features:

.1 Delay transfer from normal to standby until standby power source has obtained rated voltage: Adjustable from 0 – 5mins.

.2 Delay transfer from standby to normal source: 0 – 30 mins

.3 Neutral “off” position: 0 seconds to 5 minutes,

.4 Delay engine start contact: 0 seconds to 5 minutes.

.5 Engine cool down: 10 seconds to 30 minutes.

.5 In cover of transfer switch provide the following devices:

.1 Pilot lights indicating the position of the transfer switch and source available for both source 1 and source 2.

.2 Test switch to simulate a power failure.

.3 Audible Alarm with silence push button

.4 Push button to bypass retransfer to normal time delay

.6 Provide two sets of normally open contacts, one on normal supply and the other on standby supply.

.7 Provide a set of normally open contacts for transfer switch controller alarm contacts.

.6 Motor Starter Type: Full Voltage Non-Reversing starting. The controller shall have the following ratings:

.1 Voltage: 600 Vac

.2 Current: fire pump FLA + 200%

.3 Short Circuit: 50kA

.7 The Fire Pump Controller and Automatic Transfer Switch panel shall be mounted in a fully insulated freestanding NEMA 3R enclosure. Enclosure shall have the following features:

.1 Finish: Gray polyester powder paint inside and out.

.2 Construction: Code Gauge Steel

.3 Rating: NEMA/EEMAC Type 3R

.4 Oil resistant gasket

.5 3-point latch mechanism with oil tight pad lockable handle

.6 Heavy-gauge continuous hinge for door

.7 Back and side mounting pan

.8 1000W unit heater with integral thermostat

.9 LED control panel light with door mounted light switch.

3. Execution

3.1 INSTALLATION

.1 Commission the transfer switch in the presence of the Departmental Representative via a live load test as follows:

.1 Turn off the main breaker to the transfer switch.

.2 Verify the power transfer from normal to emergency power.

.3 Turn on the main breaker to the transfer switch.

.4 Verify the power transfer from emergency to normal power.

.5 Coordinate Utility to turn off a single phase at a time for the primary of the transformer. Ensure all building loads are turned off or disconnected.

.6 Verify “Ghost” phasing does not occur in the disconnected phase by verifying that the transfer switch does not transfer back to utility (normal power) when not under load.

.7 Demonstrate manual operation of transfer switch between Utility and Emergency sources

.8 Demonstrate test features of Automatic Transfer Switch

.9 Demonstrate all input and output signals from Automatic Transfer Switch

.10 Test the pump and Fire Suppression system to the needs of NFPA 14 and NFPA 20.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accord with applicable codes and ordinances.

.2 Contract documents of this Division and Drawings are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are **not** detailed installation instructions.

.3 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents, which in turn shall be subject to the approval of Departmental Representative.

.4 Install equipment generally in locations and routes shown, close to building structure. Minimize furring requirements and interference with other services or free space. Remove and replace improperly installed equipment at no extra cost. Install all piping and ductwork in concealed spaces unless noted otherwise.

.5 Provide additional material for modifications that may be required to correct minor job conflicts.

.6 Provide adequate clear space for future or Owner-supplied equipment and connections for such equipment, and for future extensions to the building. If required by Departmental Representative, provide detailed layouts for checking and approval before commencing work.

.7 Plumbing fixtures shown on Architectural drawings and not on Mechanical drawings shall be supplied and installed by the Contractor with all necessary piping for the complete operation of the fixture. Check all architectural drawings during the tendering period.

.8 Refer to Architectural drawings for construction details. These shall be used to relate to roof supports, piping and duct penetrations in walls, roof and other building construction.

1.2 MATERIALS

.1 Materials and equipment installed shall be new, full weight and of quality specified.

.2 Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.

.3 Each major component of equipment shall bear manufacturer's name, address, catalog and serial number in a conspicuous place.

.4 Equipment and materials shall conform to space limitations and shall not require redesign of any parts of the structural, mechanical, electrical, or architectural layout.

.5 Materials selected for a particular type, class, or service shall be of one manufacture. No indiscriminate mixing of manufacturers will be allowed.

1.3 METRIC CONVERSION

.1 All units in this division are expressed in SI units.

.2 Submit all shop drawings and maintenance manuals in SI units.

.3 On all submittals (shop drawings etc.) use the **same** SI units as stated in the specification.

1.4 CUTTING AND PATCHING

.1 Provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves at no additional cost to the contract.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Obtain written approval from Departmental Representative before cutting or burning structural members.

.4 Provide openings and holes required in precast members for mechanical work. Cast holes larger than 100 mm in diameter. Field-cut smaller than 100 mm.

.5 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.

1.5 WATERPROOFING

.1 Where any waterproofing membrane or waterproof concrete must be pierced by the work, reseal the opening using a method approved by the Departmental Representative prior to doing the work. Furnish and install sleeves, caulking and flashing subsequently required.

1.6 SHOP DRAWINGS

.1 Comply with requirements of Division 01 Submittals.

.2 Provide shop drawings as indicated.

.3 Identify materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalog material. Do not assume applicable catalogues are available. Maintenance and operating manuals are not suitable submittal material.

.4 Include dimensional data for roughing-in and installation, technical data sufficient to check that equipment meets requirements of the Contract Documents, wiring, piping and service connection data, motor sizes complete with voltage ratings, and schedules as applicable.

.5 Clearly mark submittal material using arrows, underlining or circling to show data applicable to the project. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps seals, materials or finish.

.6 Shop drawings submitted for review shall be certified by the manufacturer and carefully checked by the trade involved, noting all revisions required. Where electrical connections are required, the electrical trade shall also be required, in conjunction with the mechanical trade, to check that his work will fit to the equipment being submitted for review. Drawings submitted for review shall bear the approval stamps and signatures of the Trades involved in the properly coordinated installation of the equipment.

.7 The Contractor shall accept responsibility for any equipment ordered where proper procedure has not been followed and no charges for cancellation, handling, restocking, etc. will be accepted.

.8 The submission of the drawings shall infer that it meets all specifications and drawing requirements. Any discrepancies shall be noted on the submission for review by the Departmental Representative. Failure to note these discrepancies and variations by the Departmental Representative will not in any way relieve the Contractor from responsibility to correct the installation to the intent of the specifications and drawings. Drawings will not be accepted for review by the Departmental Representative if not previously checked and stamped by the Contractor.

.9 No shop drawings shall be used which do not bear the signed review stamp of the Departmental Representative.

.10 Until submission is reviewed, work involving relevant products may not proceed.

1.7 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT

.1 Replace materials less than specified quality or as designated by Departmental Representative and relocate work incorrectly installed as determined by Departmental Representative.

.2 Install material and equipment using qualified trades people.

.3 Contractor's work will be inspected periodically by the Departmental Representative solely for purpose of determining general quality of work, and not for any other purpose. Guidance will be offered to Contractor in interpretation of plans and specifications to assist them to carry out work. Inspection and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose upon the Departmental Representative any responsibility to supervise or oversee erection or installation of any work.

1.8 COOPERATION WITH OTHER TRADES

.1 Give full cooperation to all other trades, submit any written information where necessary to permit the work of other trades to proceed without delay or interference. A copy of this information shall also be submitted to the Departmental Representative.

.2 Where Mechanical Contractor's work will be installed in close proximity to the work of other trades, or where there appears to be an interference between trades, all trades involved shall assist in working out a suitable space arrangement. Failure

to make notification of conflicts prior to installation may require the Mechanical Contractor to make necessary changes at his own expense.

1.9 MECHANICAL AND ELECTRICAL TRADE COORDINATION

.1 Mechanical Subcontract Responsibilities

.1 Include the supply and installation of all electrical motors, control devices, temperature control systems and other devices and systems specified under this Division that is required for proper and safe operation.

.2 Provide all wiring for package equipment and where required provide controlling devices such liquid level controllers, multi-speed motor controllers, etc.

.3 Include all low and line voltage wiring associated with the control systems. This includes all wiring necessary for the interconnection of components to enable the automatic operation of equipment as intended and specified in Division 21 work. Include all wiring as associated with the installation of control panels.

.4 Provide CSA labelling on all mechanical equipment that will require electrical connections.

.5 Submit a list of motor requirements and electrical connections that will be required for the mechanical system. Include voltage, phase and motor horsepower requirements as applicable.

.2 Electrical Subcontract Responsibilities

.1 Supply and installation of all disconnect switches, starters, relays, heater coils, interlocks, etc., which are not an integral part of package units or equipment but which are required for the performance and intended operation of all equipment.

.2 All electrical connections and wiring for equipment provided under Division 21 with the exception of that required for Controls and Instrumentation as noted elsewhere in this Division. This shall include all power connections to starters supplied with equipment. In general, include all power wiring between the power source, the starter and the motor to enable the motor to be operated manually. This will include the interconnections of series controls such as line voltage thermostats, pump controllers, etc.

.3 Package Equipment

.1 Equipment such as heating and cooling units, etc., which are intended to be supplied as pre-assembled single responsibility packages shall have all low and line voltage prewired.

.2 Provide all interconnecting wiring required for on-site assembly of various parts and for remote controlling devices.

.3 Include starters as part of the package where specified.

1.10 OPERATING AND MAINTENANCE MANUALS

.1 Refer to Section 01 78 00 – Closeout Submittals.

.2 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Departmental Representative two (2) weeks prior to substantial completion.

.3 Provide documentation agent with one set of plans, specifications, addenda and change orders for their use only.

.4 Provide 2l6 mm x 280 mm capacity, 3 post expandable binders, hot stamped lettering front and spine. Provide three copies to Departmental Representative. Maximum thickness of binders not to exceed 100 mm.

.5 Index binder according to the following system:

Tab - 1.0 System Information

Tab - 1.1 List of Mechanical Drawings

Tab - 1.2 Description of Systems:

Provide complete description of the operating sequence for each system. Include detailed system description, with individual components described, explanation of how components interface with others and to the complete system. Index according to system:

1.0 Heating and Cooling System
2.0 Plumbing System
3.0 Fire Protection
4.0 Miscellaneous Systems
5.0 Control System

Tab - 1.3 Operating Division:

Provide complete and detailed description of operation for each major system and its components. Provide information on locations of components, how to energize switches and controls, how components interface with other components, operation of controls including operational sequence, operational changes for summer or winter operation, how to accomplish the changeover, complete troubleshooting sequence, emergency operating sequences in event of major component failure and safeguards to indicate if equipment goes off-line.

Tab - 1.4 Maintenance and Lubrication Division:

Provide general maintenance and lubrication schedule for each major system and components. Include daily, weekly, monthly, semi-annual and yearly checks and tasks. Provide material received in compliance with clause "Submittals" and integrate with maintenance description.

Tab - 1.5 List of Equipment Suppliers and Contractors:

Provide list of equipment suppliers and contractors, including address and telephone number. Outline procedures for purchasing parts and equipment.

Tab - 2.1 Certification:

Secure copies of inspection certification from authorities.

Tab - 2.2 Testing:

Include copies of test data and start-up reports, including the following:

Tab - 3.0 Shop Drawings

Tab - 4.0 Balance Reports:

Secure copies of final air balance report and include in this division as one single submission, complete with title page, index and site data.

Tab - 4.1 Air Balance

Tab - 5.0 Component Information

Tab - 6.0 Spare Parts:

Include listing of recommended spare parts as outlined in Section 23 02 00.

.6 Assemble data for controls, operating and maintenance in a separate manual. Refer to Section 23 09 33.

Control System Software

Prepare and submit PLC Control System Software information consisting of the following:

.1 System Introduction

.1 Provide a brief description of overall control philosophy.

.2 Describe hardware interlocks with other equipment that may affect or override action of software control modules.

.3 Describe procedure for operating staff to interface with software control modules to override system or component operation, to adjust system or building control setpoints, etc. Name virtual points provided in software for this purpose and recommend adjustment increments and limits where applicable.

.2 System Schematic: provide a labelled schematic indicating locations, point mnemonics, and proper names of physical control points in system. Include RCU panel wiring diagrams with field point termination addresses. Good quality shop drawings may be used for this purpose.

.3 Software Modules:

.1 For each module provide a description of purpose and logic of module.

.2 Provide a table listing Input and Output Variables used by module on "Control Software Input/Output Variable Table".

.3 Provide description of each software Input and Output Variable on "Point Mnemonic Descriptions" sheet.

.4 Provide hardcopy listing of software module.

.7 The divider tabs shall be laminated plastic and coloured according to Section. Plastic tabs with typewritten card insertions will not be accepted.

.8 Submit documents to the Departmental Representative for approval prior to transmitting final copies.

1.11 PROJECT RECORD DRAWINGS

.1 Refer to Section 01 78 00 – Closeout Submittals.

.2 At substantial performance of the Contract, turn the record drawings over to the Departmental Representative. Clearly mark the drawings, "Record Drawing", stamp with the name of the Contractor and Mechanical sub-Contractor, with name and signature of the responsible representative of the Mechanical sub-Contractor.

.3 Submit record drawings identifying location of fire dampers, major control lines, EMCS sensors, access doors, tagged valves and actual room names or numbers.

1.12 TEMPORARY HEAT

.1 Refer to Section 01 51 00 – Temporary Utilities.

.2 Do not use the permanent system for temporary heating purposes without written permission from the Departmental Representative.

.3 Thoroughly clean and overhaul permanent equipment used during the construction period, replace worn or damaged parts before final inspection.

.4 Use of permanent systems for temporary heat shall not modify terms of warranty.

.5 Operate heating systems under conditions which ensure no temporary or permanent damage. Operate fans at proper resistance with filters installed. Change filters at regular intervals. Operate with proper safety devices and controls installed and fully operational. Operate systems only with treated water as specified.

.6 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets. Clean duct systems which have become dirty.

.7 When permanent systems are used for temporary heat, provide alarm indicating system failure.

.8 Where pumps are used for temporary heating, replace mechanical seals, regardless of condition, with **new** mechanical seals.

1.13 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.

.3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

1.14 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

1.15 SITE UTILITY SERVICES

.1 Maintain liaison with the Departmental Representative to interrupt, re-route or connect to water, sewer, heating, or gas systems, with minimum interruption of services.

1.16 ELECTRICAL MOTORS

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40°C for open housing and 50°C for drip proof housing, and operate at 1200 or 1800 r/min unless otherwise specified.

.3 Motors shall have ball or roller type bearings.

.4 Provide grease lubrication fittings on motors with frame sizes 254T and larger.

.5 Refer to electrical specification for voltage, phase and cycle.

.6 Existing building will be unoccupied during term of this contract. Maintain the existing heating system operational during the winter period to prevent damage to other building systems.

.7 Maintain continuous and adequate heating, plumbing, washroom facilities and other services during entire time of this contract. Provide temporary connections, valving, etc., where necessary to meet this requirement.

END OF SECTION

Part 1 General

1.1 REFERENCE DOCUMENTS

.1 Pipe supports shall meet the requirements of ANSI/ASME B31.1, Power piping.

.2 Duct hangers shall follow the recommendations of the SMACNA Duct Manuals.

1.2 GENERAL REQUIREMENTS

.1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction and to accommodate insulation; provide insulation protection saddles.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building steel or inserts in concrete construction.

.5 Provide and set sleeves required for equipment, including openings required for placing equipment.

.6 Dielectrically isolate dissimilar metals.

.7 Pipe, duct and conduit supports are not all necessarily shown on the Contract Drawings. The Contractor is responsible to ensure sufficient supports are supplied, fabricated, and installed to properly secure all pipe, fittings, and equipment to satisfy manufacturer’s recommendations.

1.3 APPROVALS

.1 Obtain approval from the Departmental Representative prior to drilling for inserts and supports for piping systems.

.2 Obtain approval from the Engineer prior to using percussion type fastenings.

.3 Use of perforated band iron, wire or chain as hangers is not permitted.

Part 2 Products

2.1 INSERTS

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

.1 Hangers: Pipe sizes 15 mm to 40 mm: Adjustable wrought steel ring.

.2 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes 150 mm Over: Adjustable wrought steel clevis.

.3 Hangers: Hot Pipe Sizes 150 mm: Adjustable steel yoke and cast iron roll.

.4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.

.5 Wall Support: Pipe Sizes to 80 mm: Cast iron hook.

.6 Wall Support: Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm and over.

.7 Vertical Support: Steel riser clamp.

.8 Floor Support: Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

.9 Floor Support: Hot Pipe Sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

.10 Design hangers so they cannot become disengaged by movements of supported pipe.

.11 Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

.12 Insulate all piping from dissimilar metal supports.

2.3 HANGER RODS

.1 Provide steel hanger, threaded rods required to accommodate final pipe gradients and installation.

2.4 DUCT HANGERS AND SUPPORTS

.1 Hangers: Galvanized steel band iron or rolled angle and 10 mm rods.

.2 Wall Supports: Galvanized steel band iron or fabricated angle bracket.

.3 Vertical Support at Floor: Rolled angle.

2.5 FLASHING

.1 Steel Flashing: 0.55 mm galvanized steel.

.2 Lead Flashing: sheet lead, as follows:

.1 For Waterproofing: 25 kg/m^2.

.2 For Soundproofing: 5 kg/m^2.

.3 Lead Sheet Size:

.1 Roof Drains: minimum 810 mm x 810 mm.

.2 Roof Plumbing Vents: as required to provide base flashing overlap to ARCA detail.

.3 Floor Drains: minimum 920 x 920 mm and as specified.

.4 Other Locations: as specified.

.3 Safes: 25 kg/m^2 sheet lead or 200 micrometre neoprene.

.4 Caps: Steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

2.6 SLEEVES

.1 Pipes through Floors: Form with 1.2 mm galvanized steel.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe or 1.2 mm thickness galvanized steel.

.3 Roof Drains: form sleeves with 0.7 mm thick sheet steel galvanized with Z275 zinc coating to ASTM A653M.

.4 Round Ducts: Form sleeves with galvanized steel.

.5 Rectangular Ducts: Form sleeves with galvanized steel or wood.

.6 Size large enough to allow for expansion with continuous insulation.

2.7 FINISHES ON HANGER RODS, HANGERS AND SUPPORTS

.1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CAN/CGSB-1.40-M89.

Part 3 Execution

3.1 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.2 PIPE HANGERS AND SUPPORTS

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size	Distance Between Supports	Hanger Rod Diameter
15 mm	1.8 m	10 mm
20 mm to 40 mm	1.8 m	10 mm
50 mm & 65 mm	3 m	10 mm
80 mm & 100 mm	3.6 m	16 mm
150 mm to 300 mm	4.3 m	22 mm
350 mm to 450 mm	6.1 m	25 mm

.2 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent work.

.3 Place a hanger within 300 mm of each horizontal elbow.

.4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

3.3 LOW VELOCITY DUCT HANGERS AND SUPPORTS

.1 Hanger Minimum Sizes:

.1 Up to 750 mm wide: 25 x 1.6 mm at 3 m spacing.

.2 790 to 1200 mm wide: 40 x 1.6 mm at 3 m spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

.1 Up to 450 mm wide: 40 x 1.6 mm or 25 x 25 x 3 mm at 2.4 m spacing.

.2 480 x 1000 mm wide: 40 x 40 x 3 mm at 1.2 m spacing.

.3 Vertical Duct on Wall Supports Minimum Sizes at 3.65 m spacing:

.1 Up to 610 mm wide: 40 x 1.6 mm.

.2 640 to 900 mm wide: 25 x 25 x 3 mm.

.3 940 to 1200 mm wide: 30 x 30 x 3 mm.

.4 Over 1520 mm wide: 50 x 3 mm.

.4 Vertical Duct Floor Supports Minimum Sizes, riveted or screwed to ducts:

.1 Up to 1520 mm wide: 40 x 40 x 3 mm.

.2 Over 1520 mm wide: 50 x 3 mm.

3.4 MEDIUM AND HIGH VELOCITY DUCT HANGERS AND SUPPORTS

.1 Hanger Minimum Sizes:

.1 Up to 900 mm wide: 2 at 25 x 1.6 mm at 3 m spacing.

.2 940 x 1520 mm wide: 2 at 25 x 1.6 mm at 2.4 m spacing and 50 x 50 x 6 mm trapeze.

.3 1550 x 3050 mm wide: 2 at 38 x 2.6 mm at 2.4 m spacing and 50 x 50 x 7 mm trapeze.

.4 3070 x 6700 mm wide: 3 at 10 mm diameter at 1.2 m spacing and 65 x 65 x 5 mm trapeze.

.2 Round Duct Hangers Minimum Sizes at 3 m spacings:

.1 Up to 460 mm diameter: 25 x 1.6 mm.

.2 480 to 900 mm diameter: 25 x 2.6 mm.

.3 940 to 1270 mm diameter: 40 x 2.6 mm.

.4 1300 to 2130 mm diameter: 2 at 40 x 2.6 mm from girth reinforcing angle.

.3 Vertical Duct Floor Supports Minimum Sizes:

.1 Up to 1220 mm wide: 40 x 40 x 3 mm.

.2 Over 1220 mm wide: 50 x 50 x 30 mm.

.3 Rivet to duct and tie angles together with rod, angles or band Iron.

.4 Angle reinforcing may be used for support omitting trapeze.

3.5 EQUIPMENT BASES AND SUPPORTS

.1 Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Rigidly anchor ducts and pipes immediately after vibration connections to equipment.

3.6 FLASHING

.1 Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

.2 Flash vent and soil pipes projecting 75 mm minimum above roof membrane with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides. For pipes through outside walls turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead minimum 250 mm clear on sides. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations, minimum 200 mm high.

.5 Attach counterflashings to mechanical equipment and lap base flashings on roof curbs.

.6 All joints in counterflashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Use storm collars above all roof jacks.

.7 Screw vertical flange section of roof jacks to face of curb.

.8 Provide continuous lead or neoprene safes below air supply casings, floors located above finished rooms. Solder at joints, flash into floor drains and turn up 150 mm into walls or to top of curbs and caulk into joints.

.9 Provide lead flashing around ducts and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

.10 Cut openings in lead flashings installed over roof drains and work down lead into drain body as indicated on detail drawings appended to roofing specification.

3.7 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Where piping or ductwork passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

.4 Install chrome plated escutcheons where piping passes through finished surfaces.

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

.1 Provide labels to CSA and ANSI Standards.

Part 2 Products

2.1 TAGS, LABELS AND BANDING

.1 HVAC Valve Tags: tags with 12 mm high lettering and brass jack chain for fastening to valve. Following types of valve tags are acceptable:

.1 Brass tags: 40 mm diameter affixed to valve with brass jack chain.

.2 50 mm x 50 mm fibreglass tags.

.3 40 mm diameter anodized aluminum tags.

.2 Laminated Plastic Nameplate: self-adhesive composite laminated plastic nameplates with one smooth white surface and core of black plastic. Designed to leave black lettering on a white background when engraved.

.1 Mechanical Equipment: engraved lettering 20 mm high.

.2 Panels and Panel Mounted Equipment: engraved lettering 20 mm high.

.3 Equipment Cabinet front mounted switches and displays: engraved lettering 8 mm high.

.3 Colour Banding Tape: adhesive backed plastic tape, integrally coloured.

.4 Identification Labels: adhesive backed plasticized labels, yellow colour, with:

.1 Legends consisting of black lettering, minimum 50 mm high.

.2 Black direction of flow arrows.

.3 Fasten labels with mechanical fastener in addition to adhesive backing on labels.

.5 Stencils: 50 mm high black lettering and flow arrows.

2.2 VALVE TAG DIRECTORY

.1 Provide a typewritten of **all valves** identifying the following information:

.1 Valve number
.2 Location
.3 Service
.4 Make/model size
.5 With/without handwheel
.6 Type of control

Part 3 Execution

3.1 LABELS

.1 Use identification labels or stencils to apply legends and direction of flow arrows, as detailed in **CGSB 24-GP-3A Colour Standard** Colour Coding Requirements, and as follows:

.1 Apply to full colour coded mechanical piping and to mechanical ductwork in sufficient numbers of locations to provide easy identification.

.2 Apply to intermittent colour coded mechanical piping wherever colour coding bands occur.

.2 Adhere labels with sufficient coat of contact cement to ensure permanent adhesion. Seal with two coats of clear lacquer.

.3 Apply pipe and duct labels at 15 m intervals, before and after pipes pass through walls, at access door openings.

.4 Identify major mechanical equipment with laminated plastic nameplates.

.5 Identify electric starting switches, electric disconnects and remote push buttons with laminated plastic nameplates.

3.2 NAMEPLATES

.1 Provide name/data plates on major equipment components with manufacturer's name, model number, serial number, capacity and electrical data. Attach plate in a conspicuous place.

3.3 TAGS

.1 Tag all valves in mechanical rooms, and all circuit balancing and isolating valves external to mechanical room except valves at terminal heating and cooling equipment.

.2 Identify and tag air terminal boxes and radiator valves with numbers.

.3 Identify and tag thermostats relating to terminal boxes and valve numbers.

.4 Identify and tag temperature sensors or intelligent thermostats by mnemonic and related terminal box and valve numbers.

3.4 LOCATION IDENTIFICATION

.1 Provide equipment, valve and damper location tacks or adhesive disks at access panels in ceilings, colour coded as follows:

.1 Yellow - HVAC Equipment

.2 Red - Fire Dampers/Smoke Dampers

.3 Green - Plumbing Valves

.4 Blue - Heating/Cooling Valves.

.2 Locate tacks or disks in corner of access panel closest to equipment.

3.5 DIRECTORIES

.1 Install valve tag directory on wall in **building operator's office**.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Comply with requirements of Section 20 00 13.

.2 Submit an insulation schedule, including the following information for each application:

.1 Material

.2 "k" value

.3 Thickness

.4 Density

.5 Finish

.6 Jacket

.3 Submit product data and test reports when requested to substantiate that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements for the assembly and thickness used.

1.2 DEFINITIONS

.1 For the purposes of this section, the following definitions apply:

.1 Concealed: ductwork and equipment in shafts, furring, suspended ceilings and attics.

.2 Exposed: ductwork and equipment in mechanical rooms or otherwise not "concealed".

.3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

1.3 FLAME/SMOKE DEVELOPMENT RATINGS

.1 Duct insulation, recovery materials, vapour barrier facings, tapes and adhesives shall have maximum flame spread ratings less than or equal to 25 and maximum smoke developed less than or equal to 50, when tested in accordance with CAN/ULC S102, NFPA 255 or ASTM E84.

.2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C411.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS

.1 Fiberglas, Manson, Owens Corning, Knauf, Certainteed Corp.

2.2 MINERAL FIBRE INSULATION

.1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.

.2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.

.3 Service Temperature: -40°C to 65°C.

2.3 ACOUSTIC DUCTWORK INSULATION

.1 Material: rigid mineral fibreboard to CAN/CGSB-51.10.

.2 Acoustic Properties: minimum NRC or 0.8 for 25 mm thickness.

.3 "k" Value: maximum 0.035 W/m°C at 24°C mean temperature.

.4 Service Temperature: -40°C to 65°C.

.5 Surface Finish: air stream side coated to prevent fibre erosion. Surface roughness not exceeding 0.58 mm.

2.4 BREECHING INSULATION

.1 Material: Semi-rigid mineral fibre with glass mat.

.2 "k" Value: Maximum 0.038 W/m°C at 24°C mean temperature.

.3 Service Temperature: 65°C to 450°C.

2.5 ACCESSORIES

.1 FSK Tape: 100 mm wide vapour barrier tape consisting of laminated aluminum foil, glass fiber scrim and paper, with pressure sensitive self adhesive.

.2 ASJ Tape: vapour resistant tape consisting of all service jacket material with pressure sensitive self adhesive.

.3 Contact Adhesive: quick setting, adhesive to adhere flexible or rigid mineral fibre insulation to ducts.

.4 Lap Seal Adhesive: quick setting adhesive for joints and lap sealing of vapour barriers.

.5 Canvas Adhesive: washable adhesive for cementing canvas jacket to duct insulation.

.6 Pins: welding pins 4 mm diameter shaft with 35 mm diameter head for installation through the insulation. Length to suit thickness of insulation with 32 mm square nylon retaining clips.

.7 Finishing Cement: to CAN/CGSB-51.12-95, Type 1 - mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.

2.6 RECOVERY MATERIALS FOR EXTERIOR DUCTWORK

.1 Aluminum Jacket: to CSA HA Series M-1980, 0.5 mm thick with aluminum alloy butt straps, secured with mechanical fastener. Ensure weather proof installation.

Part 3 Execution

3.1 INSTALLATION, GENERAL

.1 Dimensions shown are clear inside free area measurement regardless of insulation placement. Fabricate ducts accordingly.

.2 Apply insulation after required duct system tests have been completed and inspected by the Departmental Representative.

.3 Ensure duct surfaces are clean and dry before installing insulation.

.4 Install insulation over entire surface of duct, for full length of duct run including portions of duct passing penetrations through walls and floors.

.5 Install insulation in a manner to insure hangers and standing duct seams do not penetrate insulation.

.6 Locate finished seams in least visible location.

.7 Do not insulate ductwork with external thermal insulation where acoustic duct insulation has been specified.

.8 Install insulation at ambient temperatures within acceptable ratings for tapes, sealants and adhesives.

.9 Recover exposed insulated duct work with aluminum.

3.2 INSTALLATION

.1 Adhere mineral fibre insulation to round and oval ductwork with adhesive applied in 150 mm wide strips on 400 mm centres. Band on outside until mastic sets then remove bands.

.2 Butt mineral fibre insulation and seal joints with lap seal adhesive; cover joint with FSK tape.

.3 Secure rigid insulation on rectangular ducts with 50% area coverage of adhesive and impale on pins located 400 mm on centre and secure in place with the retaining clips.

.4 Butt rigid insulation on rectangular ducts and seal joints with lap seal adhesive; cover joints with 100 mm strips of open mesh cloth imbedded between two coats of lap seal adhesive.

3.3 ACOUSTIC DUCT INSULATION APPLICATION

.1 Line ducts with flexible or rigid acoustic insulation. Line plenums with rigid acoustical insulation. Adhere insulation to duct with 100% coverage of contact adhesive and pins located 400 mm OC each way. Secure in place with retaining clips. Remove excess length of pins and cover with brush coat of lap seal adhesive.

.2 Bevel corners at joints and butt together. Brush coat all cut edges with lap seal adhesive. Install acoustic gauze over all cut corners and joints and brush coat with lap seal adhesive.

.3 Where duct velocities exceed 20 m/s, cover insulation with 0.8 mm perforated galvanized steel with 24% free area.

3.4 DUST COLLECTOR SYSTEMS

.1 Insulate all ductwork exposed to outdoors with 50 mm thick Mineral Fibre Insulation.

.2 Do not re-insulate the silencer section.

.3 Cover insulated ductwork and silencer with aluminum jacket; ensure weatherproof installation.

Service Type	Insulation Type	Insulation Thickness (mm)
Exhaust and relief ducts within 3 m of exterior openings	Hot duct	25
Relief ducts and plenums	Hot duct	25
Supply ducts and plenums	Hot duct	25
Combustion air	Cold duct	50
Outside air	Cold duct	50
Mixing plenums	Cold duct	50
Supply air plenums	Cold duct	25
Medium pressure supply ducts	Cold duct	25
Low pressure supply ducts	Cold duct	25
Supply and return ducts exposed to outdoors	Cold duct	75
Supply and return ducts in cold attic spaces	Cold duct	50
Ventilation equipment	Cold duct	50
Evaporative condenser intake and exhaust	Cold duct	25
High and Medium pressure supply ducts	Acoustic	25
Low pressure supply and return	Acoustic	25
Plenums	Acoustic	25
Sound Traps	Acoustic	50
Boilers	Breeching	50
Domestic hot water heaters, atmospheric burners	Breeching	25
Domestic hot water heaters, forced air burners	Breeching	50
Furnaces	Breeching	25
Gas-fired unit heaters	Breeching	25
Indirect gas-fired air handling units, forced air burners	Breeching	25
Indirect gas-fired air handling units, atmospheric burners	Breeching	50

END OF SECTION

1. General

1.1 INTENT

.1 Inspect, start and test each piece of mechanical equipment. Verify that equipment has been properly installed and is operating at a level which meets specified requirements.

1.2 FACTORY TRAINED REPRESENTATIVES

.1 Use factory trained representatives and submit manufacturer's check sheets for starting following specialty equipment:

.1 Air handling units.
.2 Boilers.
.3 Chillers.
.4 Cooling towers.
.5 Compressors and vacuum pumps.
.6 Variable speed drive units.
.7 Air flow measuring stations.
.8 Control components.
.9 Chemical cleaning and treatment.

.2 Use manufacturers factory trained personnel where required to maintain manufacturer's warranty.

2. Products

Not Used

3. Execution

3.1 FUEL FIRED EQUIPMENT - BOILERS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Boiler is level on housekeeping base.

.2 Flue and chimney installed without visible damage.

.3 No visible damage to boiler jacket.

.4 No visible damage to refractory or combustion chamber.

.5 Check PRVs for correct operation and specified relief pressure. Adjust as required.

.6 Clearances have been provided and piping is flanged for easy removal and servicing.

.7 Heating circuit pipes have been connected to correct ports.

.8 Labels are clearly visible.

.9 Boiler, burner and flue completely clean and free of construction debris.

.10 Burner blower rotates in correct direction.

.11 Pressure and temperature gauges installed.

.12 Controls completed.

.3 Ensure pumps are operational.

.4 Check for proper operation of pressure reducing valve on gas train, including venting.

.5 Ensure boiler fluid level, flow switch and high temperature interlocks are in place.

.6 Obtain following from manufacturer and submit as specified in Section 20 00 13:

.1 All equipment performance selection tables.
.2 Manufacturer's equipment start-up sheets.

.2 Starting:

.1 Start pumps.

.2 Perform starting of boilers and adjustment of burners using manufacturer’s factory trained personnel.

.3 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.4 Check and record performance of all factory provided boiler protection devices, and firing sequences.

.5 Check and record performance of boiler fluid level, flow switch and high temperature interlocks.

.6 Run-in as recommended or required by manufacturer.

.3 Post Starting:

.1 Perform following tests for each firing rate for high/low burners and for 100%, 66%, and 33% load for modulating burners. Adjust boiler combustion efficiency (%) at each firing rate to that specified or advertised by manufacturer, if latter is higher.

.1 Measure gas pressure on manifold**.**

.2 Measure combustion air temperature at inlet to burner.

.3 Measure flue gas temperature at boiler discharge.

.4 Perform flue gas analysis. Measure and record flue gas CO^2 and O^2 concentration.

.5 Measure natural flue draft.

.2 Measure water flow rate, pressure drops, and temperature rise through each boiler.

.3 Inspect expansion tank**,** make-up water meter, tank pressure, PRV, water level and backflow preventer.

.4 Pre-Interim Acceptance: - Not applicable.

3.2 FUEL FIRED EQUIPMENT - SERVICE WATER HEATERS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Heater is level on housekeeping base.

.2 Flue and chimney installed without visible damage.

.3 No visible damage to heater jacket.

.4 No visible damage to refractory or combustion chamber.

.5 Check PRVs for correct operation and specified relief pressure. Adjust as required.

.6 Clearances have been provided and piping is flanged for easy removal and servicing.

.7 Labels are clearly visible.

.8 Heater, burner and flue completely clean and free of construction debris.

.9 Burner blower rotates in correct direction.

.10 Controls completed.

.11 Tank has dielectric unions on piping connections.

.3 Verify that chemical sterilization of piping system is completed.

.4 Ensure circulation pump is operational.

.5 Check for proper operation of pressure reducing valve on gas train, including venting.

.2 Starting:

.1 Ensure pilot is operating.

.2 Ensure tank is full of water, vented and flushed.

.3 Ensure thermostat is set at 50°C.

.4 Start as recommended by manufacturer.

.5 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.6 Check and record performance of all factory provided protection devices, and firing sequences.

.7 Run-in as recommended or required by manufacturer.

.3 Post-Starting:

.1 Measure gas pressure on manifold.

.2 Measure combustion air temperature at inlet to burner.

.3 Measure flue gas temperature at boiler discharge.

.4 Perform flue gas analysis. Measure and record flue gas CO_2 and O_2 concentration.

.5 Measure natural flue draft.

.6 Adjust heater combustion efficiency (%) to that specified, or advertised by manufacturer if latter is higher.

.7 Fill tank with cold domestic water and determine tank recovery time.

.4 Pre-Interim Acceptance:

.1 Drain tank, refill and vent.

3.3 FUEL FIRED EQUIPMENT - PACKAGED DIRECT FIRED AIR SYSTEMS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Unit is level.

.2 No visible damage to unit casing.

.3 Clearances have been provided.

.4 Discharge air thermostats operational and calibrated.

.5 Roof curb sealed to duct penetration, if applicable.

.6 Filter installed.

.7 Labels are clearly visible.

.8 Controls completed.

.3 Check for proper operation of pressure reducing valve on gas train, including venting.

.4 Ensure burner, fan and damper interlocks are in place.

.5 Lubricate bearings on fan as recommended by manufacturer.

.6 Ensure fan wheel rotates in correct direction without vibration or binding.

.7 Adjust belt to proper alignment and tension.

.2 Starting:

.1 Check correct operation of safety interlocks, including exhaust fans, outside air damper, fan and burner interlocks, CO detector.

.2 Start as recommended by manufacturer.

.3 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.4 Check and record performance of all factory provided burner protection devices, and firing sequences.

.5 Check summer operation burner firing lockout.

.6 Run-in as required by manufacturer.

.3 Post-Starting:

.1 Perform a discharge air combustion products analysis and adjust burner for peak efficiency over entire turn down range of burner.

.2 Measure gas pressure on manifold**.**

.3 Measure air flow on high and low fire to ensure sufficient velocities across burner profile plate.

.4 Adjust belt tension and change pulley sheaves to desired air flow.

.5 Check to see that following occurs:

.1 Exhaust fans are interlocked with unit.
.2 High temperature limit for correct operation and calibration.
.3 Air flow lockout for proper operation.
.4 High and low gas pressure switches for proper operation.
.5 Burner turn down and flame stability.
.6 Vibration isolators are free.
.7 Calibrate discharge air control and set to specified level.

.4 Pre-Interim Acceptance:

.1 Replace filters.
.2 Lubricate bearings.
.3 Adjust belt tension.

3.4 FUEL FIRED EQUIPMENT - FORCED AIR FURNACES

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Furnace is level on housekeeping base.

.2 Flue and chimney installed without visible damage.

.3 No visible damage to furnace jacket.

.4 No visible damage to combustion chamber.

.5 Clearances to combustibles have been maintained.

.6 Clearances have been provided for servicing.

.7 Labels are clearly visible.

.8 Furnace and flue are completely clean and free of construction debris.

.9 Filter installed.

.10 Controls completed.

.11 Combustion and make-up air have been provided.

.12 Gas line is complete and purged.

.3 Lubricate bearings on fan as recommended by manufacturer.

.4 Ensure fan wheel rotates in correct direction without vibration or binding.

.5 Adjust belt to proper alignment and tension.

.2 Starting:

.1 Start furnaces as recommended by manufacturer.

.2 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.3 Check and record performance of all factory provided furnace protection devices, and firing sequences.

.4 Run-in as required by manufacturer.

.3 Post-Starting:

.1 Measure gas pressure on manifold.

.2 Measure combustion air temperature at inlet to combustion chamber.

.3 Measure flue gas temperature at furnace discharge.

.4 Perform flue gas analysis. Measure and record flue gas CO^2 and O^2 concentration.

.5 Measure natural flue draft.

.6 Adjust burner for peak efficiency. Adjust pilot to stable flame.

.7 Check for backdraft under full operation.

.8 Determine furnace room negative pressure.

.9 Confirm humidifier interlock.

.10 Calibrate thermostats.

.11 Adjust heat exchanger preheat and postcool fan timing controls.

.12 Adjust and check high temperature limits.

.13 Check fan on-off-auto switch for proper operation.

.14 Check heat-cool switch for proper operation, if applicable.

.4 Pre-Interim Acceptance:

.1 Replace filters.
.2 Lubricate bearings.
.3 Adjust belt tension.

3.5 FUEL FIRED EQUIPMENT - GAS FIRED UNIT HEATERS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Unit is level.

.2 Flue and chimney installed without visible damage.

.3 No visible damage to unit casing.

.4 No visible damage to combustion chamber.

.5 Clearances to combustibles have been maintained.

.6 Clearances have been provided for servicing.

.7 Labels are clearly visible.

.8 Combustion chamber and flue completely clean and free of construction debris.

.9 Controls completed.

.10 Combustion air has been provided.

.11 Gas line is complete and purged.

.3 Lubricate bearings on fan as recommended by manufacturer.

.4 Ensure fan wheel rotates in correct direction without vibration or binding.

.2 Starting:

.1 Start gas fired unit heaters as recommended by manufacturer.

.2 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.3 Check and record performance of all factory provided unit heater protection devices, and firing sequences.

.4 Run-in as recommended or required by manufacturer.

.3 Post-Starting:

.1 Measure gas pressure on manifold.

.2 Measure combustion air temperature at inlet to combustion chamber.

.3 Measure flue gas temperature at furnace discharge.

.4 Perform flue gas analysis. Measure and record flue gas CO^2 and O^2 concentration.

.5 Measure natural flue draft.

.6 Adjust burner for peak efficiency. Adjust pilot to stable flame.

.7 Check for backdraft under full operation.

.8 Calibrate thermostats.

.9 Adjust heat exchanger preheat and postcool fan timing controls.

.10 Adjust and check high temperature limits.

.4 Pre-Interim Acceptance:

.1 Lubricate bearings.
.2 Adjust belt tension.

3.6 FUEL FIRED EQUIPMENT - PACKAGED ROOFTOP FURNACE WITH COOLING

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Packaged unit is level on housekeeping base, and curbs are properly flashed to unit and to roof.

.2 No visible damage to unit casing.

.3 No visible damage to furnace combustion chamber.

.4 No visible damage to DX compressor, air cooled condenser coil or fans.

.5 Clearances have been provided for servicing.

.6 Labels are clearly visible.

.7 Furnace, flue and DX condenser completely clean and free of construction debris.

.8 Controls completed.

.9 Remove shipping bolts, blocks and tie-down straps.

.10 Filter installed.

.11 Adjust vibration isolators.

.12 Gas line is complete and purged.

.13 Check burner and controls are suitable for operation down to -40°C.

.14 Check acoustic insulation.

.15 Check operation of barometric dampers.

.3 Lubricate bearings on fan as recommended by manufacturer.

.4 Ensure fan wheel rotates in correct direction without vibration or binding.

.5 Adjust belt to proper alignment and tension.

.2 Starting:

.1 Start furnace and DX chiller in accordance with manufacturer's recommendations.

.2 Perform starting of DX chiller in summer only.

.3 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.4 Check and record performance of all factory provided furnace and DX chiller interlocks and protection devices, and furnace firing sequences.

.5 Run-in as recommended or required by manufacturer.

.3 Post-Starting:

.1 Perform following operations for both minimum and maximum firing, and adjust burner for peak efficiency. Adjust pilot to stable flame.

.1 Measure gas pressure on manifold.

.2 Measure combustion air temperature at inlet to combustion chamber.

.3 Measure flue gas temperature at furnace discharge.

.4 Perform flue gas analysis. Measure and record flue gas CO^2 and O^2 concentration.

.2 Measure furnace air on and off dry bulb temperatures and air volume at maximum firing rate. Calculate useful heat to supply air.

.3 Check for backdraft under full operation.

.4 Calibrate thermostats.

.5 Adjust and check high temperature limits.

.6 Check internal isolators.

.7 Check outside air damper for proper stroke and interlock with return air dampers.

.8 Check controls for correct sequencing of furnace, mixing section dampers, DX chiller and normal and emergency shutdown.

.9 Start chiller, measure and record following:

.1 Leaving coil air dry and wet bulb temperatures.
.2 Entering coil air dry and wet bulb temperatures.
.3 Outside air dry bulb temperature.
.4 Air cooled condenser discharge dry bulb temperature.

.10 Measure and record following minimum and maximum air flows. Plot fan volumes on fan curve:

.1 Supply volume.
.2 Return volume.
.3 Relief air volume.
.4 Outside intake air volume.

.11 Simulate maximum cooling demand and check:

.1 Compressor refrigerant suction and hot gas pressures.
.2 Use smoke to check if there is any short circuiting of air through condenser or from condenser to fresh air intake.

.12 Verify operation of remote panel, including pilot light operation, failure modes, and check:

.1 High-limit-heat exchanger.
.2 Warm-up for morning cycle.
.3 Freezestat operation.
.4 Free-cooling mode outdoor air changeover.
.5 Alarms.

.4 Pre-Interim Acceptance:

.1 Replace air filters
.2 Vacuum clean heat exchanger, cooling and condenser coils.
.3 Lubricate bearings.
.4 Adjust belt tension.
.5 Check operation of power vents.

3.7 FLUID HANDLING EQUIPMENT - PUMPS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Pump is level.

.2 Isolation valves, strainers, check valve, pressure gauges, by-pass filter and flow meter are installed properly.

.3 Pump suction has sufficient length of straight run piping.

.4 Air has been completely bled off piping system.

.5 Expansion tank is charged and on-line.

.6 Strainers have clean screens in place.

.7 Where specified for large pumps, check pump base vibration isolation and flexible connections on water pipes are properly installed.

.8 Nameplate is readily visible.

.9 Check clearance space is adequate for pump servicing and removal.

.2 Starting:

.1 Start as recommended by manufacturer.

.2 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.3 Check impeller is rotating in correct direction.

.3 Post Starting:

.1 Run-in pumps for minimum 12 continuous hours.

.2 Ensure flows through parallel pumps are equally balanced.

.3 Ensure mechanical seals do not leak, or packing gland type seals are wetted.

.4 Check pump NPSH - net positive suction head.

.5 Where vibration isolation is specified, check for correct static deflection of unit vibration isolators, and that start up and shut down deflection is within resilience limits of isolators and flexible connections.

.6 Verify that motor has sufficient air flow through casing to provide cooling.

.4 Pre-Interim Acceptance:

.1 Clean strainers.
.2 Replace shaft seals if pump has been used to degrease system.

3.8 FLUID HANDLING EQUIPMENT - HEAT EXCHANGERS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Vessel is level on housekeeping base.

.2 PRVs are properly installed and operational.

.3 Clearances have been provided and piping is flanged for easy removal and servicing.

.4 Primary and Secondary circuit pipes have been connected to correct ports.

.5 Nameplate and labels are clearly visible.

.6 Unit is clean of foreign matter. Remove heads to inspect for cleanliness as required.

.7 Control valve piping is connected for correct flow through valve body and for required fail safe action of valve.

.8 Insulation is complete.

.3 Ensure Primary and Secondary side pumps are complete and operational.

.2 Starting: not applicable.

.3 Starting: Refer to Section 23 08 83 - Balancing and Adjusting of Mechanical Equipment and Systems.

.4 Pre-Interim Acceptance: not applicable.

3.9 FLUID HANDLING EQUIPMENT - COILS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Pipe connections have been correctly made for counter current heat exchange between air and fluid.

.2 Clearances have been provided and piping is flanged for easy removal and servicing.

.3 Coil air vent and drain valve and deadleg drain valves have been provided.

.4 Coil is sloped to ensure complete drain down.

.5 Pressure and temperature tappings, Pete's plugs, have been provided.

.6 Fins inspected and combed straight as required.

.7 Cooling coil drain pan and trapped drain line installed correctly.

.8 Labels are clearly visible

.9 Control valve piping is connected for correct flow through valve body and for required fail safe action of valve.

.2 Starting:

.1 Check operation of cooling coil condensate drain with supply fan at maximum air flow. Ensure that condensate will drain away against maximum suction pressure of supply fan. Check for and eliminate condensate carry over at maximum air velocity.

.3 Post-Starting: refer to Section 23 08 83 - Balancing and Adjusting of Mechanical Equipment and Systems.

.4 Pre-Interim Acceptance: not applicable.

3.10 FLUID HANDLING EQUIPMENT - ELECTRIC STEAM GRID HUMIDIFIERS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Manifold slopes back to unit to drain condensate away from duct.
.2 Clearances allowed for servicing.
.3 Interlocks and safeties operational.
.4 Make-up water and drain connections complete.

.2 Starting:

.1 Start as recommended by manufacturer.
.2 Fill out manufacturer's check sheets.

.3 Post-Starting:

.1 Check humidistat control of unit.
.2 Check automatic blowdown cycle.
.3 Measure humidifier steaming rate.

.4 Pre-Interim Acceptance: not applicable

3.11 FLUID HANDLING EQUIPMENT - WETTED MEDIA HUMIDIFIERS

.1 Pre-Starting:

.1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations. Check following:

.1 Header troff is level and evenly distributes water across the media.

.2 Clearance allowed for servicing and media replacement.

.3 Basin blowdown and chemical dosing complete.

.4 Make-up water and drain connections complete.

.2 Starting:

.1 Check operation of fully wetted media with supply fan at maximum air volume.

.2 Check for and eliminate water carry over at maximum air velocity.

.3 Ensure that any water in supply fan plenum will drain away against maximum suction pressure of supply fan.

.3 Post-Starting:

.1 Check uniform wetting of media.

.2 Check automatic blowdown cycle.

.3 Check automatic algicide and fungicide dosing of humidifier basin.

.4 Measure humidifier performance.

.4 Pre-Interim Acceptance: not applicable.

3.12 FLUID HANDLING EQUIPMENT - COOLING TOWERS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 Clean entire unit and wash down basins.

.2 Ensure all accessories are properly installed.

.3 Check water make-up float.

.4 Check clearances for air flow and for tower servicing.

.5 Check for vibration isolation and structural support.

.3 Obtain wet bulb, tower size and packing selection tables from manufacturer.

.4 Lubricate bearings on fans and shaft as recommended by manufacturer.

.5 Ensure fan wheels rotate in correct direction without vibration or binding.

.6 Adjust belts to proper alignment and tension.

.2 Starting:

.1 Start as recommended by manufacturer.
.2 Fill out manufacturer's check sheets.

.3 Post-Starting:

.1 Check water level in tower basin.

.2 Check operation of tower basin automatic blowdown, and controlling device.

.3 Check operation of tower basin, make-up line and condenser pipe automatic freeze protect dump, and controlling device.

.4 Check operation of basin immersion heater and control thermostat.

.5 Ensure system chemical treatment is properly working, and measure chemical treatment levels.

.6 Check that tower discharge plume is not recirculating into air intakes.

.4 Pre-Interim Acceptance:

.1 Check tower for proper sump level.
.2 Check and document chemical treatment level.
.3 Lubricate bearings.
.4 Check belts for tension and wear.

3.13 FLUID HANDLING EQUIPMENT - CHILLERS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:

.1 No physical damage to unit has occurred during construction.

.2 Unit is level on housekeeping base.

.3 Check that chiller base vibration isolation and flexible connections on water pipes are properly installed.

.4 Clearances have been provided and piping is flanged for easy removal, servicing and tube cleaning.

.5 Chilled and condenser water circuit pipes have been connected to correct ports.

.6 Labels are clearly visible.

.7 Oil levels are as recommended by manufacturer.

.8 Refrigerant charge is sufficient and leak tested.

.9 Shipping skids/blocks/straps are removed.

.10 Unit has adequate ventilation, as specified in CSA B52.

.11 Unit condenser refrigerant pressure relief is vented to ambient.

.12 Thermometers, pressure gauges installed.

.13 Control systems and safety interlocks are complete.

.14 Pumps completed and started.

.15 Crankcase heater is on a minimum of 24 hours prior to chiller start-up.

.3 Obtain following from manufacturer and submit as specified in section 20 00 13:

.1 All equipment performance selection tables.
.2 Manufacturer's equipment start-up sheets.

.2 Starting:

.1 Start chillers using manufacturer’s factory trained personnel.

.2 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.3 Check and record performance of all factory provided chiller protection devices.

.4 Check and record performance of all chiller flow, pump and low temperature interlocks installed or provided by other trades.

.3 Post-Starting:

.1 Run in chiller as recommended by manufacturer.

.2 Check for correct static deflection of the unit vibration isolators, and that start-up and shut down deflection is within resilience limits.

.4 Pre-Interim Acceptance:

.1 Check refrigerant level and charge as necessary.
.2 Check oil level and fill as necessary.
.3 Check refrigerant dryer and change as necessary.

3.14 FLUID HANDLING EQUIPMENT - MISCELLANEOUS

.1 Gauges and Thermometers:

.1 Confirm all gauges and thermometers can be read from the floor level and are installed as recommended by manufacturer.

.2 Calibrate.

.2 Verify following equipment is installed as recommended by manufacturer. Fill out manufacturer's start-up sheets:

.1 PRVs.
.2 Air eliminators.
.3 Strainers.
.4 Check valves.
.5 Balancing valves.
.6 Plumbing fixtures.
.7 Backflow preventers.
.8 Vacuum breakers.

3.15 AIR HANDLING EQUIPMENT - AIR HANDLING UNITS

.1 Pre-Starting:

.1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets including following:

.1 Air blender, mixing baffles.

.2 Fresh, Exhaust and Recirculation air motorized dampers, operation and size.

.3 Filters.

.4 Check that fan base vibration isolation and flexible connections to ductwork are properly installed.

.5 Special features, access doors, liners, inlet vanes, labels.

.6 For variable volume systems, ensure variable volume/speed controller is operational.

.7 Ensure silencers are installed.

.2 Lubricate bearings on fans as recommended by manufacturer. Ensure fan wheels rotate in correct direction without binding. Adjust belts to proper alignment and tension.

.3 Vacuum clean air systems.

.4 Ensure temporary filters are installed. **Never** operate system without filters installed.

.5 Ensure all balancing and fire dampers are open and ductwork is complete. For VAV systems ensure at least 60% of boxes are open.

.6 Ensure all coils are in operation. If outside air temperature is less than 2°C ensure coils are dry or filled with glycol.

.7 On parallel fan systems ensure backdraft dampers are installed.

.8 Ensure electrical connections are complete and system disconnects are within sight of unit.

.9 Ensure controls are operational.

.10 Ensure inlet and discharge duct geometry is correct.

.2 Starting:

.1 Follow manufacturer's recommendations.

.3 Post-Starting:

.1 Start fan, for variable speed fans run up to maximum speed, and check for vibration free operation.

.2 Check for correct static deflection of unit vibration isolators, and that start-up and shut down deflection is within resilience limits.

.3 Run for one day and check filters, coils, and humidifier for bypass. Seal as required.

.4 Check that bearings are not overheating.

.4 Pre-Interim Acceptance:

.1 Replace temporary filters with permanent filters.
.2 Vacuum clean heating and cooling coils.
.3 Lubricate bearings.
.4 Check belts for tension and wear.

3.16 AIR HANDLING EQUIPMENT - FANS

.1 Pre-Starting:

.1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets including following:

.1 Backdraft dampers.
.2 Accessories.
.3 Special features.
.4 Check that fan base vibration isolation and flexible connections to ductwork are properly installed.

.3 Lubricate bearings on fans as recommended by manufacturer.

.4 Ensure fan wheels rotate in correct direction without binding.

.5 Adjust belts to proper alignment and tension.

.6 Ensure ductwork and fan casing is free of dirt or foreign material.

.7 Ensure electrical connections are complete and disconnect is within sight of fan.

.8 Ensure inlet and discharge duct geometry is correct.

.2 Starting:

.1 Follow manufacturer's recommendations.

.3 Post-Starting:

.1 Start fan, for variable speed fans run up to maximum speed, and check for vibration free operation.

.2 Check for correct static deflection of unit vibration isolators, and that start-up and shut down deflection is within resilience limits.

.3 Check that bearings are not over heating.

.4 Pre-Interim Acceptance:

.1 Lubricate bearings.
.2 Check belts for tension and wear.

3.17 AIR HANDLING EQUIPMENT - AIR FLOW MEASURING STATIONS

.1 Pre-Starting:

.1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations. Check following:

.1 Manufacturer's recommended length of duct ahead and behind flow station.

.2 Straightening vane installed before flow station.

.3 Flow station located away from fan discharges, silencer outlets, duct branches, etc.

.4 No take off branches have been placed ahead of measuring station location.

.5 Straight section of duct adjacent to flow station to take air flow measurement duct traverses.

.6 Air flow measuring station sized for adequate velocity pressure range, and transducer range is compatible with design velocity range of flow station.

.2 Starting: not applicable.

.3 Post-Starting: refer to Section 23 08 83.

.4 Pre-Interim Acceptance: not applicable.

3.18 AIR HANDLING EQUIPMENT - VAV BOXES

.1 Pre-Starting:

.1 Check that each installation is as drawn and specified and in accordance with manufacturer's recommendations. Check following:

.1 Inlet duct connection:

.1 shall have four duct diameters to box inlet.

.2 shall not have more than 150 mm flexible connection between duct and box.

.3 shall not have flow straightening vanes.

.2 Access to controls.

.3 Completeness of control connections.

.4 Silencer/acoustic duct.

.5 No damage to exterior casing or controls.

.6 Box support adequate.

.7 Nameplate and identification tag is visible.

.2 Starting: not applicable.

.3 Post-Starting: refer to Section 23 08 83.

.4 Pre-Interim Acceptance: not applicable.

3.19 AIR HANDLING EQUIPMENT - UNIT AND CABINET HEATERS

.1 Pre-Starting:

.1 Check each installation is as drawn and specified and in accordance with manufacturer's recommendations. Check following:

.1 Piping connections.
.2 Unit vibration isolation.
.3 Ducting connections.
.4 Controls.
.5 Disconnect switches.
.6 Unit clean.

.2 Starting: as recommended by manufacturer.

.3 Post-Starting: refer to Section 23 08 83.

.4 Pre-Interim Acceptance: not applicable.

3.20 AIR HANDLING EQUIPMENT - MISCELLANEOUS

.1 Refer to Section 23 08 83.

3.21 MISCELLANEOUS EQUIPMENT - VARIABLE SPEED DRIVE UNITS

.1 Pre-Starting:

.1 Obtain following from manufacturer and submit as specified in Section 20 00 13.

.1 All equipment performance selection tables.
.2 Manufacturer's equipment start-up sheets.

.2 Verify that installation is as specified and in accordance with manufacturer's recommendations.

.2 Starting:

.1 Start variable speed controllers and motor powered from each drive using manufacturer’s factory trained personnel.

.2 Fill out start-up sheets and attach copy with Contractor Start-Up Report.

.3 Check and record operation of all factory provided protection devices.

.4 Run-in as required and recommended by manufacturer.

.3 Post Starting:

.1 Run motor up to maximum speed, check ampere draw. Check and set overloads.

.2 Check manual override control and manual speed control of motor

.3 Put speed controller in automatic, command motor to full speed and check that motor speed ramp operates correctly accelerating motor to maximum speed without tripping. Command motor to minimum speed and observe controlled deceleration of motor.

.4 Pre-Interim Acceptance: not applicable.

3.22 MISCELLANEOUS EQUIPMENT - TANKS

.1 Pre-Starting:

.1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations. Check following:

.1 Tank is level on housekeeping base.

.2 No visible damage to vessel.

.3 Check PRVs for correct operation and specified relief pressure. Adjust as required.

.4 Clearances have been provided and piping is flanged for easy removal and servicing.

.5 Labels are clearly visible.

.6 Controls, gauges, alarm devices, etc. are operational.

.7 Access ports/manholes provided.

.8 Piping sizes - inlet/outlet are correct.

.9 Lining is intact and not damaged.

.10 Tank has dielectric unions on piping connections.

.2 Starting: not applicable.

.3 Post-Starting:

.1 Verify operation of:

.1 Drain line.
.2 Make-up line if applicable.
.3 Gauge glass.
.4 Diaphragm if applicable.

.4 Pre-Interim Acceptable: not applicable.

3.23 MISCELLANEOUS EQUIPMENT - AIR COOLED CONDENSERS

.1 Pre-Starting:

.1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations.

.2 Complete manufacturer's installation and start-up check sheets including following:

.1 No physical damage to unit has occurred.

.2 All access doors move freely and are weathertight.

.3 Unit is free of foreign debris.

.4 All bolts, screws are tight.

.5 Condenser base vibration isolation and flexible connections on refrigerant pipes are properly installed.

.6 Controls complete.

.7 Check acoustic insulation.

.8 Fan guards are installed.

.3 Lubricate bearings on fans as recommended by manufacturer.

.4 Ensure fan wheels rotate in correct direction without binding.

.5 Adjust belt to proper alignment and tension.

.2 Starting:

.1 Start in accordance with manufacturer's instructions.
.2 Complete manufacturers starting check sheet.

.3 Post-Starting:

.1 Ensure all fan guards are tight.
.2 Check air flows over coils.
.3 Check operation of condenser capacity control device.
.4 Ensure vibration isolation and flexible connections to unit properly damp vibration transmission to structure.

.4 Pre-Interim Acceptance:

.1 Lubricate bearings.
.2 Adjust belt tension.

3.24 MISCELLANEOUS EQUIPMENT - COMPRESSORS AND VACUUM PUMPS

.1 Pre-Starting:

.1 Check following after installation:

.1 No physical damage occurred during construction.
.2 Unit base vibration isolation and flexible connections on service pipes are properly installed.
.3 Adjust belts to proper alignment and tension.
.4 Belt guards are in place.
.5 Unit is level.
.6 Fused disconnect located at unit.
.7 Air dryer properly installed.
.8 Automatic condensate drain installed.
.9 Lubricate bearings.

.2 Starting:

.1 Start unit in accordance with manufacturer's instructions.
.2 Fill out manufacturer's start-up sheets.

.3 Post-Starting:

.1 Check for correct static deflection of unit vibration isolators, and that start-up and shut down deflection is within resilience limits.

.2 Ensure sufficient outdoor air is available to unit.

.3 Check to ensure no oil carryover in air stream.

.4 Air dryer is operating and chilling air to correct temperature. Condensate is being removed from air line.

.5 Pressure regulators and PRV are correctly set.

.6 Automatic condensate drain valve is operating correctly.

.4 Pre-Interim Acceptance:

.1 Change air filter in unit.
.2 Check for oil carryover into air supply.
.3 Check oil levels, and refill as necessary.
.4 Change air line filter cartridges.
.5 Adjust belt tension.

3.25 MISCELLANEOUS EQUIPMENT - PACKAGED AIR CONDITIONING UNITS

.1 Pre-Starting:

.1 After installation check following:

.1 No damage to unit.
.2 Unit is level.
.3 Drain pan and drain line installed correctly.
.4 Compressor base vibration isolation and flexible connections on refrigerant pipes are properly installed.
.5 Make-up water complete.
.6 Humidifier flush water piping complete.
.7 Ductwork complete.
.8 Bearings lubricated.
.9 Filters installed and clean.

.2 Starting:

.1 Start unit in accordance with manufacturer’s instructions.
.2 Fill out manufacturer's check sheets.

.3 Post-Starting: refer to Section 23 08 83 - Balancing and Adjusting of Mechanical Equipment and Systems.

.4 Pre-Interim Acceptance:

.1 Change filters.
.2 Flush humidifier.

3.26 MISCELLANEOUS EQUIPMENT - FIRE EXTINGUISHERS

.1 Check the number, make, model and capacity of each portable fire extinguisher.

.2 Check the pressure drop on each extinguisher over 20 day period. Replace units loosing charge.

.3 Check that all cabinets are clean and door latch functions correctly.

3.27 MISCELLANEOUS EQUIPMENT - FIRE HOSE CABINETS

.1 Check the number, make and model of each cabinet.

.2 Ensure doors open fully and do not block exit or exit corridors.

.3 Check that all cabinets are clean and door latch functions correctly.

.4 Adjust PRV's and record pressures.

.5 Check 32 mm hose connection, 65 mm fire department connection, fire hose and nozzle and fire extinguisher as applicable.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Industrial Ventilation: A Manual of Recommended Practice for Design, 30th Ed.

1.2 INTENT

.1 Test, adjust and balance mechanical equipment and systems so that entire system produces the results for which it was designed.

.2 Survey and rebalance all dust collector inlets. This is to include all connections to each dust collector as well as the systems as a whole. Refer to Industrial Ventilation Manual in 1.1.1.

1.3 TESTING/ADJUSTING/BALANCING REPORT DATA

.1 Organize balancing data in accordance with AABC - Associated Air Balancing Council, report format. Report data in SI units.

.2 Air Systems: Include both specified and measured data.

.1 Air Outlets:

.1 Outlet location and designation.

.2 Manufacturers catalogue identification and type.

.3 Air outlet flow factors. Use 1.0 when flowhood is used.

.4 Air flow volumes.

.5 Deflector vane or diffuser cone settings.

Part 2 Products

Not Used

Part 3 Execution

3.1 BALANCING AND ADJUSTING PREPARATION

.1 Perform testing, adjusting and balancing work after equipment and systems starting procedures have been properly completed.

.2 Perform balancing during heating and cooling season of first year of operation, and at times when directed by the Departmental Representative, to ensure proper settings of controls under both summer and winter peak load conditions.

.3 Vary load to verify operation of system under partial load conditions. Test start-up, shut-down, emergency conditions, safety controls operation and automatic and manual resets and interlocks.

3.2 GENERAL PROCEDURES

.1 Assess the correct volumes for all dust collector connections based on 1.1.1, and balance system accordingly.

.1 Perform balancing to following accuracy:

.1 Air - terminal outlets ± 10%

.2 Permanently mark settings on splitters, valves, dampers or other adjustment devices.

.3 Subsequent to correcting work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

.4 As a prerequisite to the Departmental Representative's acceptance of balance report demonstrate random points in balance selected by the Departmental Representative. The Departmental Representative will witness these checks.

3.3 MISCELLANEOUS AIR HANDLING DEVICES

.1 Air Outlets:

.1 Review installation to ensure:

.1 Air outlet is clean.
.2 Air outlet is located as shown on drawings.

.3 Balancing Dampers:

.1 Check installation to ensure:

.1 Damper can open and close fully.
.2 Access is clearly marked.
.3 Damper is not located in a turbulent air stream.

3.4 BALANCING REPORT

.1 Submit draft copies of final reports prior to Interim Acceptance of the Work. Provide four copies of final report for inclusion in Operation and Maintenance Manual.

.2 Include types, serial number and dates of calibration of instruments.

.3 Submit with report. Submit grille and diffuser shop drawings and manufacturer's flow factors.

.4 Organize report as follows:

Air Systems

.1 Summary
.2 Procedure
.3 Instrumentation
.4 Terminal Unit Summary
.5 Outlet Data Summary and Schematic

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for piping, valves and fittings for gas fired equipment.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5, Pipe Flanges and Flanged Fittings.

.2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.4 ASME B18.2.1, Square and Hex Bolts and Screws Inch Series.

.2 ASTM International (ASTM)

.1 ASTM A47/A47M , Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 ASTM B75M, Standard Specification for Seamless Copper Tube.

.4 ASTM B837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

.3 CSA Group (CSA)

.1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)

.1 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.

.2 CAN/CSA B149.2, Propane Storage and Handling Code.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00- Closeout Submittals.

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.

.2 NPS2 1/2 and over, plain end.

.2 Copper tube: to ASTM B837.

2.2 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Brazing: to ASTM B837.

2.3 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ASME B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ASME B16.18.

.2 Wrought copper fittings: to ASME B16.22.

2.4 VALVES

.1 Provincial Code approved, lubricated ball type.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PIPING

.1 Install in accordance with CAN/CSA B149.1, supplemented as specified.

.2 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

.2 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products , and submit written reports, in acceptable format, to verify compliance of work with Contract.

.2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 Obtain reports within 3 days of review and submit immediately to Departmental Representative.

3.5 ADJUSTING

.1 Purging: purge after pressure test in accordance with CAN/CSA B149.1.

.2 Pre-Start-Up Inspections:

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.6 CLEANING

.1 Cleaning: in accordance with CAN/CSA B149.1, supplemented as specified.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association – CSA Group

.1 CSA Z320-11 Building Commissioning Standard.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Cx Plan:

.1 Submit contractor commissioning plan and other related submittals in accordance with Section 01 91 13.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

Not Used

Part 3 Execution

3.1 General Building Information

Project Name	
Project Address	
Building Type	
Square Footage	
Building Description	
Departmental Representative Agency	
Scheduled Completion Date	

3.2 Overview

.1 Abbreviations and Definitions

The following are common abbreviations used in this document.

A/E	Architect and design engineers	**FPT**	Functional performance test
CP	Commissioning provider	**GC**	General contractor
CC	Controls contractor	**MC**	Mechanical contractor
CX	Commissioning	**PF**	Pre-functional checklist
EM	Energy Manager	**PM**	Project Manager
CX Plan	Commissioning Plan document	**Subs**	Subcontractors to General
EC	Electrical contractor	**TAB**	Test and balance contractor
MM	Maintenance Manager	**Staff**	Maintenance Staff

.2 Purpose of the Commissioning Plan

The purpose of the commissioning plan is to provide direction for the commissioning process during construction, providing resolution for issues such as scheduling, roles and responsibilities, lines of communication and reporting, approvals, and coordination.

.3 Commissioning Goals and Objectives

Commissioning is a systematic process of ensuring that the building systems perform according to the design intent and the Departmental Representative's operational requirements. All equipment and systems should be installed according to manufacturer's recommendations and the best practices and standards of the industry.

Commissioning will include documenting the design intent, followed by activities in the construction, acceptance, and warranty phases of the project. The participation of the contractors in commissioning activities will follow the requirements defined in the specifications. The three main goals of the commissioning process are:

1. Facilitate the final acceptance of the project at the earliest possible date.
2. Facilitate the transfer of the project to the Departmental Representative's maintenance staff.
3. Ensure that the comfort systems meet the requirements of the occupants.

Commissioning is also intended to achieve the following specific objectives:

- Document that equipment is installed and started per manufacturer's recommendations.
- Document that equipment and systems receive complete operational checkout by installing contractors.

• Document system performance with thorough functional performance testing and monitoring.

• Verify the completeness of operations and maintenance materials.

• Ensure that the Departmental Representative's operating personnel are adequately trained on the operation and maintenance of building equipment.

.4 Commissioning Scope

The following marked systems will be commissioned in this project. All general references to equipment in this document refer only to equipment that is to be commissioned.

System	Equipment	Check
Architectural Systems	Continuity of Fire-Rated Separations	
	Door/Window Hardware	
HVAC System	Fire Protection System	
	Loading Chutes	
	Makeup Air Unit	
	Exhaust Systems	
	Balancing of New Air Systems	
	Boiler Combustion and Relief Air Requirements	
	Interlock of Makeup System with Existing Dust Collection Systems	
Electrical System	Fire Exit Emergency Signage	
	Fire and smoke alarm systems	
	Horn/Strobe Devices	
	Emergency Lighting	

3.3 Commissioning Team Information

Function	Name/Address	Contact Info
Departmental Representative		
Project Manager		
Commissioning Provider		

Architect		
Mechanical Engineer		
Electrical Engineer		
General Contractor		
Mechanical Contractor		
Electrical Contractor		
Controls Contractor		
Maintenance Manager		

3.4 Roles and Responsibilities

General Management Plan

In general, the CP coordinates the commissioning activities and reports to the Departmental Representative. The CP's responsibilities, along with all other contractors' commissioning responsibilities are detailed in the specifications. The Specifications will take precedence over this Commissioning Plan. All members work together to fulfill contracted responsibilities and meet the objectives of the Contract Documents.

.1 General Description of Roles

General description of roles is as follows:

CP: Coordinates the CX process, writes and/or reviews testing plans, directs and documents performance testing.

PM: Facilitates and supports the CX process and gives final approval of the CX work.

MM: Coordinates maintenance staff participation in commissioning activities.

GC: Facilitates the CX process, ensures that Subs perform their responsibilities and integrates CX into the construction process and schedule.

Subs: Demonstrate correct system performance.

Staff: Participate in commissioning tasks and performance testing, review O&M documentation, attend training.

A/E: Perform construction observation, approve O&M manuals and assist in resolving problems.

Mfr.: Equipment manufacturers and vendors provide documentation to facilitate the commissioning work and perform contracted startup.

.2 Specifications and Commissioning

Commissioning language in the specifications details the scope of commissioning for this project. The following table lists the sections of the specifications that include commissioning related language with a brief description.

Section	Description
23 08 23	Procedures for Equipment and Systems Startup and Testing
23 08 83	Procedures for Balancing and Testing of Mechanical Equipment and Systems
26 08 10	General Information for Starting and Testing of Electrical Systems
26 08 20	Information for Starting and Testing of Electrical Systems by the Contractor

.3 General Management Plan and Protocols

The following protocols will be used on this project.

Issue	Protocol
For requests for information (RFI) or formal documentation requests:	The CP goes first through the PM.
For minor or verbal information and clarifications:	The CP goes direct to the informed party.
For notifying contractors of deficiencies:	The CP documents deficiencies through the PM, but may discuss deficiency issues with contractors prior to notifying the PM.
For scheduling functional tests or training:	The CP provides input and coordination of testing and training. Scheduling is done through the PM.
For scheduling commissioning meetings:	The CP selects the date and schedules through the PM.
For making a request for significant changes:	The CP has no authority to issue change orders.
For making minor changes in specified sequences of operations:	Any required changes in sequences of operations required to correct operational deficiencies must be approved and documented by the PM and A/E team. The CP may recommend to the PM changes in sequences of operation to improve efficiency or control.

Subcontractors disagreeing with requests or interpretations by the CP shall:	Resolve issues at the lowest level possible. First with the CP, then with the GC and PM. Some issues may require input from the A/E team.

3.5 Commissioning Process

This section sequentially details the commissioning process by commissioning task or activity.

.1 Commissioning Scoping Meeting

The scoping meeting brings together all members of the design, construction, and operations team that will be involved in the commissioning process. Each building system to be commissioned is addressed, including commissioning requirements, and completion and start-up schedules. During the scoping meeting, all parties agree on the scope of work, tasks, schedules, deliverables, and responsibilities for implementation of the Commissioning Plan.

.2 Final Commissioning Plan

The commissioning agent finalizes the draft Commissioning Plan using the information gathered from the scoping meeting. The initial commissioning schedule is also developed along with a detailed timeline. The timeline is fine-tuned as construction progresses.

.3 Design Intent Documentation

The design requirements, relative to the building systems selected for commissioning, must be explicitly documented in order to establish a baseline of performance expectations to which the actual installed performance is compared. The commissioning provider, with the assistance of the building Departmental Representative and design team, prepares a Design Intent Summary that documents the design intent for those building systems selected for commissioning. The Design Intent Summary reflects the underlying assumptions and requirements that become represented in the construction documents.

.4 Submittals

The general contractor will provide the commissioning agent with a set of equipment and system submittals. This equipment data includes installation and start-up procedures, O&M data, performance data and temperature control drawings. The subcontractors, general contractor or A/E notify the commissioning agent of any new design intent or operating parameter changes, added control strategies and sequences of operation, or other change orders that may affect commissioned systems.

.5 Site Observation

The commissioning agent makes periodic site visits to witness equipment and system installations. Each site visit will have a specific agenda and will be coordinated with the general contractor site supervisor. The commissioning agent attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in commissioning. The general contractor provides the commissioning agent with information regarding substitutions or change orders that may affect commissioned equipment or the commissioning schedule.

.6 Pre-functional Checklists and Startup Procedures

A Pre-Functional Inspection Checklist are developed and completed for all mechanical equipment being commissioned. The checklist captures equipment nameplate and characteristics data, and confirms the as-built status of the equipment or system. The checklists ensure that the systems are complete and operational and document the installation of components and completion of systems.

The checklists are prepared by the commissioning agent from manufacturer's data, drawings and specifications to include the required installation, checkout, and start up procedures. The installing subcontractors date and initial the checklists as the construction and start-up is completed. The commissioning agent reviews and verifies the completed checklists before scheduling the functional performance testing.

.7 Development of Functional Test and Verification Procedures

Functional performance testing verifies the intended operation of individual components and system interactions under various conditions and modes of operation. The systems are run through all of the sequences of operation and the response of components is verified. Testing proceeds from components to subsystems to systems, and finally to interlocks and connections between systems.

The commissioning agent prepares functional performance test plans so that the complete sequence of operations is included. The commissioning agent obtains all documentation, including an updated points list, control sequences, and setpoints. If necessary, the commissioning agent may request clarifications from contractors and the design team regarding sequences and operation. Prior to execution, the commissioning agent provides a copy of the primary equipment tests to the installing subcontractor and general contractor who can review the tests for feasibility, safety, warranty and equipment protection.

.8 Execution of Functional Testing Procedures

The commissioning agent schedules functional tests through the general contractor and subcontractors. Under the supervision of the commissioning agent, the installing subcontractor performs the hardware and/or software manipulations required for the testing. Departmental Representative maintenance staff may also be present in order to assist in system observations. The commissioning agent witnesses and records the results of functional performance testing.

Any deficiencies found from functional performance testing will be documented in a Deficiency Report. The report will include all details of the components or systems found to be non-compliant with the parameters of the functional performance test plans and design documents. The deficiency report will become part of the punch list. The report will detail the adjustments or alterations required to correct the system operation, and identify the responsible party. The deficiency report will be continuously updated. The commissioning agent schedules any required retesting through the general contractor. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between commissioning agent, sub-contractor and general contractor.

.9 Short-Term Diagnostic Monitoring

Short-term diagnostic testing, using data acquisition equipment or building automation system trends to record system operation over a two to three week period, may be used to investigate the dynamic interactions between components in the building system.

The monitoring occurs after occupancy to evaluate the building systems' performance under natural occupancy and ambient load conditions. The objectives of the monitoring are to evaluate scheduling, the interaction between heating and cooling, and the effectiveness of the system in meeting the comfort requirements of the occupants.

.10 Operations and Maintenance Manuals

The operation and maintenance manuals prepared by the contractors for the Departmental Representative's maintenance personnel are reviewed for completeness. The contractors are encouraged to submit O&M manuals at the earliest possible date. Materials may be added, or requested from the contractors, to stress and enhance the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. A database of preventative maintenance information may also be created from the materials in the O&M manuals.

.11 Training and Orientation of Departmental Representative Personnel and Occupants

Effective maintenance personnel training is critical to the long term performance of the new building. The commissioning agent will assist the Departmental Representative and general contractor in organizing the training sessions by identifying the appropriate staff for each session and creating an overall training plan.

For each training session, the contractors provide a detailed agenda for each piece of equipment or system for which training is required. The agenda describes the training scope, duration, and methods, along with the name and qualifications of the trainers. The commissioning agent develops a plan for including in the training session contractors / trainers from different disciplines, when appropriate. The trainer documents each training session (duration, general subjects covered, and attendees). The commissioning agent may witness any of the training sessions.

.12 Warranty Period

Seasonal variation in operations or control strategies may require additional testing during peak cooling and heating seasons to verify system performance. During the warranty period, seasonal testing and other deferred testing is completed as required to fully test all sequences of operation. The commissioning agent coordinates this activity. Tests are executed and deficiencies corrected by the appropriate subcontractors, witnessed by facilities staff and the commissioning agent. Any final adjustments to the O&M manuals and as-builts due to the testing are made.

The commissioning agent will request input from the Departmental Representative's operations staff and occupants about the performance of the building systems. The commissioning agent also supports the general contractor's troubleshooting process during the warranty period. The general contractor's warranty team will first try and resolve the issues before requesting assistance from the commissioning agent.

.13 Commissioning Report

A final Commissioning Report will be compiled which summarizes all of the tasks, findings, and documentation of the commissioning process. The report will address the actual performance of the building systems in reference to the design documents. All test reports by various sub-contractors, manufacturers and controlling authorities will be incorporated into the final report.

The commissioning report includes:

• An evaluation of the operating condition of the systems at the time of functional test completion,

• Deficiencies that were discovered and the measures taken to correct them,

• Functional test procedures and results,

• Reports that document all commissioning field activities as they progressed, and

• A description and estimated schedule of required deferred testing.

3.6 Schedule

.1 General Issues

The following sequential priorities are followed:

1. Equipment is not "temporarily" started (for heating or cooling), until pre-start checklist items and all manufacturer's pre-start procedures are completed and moisture, dust and other environmental and building integrity issues have been addressed.
2. Functional performance testing does not begin until pre-functional, start-up and TAB is completed for a given system.
3. The controls system and equipment it controls are not functionally tested until all points have been calibrated and pre-functional checklists are completed.

.2 Project Schedule

Preliminary Commissioning Schedule

Commissioning Activity	**Duration**	**Estimated Start Date**	**Estimated Completion Date**
Document design intent and basis of design			
Commissioning Plan			
Preliminary Commissioning Plan			
Scoping Meeting			
Final Commissioning Plan			
Submittals and test writing			
Review Mechanical submittals			
Write Startup and PF checklists			
DDC program review meeting			
Write FPT Tests			
Construction Observation			
Site observations			
HVAC PF checklist completion			
Equipment startup			
Startup documentation			
Controls system checkout			
Test and Balance			
TAB air side			
TAB water side			
HVAC Functional performance testing			
Substantial Completion			
Post Acceptance Phase			
Owner move-in			
Short-term diagnostic monitoring			
O&M, training, reporting, warranty			
O&M Manuals submitted			
Review O&M manuals			
Review as-built documentation			
Seasonal testing			
Final commissioning report			

Part 4

4.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

4.2 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

4.3 INSTALLATION

.1 Install equipment in accordance with relevant codes and standards of practice, contract specifications, and manufacturer’s recommendations.

4.4 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements; supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

.2 Procedures:

.1 Before starting equipment, check that other protective devices are installed and operative.

.2 Adjust equipment to suit specified operational times and quantities.

4.5 PERFORMANCE VERIFICATION (PV)

.1 General:

.1 Verify performance in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified herein.

.2 Verify that manufacturer's performance specifications are accurate.

.3 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.4 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements reports supplemented as specified herein. Reports to include:

.1 Record of points of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning.

.2 Use Report Forms specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.

.3 Equipment performance curves (family of curves).

4.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

END OF SECTION

1. General

1.1 REFERENCE DOCUMENTS

.1 American Society for Testing and Materials (ASTM):

.1	ASTM A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process

.2 National Fire Protection Association (NFPA):

.1	NFPA 90A	Standard for the Installation of Air Conditioning and Ventilation Systems
.2	NFPA 90B	Standard for the Installation of Warm Air Heating and Air Conditioning Systems

1.2 ALTERNATIVES

.1 Size round ducts installed in place of rectangular ducts indicated from ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration of sizes permitted except by written permission.

1.3 DEFINITIONS

.1 Low Pressure: Static pressure in duct less than 0.5 kPa and velocities less than 10 m/s.

.2 Medium Pressure: Static pressure in duct less than 1.5 kPa and velocities greater than 10 m/s.

.3 High Pressure: Static pressure over 1.5 kPa and less than 2.5 kPa and velocities greater than 10 m/s.

.4 Duct Sizes: Inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings in accordance with Section 20 00 13 – Mechanical General Requirements.

.1 Submit shop drawings and samples of duct fittings for approval, including particulars such as thicknesses, welds and configurations prior to start of work.

.2 Submit shop drawings for fibrous glass ducts including manufacturers fabrication and installation manual.

.2 Submit written inspection report of manufacturers acceptance of fabrication and installation of fibrous glass ductwork. Confirm ductwork has been fabricated and installed in accordance with recommendations and SMACNA standards. Inspection shall occur at beginning of installation.

1.5 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

2. Products

2.1 MATERIALS

.1 Ducts: Galvanized steel lock forming quality, having galvanized coating to ASTM A653M, G90 designation for both sides.

.2 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

.3 Sealant: Water resistant, fire resistive, compatible with mating materials.

.4 Flexible Ducts: Corrugated aluminum or fabric supported by helically wound steel wire or flat steel strips.

.5 Flexible Fibrous Glass Ducts: Flexible duct wrapped with flexible fibrous glass insulation, enclosed by seamless aluminum pigmented plastic vapour barrier jacket, "K" value at 24°C maximum 0.033 W/m.°C

.6 Fibrous Glass Duct: 25 mm thick rigid fibrous glass with aluminum foil, glass scrim and kraft or plastic jacket vapour barrier, "K" value at 24°C maximum 0.033 W/m.°C

.7 Kitchen Exhaust Ducts: Minimum 1.6 mm galvanized steel or 1.2 mm stainless steel with welded joints.

2.2 FABRICATION

.1 Complete metal ducts with themselves with no single partition between ducts. Where width of duct exceeds 450 mm cross break for rigidity. Open corners are not acceptable.

.2 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.3 Construct tees, bends, and elbows with radius of not less than 1 1/2 times width of duct on centre line. Where not possible and where rectangular elbows used, provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibreglass inside.

.4 Increase duct sizes gradually, not exceeding 15 degree divergence wherever possible. Maximum divergence upstream of equipment to be 30 degree and 45 degree convergence downstream.

.5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

.6 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.

.7 Provide necessary baffling in mixed air plenums to ensure good mixed air temperature with variations of not more than ± 15°C under all operating conditions.

.8 Fabricate continuously welded medium and high pressure round and oval duct fittings of one gauge heavier than gauges indicated for duct size. Joints shall be 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints. Fabricate elbows of five piece construction. Provide standard 45° take-offs unless otherwise indicated where conical 90° tee take-off connections may be used. Adequately brace with truss couplings or comparison angle flanges with asbestos gaskets bolted at 150 mm centers.

.9 Fabricate plenums and casings to configurations shown on drawings. Construct plenums of galvanized panels joined standing seams on outside of casing riveted or bolted on approximately 300 mm centers. Reinforce with suitable angles and provide diagonal bracing as required. Tightly fit at apparatus and caulk with sealant.

.10 Provide 75 mm reinforced concrete curb for plenum walls and floor mounted casings. At floor, rivet panels on 200 mm centers to angles. Where floors are acoustically insulated, provide liner at 1.2 mm galvanized expanded metal mesh, turned up 300 mm at sides with sheet metal shields.

.11 Reinforce door frames with angle iron tied to horizontal and vertical plenum supporting angles. Install hinged access doors where shown, specified or where required for access to equipment for cleaning and inspection.

.12 Fabricate acoustic plenums of galvanized steel. Provide 1.6 mm back facing and 0.8 mm perforated front facing with 3 mm diameter holes on 4 mm centers. Construct panels 75 mm thick packed with 72 kg/m^3 minimum fibrous glass media, on inverted channels of 1.6 mm.

3. Execution

3.1 INSTALLATION

.1 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pivot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.2 Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

.3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.4 Slope underground ducts to plenums or low pumpout points at 2 mm per metre. Provide access doors for inspection. Encase ducts in 80 mm minimum of concrete. Provide adequate tie-down points to prevent ducts from floating during concrete pour. Introduce no heat into ducts until 20 days after pouring of concrete.

.5 Coat underground ducts with one coat of asphalt solvent base protective coating.

.6 Provide floor drains in fresh air and humidifier sections with deep seal traps.

.7 Set plenum doors 150 mm to 300 mm above floor. Arrange door swings so that fan static holds door in closed position.

.8 Connect terminal units to medium or high pressure ducts with 300 mm maximum length of flexible duct. Do not use flexible duct to change direction.

.9 Connect diffusers or troffer boots to low pressure ducts with 1.5 m maximum length of flexible duct. Hold in place with caulking compound and strap or clamp.

3.2 LOW PRESSURE DUCT THICKNESSES (MINIMUM)

.1 Rectangular Ducts

Maximum Width	mm
Up to 300 mm	0.6
330 mm to 760 mm	0.8
790 mm to 1370 mm	0.8
1400 mm to 2130 mm	1.0
2160 mm and Over	1.2

.2 Round Ducts

Duct Diameter	mm
Up to 330 mm	0.6
350 mm to 550 mm	0.8
580 mm to 1270 mm	0.8
890 mm to 910 mm	1.0
1300 mm to 1520 mm	1.2
1550 mm to 2130 mm	1.6

.3 Underground Ducts

Duct Diameter	Spiral Lock Seam mm	Longitudinal Seam mm
Up to 380 mm	0.8	0.8
400 to 510 mm	0.8	1.0
530 to 890 mm	1.0	1.2
Over 910 mm	1.2	1.6

3.3 MEDIUM PRESSURE DUCT THICKNESS

.1 Rectangular Ductwork

Maximum	mm
Up to 460 mm	0.8
480 mm to 1220 mm	0.8
1250 mm to 1830 mm	1.0
1850 mm to 2440 mm	1.2
2460 mm and Over	1.6

3.4 HIGH PRESSURE DUCT THICKNESSES

.1 Rectangular Ductwork

Maximum Width	mm
Up to 460 mm	0.8
480 mm to 1220 mm	1.0
1250 mm to 1830 mm	1.2
1850 mm to 2440 mm	1.6
2460 mm to 3660 mm	2.0

3.5 MEDIUM & HIGH PRESSURE DUCT THICKNESSES

.1

Round Ducts	Spiral Lock Seam mm	Longitudinal Seam mm
Up to 200 mm	0.6	0.8
230 to 560 mm	0.8	0.8
580 to 910 mm	0.8	1.0
940 to 1270 mm	1.0	1.0
1300 to 1520 mm	1.2	1.2
1550 mm and Over	1.6	0.6

3.6 OVAL DUCTWORK (FACTORY MADE WITH SPIRAL LOCK SEAMS)

.1

Maximum Width	mm	Centers	Reinforcement
Up to 500 mm	0.8		none
280 to 500 mm	0.8	1220 mm	L50 x 50 x 3 mm
530 to 1020 mm	1.2	760 mm	L50 x 50 x 5 mm
1040 to 1830 mm	1.6	600 mm	L75 x 75 x 5 mm

3.7 PLENUM GAUGES

.1 Fabricate fan plenums and plenums downstream of fan in accordance with duct gauges.

.2 Fabricate plenums upstream of fan between apparatus of 1.6 mm.

.3 Fabricate plenums upstream of filters of 1.2 mm

3.8 FIBROUS GLASS DUCTS

.1 Fibrous glass ductwork may be substituted for internally or externally insulated or uninsulated low pressure sheet metal ductwork.

3.9 KITCHEN EXHAUST DUCTS

.1 Protect galvanized ductwork exposed to outside elements by painting or coating with suitable weather resistant material.

.2 Provide residue traps at base of vertical risers with provisions for cleanout.

END OF SECTION

1. General

1.1 REFERENCE DOCUMENTS

.1 National Fire Protection Association (NFPA):

.1 NFPA 90A-2009 Standard for the Installation of Air Conditioning and Ventilation Systems

.2 Underwriter Laboratories of Canada (ULC):

.1 CAN/ULC-S112-M90 (R2001) Standard Methods of Fire Test of Fire Damper Assemblies

.2 ULC S505-1974 Fusible Links for Fire Protection Service

1.2 SUBMITTALS

.1 Samples:

.1 Submit samples in accordance with Section 20 00 13 – Mechanical General Requirements. Samples to include:

.1 Shop fabricated assemblies as requested.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 20 00 13 – Mechanical General Requirements. Shop drawing to include:

.1 Factory fabricated assemblies.

1.3 QUALITY ASSURANCE

.1 Fire dampers shall be UL listed and constructed in accordance with CAN/ULC-S112, Fire Test of Fire Damper Assemblies.

.2 Fusible links on fire dampers shall be constructed to ULC S505.

.3 Demonstrate resetting of fire dampers to authorities having jurisdiction and Departmental Representative.

.4 Access doors shall be UL labelled.

.5 Accessories shall meet the requirements of NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.6 Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

2. Products

2.1 ACCESS DOORS

.1 Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and suitable quick fastening locking devices. Install minimum 25 mm thick insulation with suitable sheet metal cover frame for insulated ductwork.

.2 Fabricate with two butt hinges and two sash locks for sizes up to 450 mm, two hinges and two compression latches with outside and inside handles for sizes up to 600 x 1200 mm and an additional hinge for larger sizes.

2.2 FIRE DAMPERS

.1 Fabricate of galvanized steel or prime coated black steel weighted to close and lock in closed position when released by fusible link.

.2 Fire dampers in low pressure ductwork may be offset butterfly or curtain type.

.3 Fabricate combination fire and balancing dampers with linkage readily adjustable in open position.

.4 Fire dampers in medium and high pressure ductwork shall be curtain type.

.5 Curtain type fire dampers shall have blades retained in a recess so free area of connecting ductwork is not reduced.

.6 Fusible links shall be set for 72°C.

2.3 DAMPERS

.1 Fabricate of galvanized steel, minimum 1.6 mm, and provide with quadrants or adjustment rod and lock screw.

.2 Fabricate splitter dampers of double thickness sheet metal to streamline shape, properly stiffened to avoid vibration. Size on basis of straight air volume proportioning.

.3 Fabricate single blade dampers for duct sizes to 240 x 760 mm.

.4 Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 300 x 1800 mm. Assemble center and edge crimped blade in prime coated or galvanized channel frame with approved type hardware.

.5 Construct damper blades for medium and high pressure systems to block air passage 70% maximum. Provide complete with locking type handles.

.6 Fabricate multi-blade, parallel action gravity balanced backdraft dampers with blades a maximum of 150 mm width having felt or flexible vinyl sealing edges, linked together in rattle-free manner and with adjustment device to permit setting for varying differential static pressure.

2.4 FLEXIBLE CONNECTIONS

.1 Fabricate of approved neoprene coated flameproof fabric approximately 50 mm wide tightly crimped into metal edging strip and attach to ducting and equipment by screws or bolts at 150 mm intervals.

3. Execution

3.1 INSTALLATION

.1 Provide adequately sized access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Review locations prior to fabrication.

.2 Provide 100 x 100 mm quick opening access doors for inspection at balancing dampers.

.3 Provide fire dampers at locations indicated on drawings. Fire dampers shall be complete with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges.

.4 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

.5 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing.

.6 Provide balancing dampers on high pressure systems where indicated. Splitter dampers shall only be used where indicated on the drawings.

.7 Install ducts associated with fans and equipment subject to forced vibration with flexible connections, immediately adjacent to equipment and where indicated on the drawings.

.8 For connections to medium and high pressure fans, install 12 mm thick neoprene pad over fabric and hold in place with additional metal straps.

END OF SECTION

1. General

1.1 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 01.

.2 Substitute products shall not decrease motor wattage, increase noise level, increase tip speed by more than 10%, or increase inlet air velocity by more than 20%, from that specified.

1.2 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings in accordance with Section 20 00 13 – Mechanical General Requirements.

.2 Submit with shop drawings acoustical data and fan curves showing fan performance with fan and system operating point plotted on curves.

2. Products

2.1 GENERAL

.1 Statically and dynamically balance fans so no objectionable vibration or noise is transmitted to occupied areas of the building.

.2 Provide balanced variable sheaves for motors 10 kW and under and fixed sheave to 15 kW and over.

.3 Fans shall be capable of accommodating static pressure variations of ±10% with no objectionable operating characteristics.

2.2 CENTRIFUGAL FANS

.1 Fabricate with multi-blade wheels in heavy gauge steel housing reinforced for service encountered.

.2 Provide V-belt drives with fan and motor mounted on reinforced, rigid steel base with adjustable motor mount.

.3 Provide heavy duty, self-aligning, anti-friction bearings with external lubrication.

.4 Provide where indicated variable inlet vanes.

.5 Provide access door and drain connection to scroll.

.6 Except for packaged air units, belted vent sets and as otherwise noted, centrifugal fans over 430 mm diameter shall have die formed air foil blades welded to side and back plate.

2.3 ROOF MOUNTED FANS

.1 Provide V-belt drives with fan and motor mounted to main housing through neoprene anti-vibration pads.

.2 Heavy aluminum dome type housings shall be reinforced as necessary on sizes with 500 mm wheel and larger.

.3 Provide with multi-blade, rattle free, backdraft damper with felt lined blade edges, birdscreen, disconnect switch and curb caps.

2.4 AXIAL FANS

.1 Provide either adjustable die cast impeller blades with motor integral part of hub design or die formed blades with belt drive and motor mounted outside air stream.

.2 Extend lubrication fittings to outside of fan casing. Terminal box shall be external.

.3 Housing shall have flanges for connection of ductwork. When not connected to ducting, provide inlet cones.

.4 Provide easy access to fan wheel for varying blade angle setting during air balancing.

.5 Provide variable inlet vanes where indicated.

.6 Fans operating at over 370 Pa shall be of vane-axial design for improved operating efficiency.

2.5 PROPELLER FAN

.1 Directly connect steel or aluminum blade fans with heavy hubs to motor.

.2 Motor shall have self-aligning ball or sleeve bearings with adequate lubricating arrangements.

.3 Mountings shall be cast or die formed to smooth curves. Supply size to fit openings provided.

.4 Provide safety screens in inlet and backdraft dampers on outlet.

.5 Use neoprene vibration isolation between fan assembly and mounting plate.

3. Execution

3.1 PERFORMANCE

.1 Fan performance based on sea level conditions.

.2 Refer to Fan Schedule.

3.2 INSTALLATION

.1 Where inlet or outlet is exposed, provide safety screen.

.2 Provide belt guards on belt driven fans.

.3 Supply and install sheaves as necessary for final air balancing.

.4 Set roof mounted fans on curbs 200 mm minimum above roof. Provide acoustic insulation on duct to below roof line and on fan inlet plenum, and drip pan for collecting condensation.

3.3 PRIMING

.1 Prime coat fan wheels and housing factory inside and outside. Prime coating on aluminum parts is not required.

.2 Provide two additional coats of paint on fans handling air downstream of humidifiers.

3.4 STARTING AND TESTING

.1 Start and test fans as specified in Section 23 08 23.

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

.1 Air flow tests and sound level measurement shall be made in accordance with applicable ADC equipment test codes and ASHRAE standards.
.2 Unit ratings shall be approved by ADC.
.3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's product data in accordance with Section 20 00 13 – Mechanical General Requirements.
.1 Submit copies of manufacturer's product literature, specifications and datasheets.
.2 Indicate the following information:
.1 Capacity.
.2 Throw and terminal velocity.
.3 Noise criteria.
.4 Pressure drop.

.2 Closeout Submittals:

.1 Submit maintenance materials in accordance with Section 20 01 06 – Mechanical Operation and Maintenance Manual.
.1 Include keys for volume control adjustment and air flow pattern adjustment.

Part 2 Products

2.1 GENERAL

.1 Base air outlet application on space noise level of NC 35 maximum.
.2 Provide supply outlets with sponge rubber seal around the edge.
.3 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.
.4 Provide plaster frame for diffusers located in plaster surfaces.
.5 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

Part 3 Execution

3.1 INSTALLATION

.1 Positions indicated on drawings are approximate only. Check location of outlets and make necessary adjustments in position to conform with architectural features, symmetry and lighting arrangement.

END OF SECTION

1. General

1.1 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's product data in accordance with Section 20 00 13 – Mechanical General Requirements

.1 Submit copies of manufacturer's product literature, specifications, and datasheets.

.2 Closeout Submittals:

.1 Submit operations and maintenance data for incorporation into manuals specified in Section 20 01 06 – Mechanical Operation and Maintenance Manual.

1.2 QUALITY ASSURANCE

.1 Comply with local and Provincial Regulations and have CSA approval.

.2 Factory test to check construction, controls and operation of unit and provide certification.

.3 Operationally test after installation.

2. Products

2.1 GENERAL CONSTRUCTION

.1 Construct heater casing and components of 1.3 mm steel panels, reinforced with structural angles and channels to ensure rigidity under normal handling. Provide access panels to burner and blower motor assemblies from either side of unit.

.2 Locate observation port on burner section for observing main and pilot flames.

.3 Insulate complete unit with 25 mm neoprene faced fibrous glass insulation.

.4 Finish casing and components with heat resistant baked enamel.

.5 For suspended installations, provide service platforms complete with handrails and access ladder.

.6 For outdoor installation, provide weatherproofed casing with intake louver or hood.

2.2 FILTERS

.1 Provide filter section complete with removable 50 mm thick fibrous glass disposable filters in metal frames.

2.3 BURNER

.1 Provide raw gas burner suitable for natural gas and capable of modulating turn down ratio of 25:1. Burner assembly and gas piping arrangement to include electric modulating main gas valve, motorized shutdown valve, main and pilot gas regulators, pilot electric gas valve, manual shut-off valve, and pilot adjustment valve.

.2 Furnish gas burner with electrically ignited supervised pilot. Pilot automatically ignited by spark rod through high voltage ignition transformer.

.3 Provide motorized damper complete with end switch to prove position before burner will fire.

2.4 FAN

.1 Provide statically and dynamically balanced centrifugal fan mounted on solid steel shaft with heavy duty self-aligning pre-lubricated ball bearings and V-belt drive with matching motor sheaves and belts.

2.5 CONTROLS

.1 Pre-wire unit completely so connection of power supply and field wiring from unit to remote control panel shall make unit operative.

.2 Remote control panel shall contain on-off switch, indicating lights for supply fan, pilot operation, burner operation, clogged filter indication.

.3 Interlock unit to start when exhaust fan is running. Interlock burner to operate when flow switch located in exhaust duct proves flow.

.4 Fan discharge thermostat shall control modulating gas valve to maintain supply air temperature.

.5 Provide safety controls to provide correct air flow before energizing pilot and to sense pilot ignition before activating main gas valve.

.6 Provide manual reset low and high limit controls to maintain supply air temperature between set points and shut fan down if temperatures are exceeded.

.7 Provide purge period timer to delay burner ignition and automatically bypass low limit control.

3. Execution

3.1 PERFORMANCE

.1 Provide outdoor unit with 20°C delivery temperature based on 55°C temperature rise of 1890 L/s at 0.125 kPa external static pressure with 2.25 kW motor. (Gas heating capacities are sea level ratings).

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83(R2010) , Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000 , The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for

Moulded Case Breakers

Power Generation Equipment

Fire Pump Controllers

Motor Starters

Lighting

Fire Alarm Equipment

.3 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frame at fire alarm control panel and annunciator.

.4 Shop drawings:

.1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within days of review, verifying compliance of Work and electrical system and instrumentation testing , as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals .

.2 Operation and Maintenance Data: submit operation and maintenance data for all new or modified systems

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification labels nameplates for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Provide equipment in accordance with Section 01 61 00- Common Product Requirements.

.2 Equipment to be CSA certified.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Controls and control wiring in accordance with Section 27 20 10 Control and Instrumentation General Requirements.

2.4 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish

.2 Paint indoor switchgear and distribution enclosures light gray

2.5 NAMEPLATES AND LABELS

.1 Lamicoid Nameplates:

.1 Size 1: 12 mm high with 5 mm high letters.

.2 Size 2: 20 mm high with 8 mm high letters

.3 Size 3: 25 mm high with 12 mm high letters.

.2 Wire Identification Materials: Use one of the following:

.1 Heat shrink sleeves, blank.

.2 Clear plastic tape wrap-on strips with white writing section

.3 Wrap-on strips, pre-numbered.

.4 Slip-on identification bead markers or sleeves, blank or pre-numbered.

.3 Colour Banding Tape: Adhesive backed plastic tape, integrally coloured.

.4 Receptacle circuit designations: Clear adhesive tape with machine printed black lettering.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of existing electrical equipment being used are suitable for code compliant re-use.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: Sch 40 plastic , sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

.1 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.1 Confirm heights of boxes are compliant with CSA B 651, modify heights of existing boxes on systems that are being modified to suit new device height requiremetns.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline 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: 1100 mm.

.2 Fire alarm stations: 1100 mm.

.3 Fire alarm bells: 2100 mm.

.4 Wall mounted speakers: 2100 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 Conduct following tests in accordance with Section 01 45 00- Quality Control.

.1 Power generation system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: Power generation, fire alarm, and communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.2 Carry out tests in presence of Departmental Representative.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.4 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 SYSTEM STARTUP

.1 Instruct Departmental Representative in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.9 COLOUR IDENTIFICATION OF EQUIPMENT

.1 Electrical equipment shall be prefinished in coded colours designating voltage or system, as indicated in Equipment Identification Schedule.

.2 Voltage colour identification for line voltage equipment shall be as follows:

	Voltage	Colour
.1	120/208 V or 120/240 V:	Grey
.2	347/600 V:	Grey

.3 System colour identification for low voltage systems equipment shall be as follows:

	System	Colour
.1	Fire Alarm and Fire Telephone:	Red
.2	Telephone Cabinets:	Green
.3	Computer and Data Systems:	Orange
.4	Door Security:	Ivory

.4 Where impracticable to obtain equipment prefinished in coded colours, equipment may be site painted in coded colours. Coordinate with work specified in Section 09 91 00.

3.10 NAMEPLATE IDENTIFICATION OF EQUIPMENT

.1 Identify equipment with lamicoid nameplates, as indicated in Equipment Identification Schedule.

3.11 PANELBOARD DIRECTORIES

.1 Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory.

3.12 COMMUNICATIONS CABLE AND EQUIPEMENT LABELING

.1 Label PLC Control Sensors, panels and ports with nameplates as specified in Equipment Identification Schedule.

.2 Label each of cables with other ends address using Wire Identification Materials.

.3 Label outlets with labels vertically aligned in each row.

.4 Position panel labels in the same position on each panel.

3.13 IDENTIFICATION OF PULL AND JUNCTION BOXES

.1 Identify pull and junction boxes over 100 mm size as follows:

.1 Use boxes which are prefinished in coded colours, or spray paint inside and outside of boxes prior to installation, in coded colours designating voltage or system.

.2 Apply size 2 lamicoid nameplate to cover of each box. Identify system name. Where sequence identification is required, identify system name and number.

.2 Identify pull and junction boxes 100 mm or less in size as follows:

.1 Spray paint inside of boxes in coded colours designating voltage or system.

.2 Apply permanent identifying markings directly to box covers designating voltage or system using indelible black ink.

3.14 COLOUR IDENTIFICATION OF WIRING

.1 Identify No. 4/0 AWG wiring and smaller by continuous insulation colour.

.2 Identify wiring larger than No. 4/0 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.

.3 Colour coding shall be in accordance with Canadian Electrical Code, and as follows:

	Voltage	**Colour**
.1	120/208 V, 3 phase:	Red, black and blue.
.2	120/208 V emergency:	Red, black and blue with yellow tracer.
.3	347/600 V 3 phase:	Orange, brown and yellow.
.4	347/600 V emergency:	Orange, brown and yellow with red tracer.

.4 Where multi-conductor cables are used, use same colour coding system for identification of wiring throughout each system.

.5 Maintain phase sequence and colour coding throughout each system.

3.15 NAME/NUMBER IDENTIFICATION OF WIRING

.1 Identify No. 8 AWG wiring and smaller using one of the wire identification materials specified in 2.1.

.2 Type or print on blank wire identification materials using indelible black ink.

.3 Identify wiring at all pull boxes, junction boxes, and outlet boxes for all systems.

.4 Identify each conductor as to panel and circuit, terminal, terminal numbers, system number scheme, and polarization, as applicable.

3.16 IDENTIFICATION OF RECEPTACLES AND FIRE ALARM END OF LINE RESISTORS AND DUCT DETECTORS

.1 Standard duplex receptacles: provide label indicating circuit and panel designation and locate on wall above receptacle. On all other receptacles provide nametag indicating voltage, phase, amps, circuit and panel designations.

.2 Fire alarm end-of line resistors and duct detectors: identify zone number with 6 mm high lettering nametag located on wall above device. Identify remote LED indicators for duct detectors.

3.17 EQUIPMENT IDENTIFICATION SCHEDULE

Equipment	Colour	Nameplate Identification		Lamicoid Nameplate Size
Main Distribution Centre	Voltage Colour	-	Building name, consulting engineer, date installed, amperage, voltage	3
		-	Main breaker	
			Metering cabinet	2
		-	Instrument transformer enclosure	2
		-	Loads controlled by each overcurrent protective device	1
		-	Metering devices	1
Distribution Centres	Voltage Colour	-	Distribution centre designation, amperage, and voltage	2
		-	Loads controlled by each overcurrent protective device	1
Panelboards	Voltage Colour	-	Panelboard designation	2
Motor Control Centres	Voltage Colour	-	M.C.C. designation, amperage and voltage	2
		-	Motors or loads controlled by each unit and mnemonics	1
		-	Relay terminal and transformer compartments	1
Manual Motor Starters	N/A	-	Load controlled and mnemonics	1
Ground Bus	N/A	-	System Ground	1
On/Off Switches	N/A	-	Load controlled	1

3.17 EQUIPMENT IDENTIFICATION SCHEDULE (CONT'D)

Equipment	Colour	Nameplate Identification		Lamicoid Name plate Size
Disconnect Switches, Motor Starters and Contactors:	Voltage Colour	-	Voltage and equipment controlled and mnemonics	2
Transformers	Voltage Colour	-	Transformer designation, capacity, secondary and primary voltages	2
Emergency Power Equipment	Voltage Colour	-	Designation and voltage	2
Wireways	N/A	-	Voltage and system designation	2
Line Voltage Cabinets and Enclosures	Voltage Colour	-	Designation and voltage	2
Low Voltage Cabinets and	System Colour	-	System name; system name and number if more than one cabinet or enclosure	2
Enclosures		-	Major components within cabinets and enclosures	1
PLC Device	N/A	-	Sensor Designation	1
Communication Panels	N/A	-	Panel Designation	1
Communication Ports	N/A	-	Port Designation	1

3.18 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for selective demolition and removal of electrical safety components, including removal of conduit, junction boxes, and panels to source (home run removal) and incidentals required to complete work described in this Section ready for new construction.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

.1 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

1.3 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes , cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.3 Remove and Salvage: Detach items from existing construction and deliver them to Department Representative ready for reuse.

.4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

.6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide in accordance with Section 01 33 00– Submittal Procedures before starting work of this Section:

.1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19– Construction Waste Management and Disposal.

.2 Landfill Records: Indicate receipt and acceptance of selective demolition waste, and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.5 SITE CONDITIONS

.1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.

.2 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Department Representative if materials suspected of containing hazardous substances are encountered and perform following activities:

.1 Hazardous substances will be as defined in Hazardous Products Act.

.2 Stop work in area of suspected hazardous substances.

.3 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.

.4 Hazardous substances will be removed by Department Representative under a separate contract or as a change to Work.

.5 Proceed only after written instructions have been received from Department Representative .

Part 2 Products

2.1 REPAIR MATERIALS

.1 General Patching and Repair Materials: Coordinate with architectural divisions for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.

.2 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.

.3 Firestopping Repair Materials: Use firestopping materials compatible with existing firestopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

2.2 SALVAGE AND DEBRIS MATERIALS

.1 Material Ownership: Demolished materials become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, reinstalled, or otherwise indicated to remain Department Representative's property.

.2 Salvaged Materials: Carefully remove materials designated for salvage and store in a manner to prevent damage or devaluation of materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect work of this Section before tendering Bid; Department Representative will not consider claims for extras for work or materials necessary for proper execution and completion of contract that could have been determined by a site visit.

3.2 PREPARATION

.1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:

- .1 Existing process equipment to remain functional throughout construction.
- .2 Notify Department Representative and cease operations where safety of equipment, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
- .3 Prevent debris from entering process.
- .4 Protect mechanical systems that will remain in operation.

.2 Protection of Building Occupants: Sequence demolition work so that interference with use of the building by Department Representative and users is minimized and as follows:

- .1 Prevent debris from endangering safe access to and egress from occupied buildings.
- .2 Notify Department Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

.1 Demolition/Removal: Coordinate requirements of this Section with architectural divisions and as follows:

- .1 Disconnect electrical circuits where required; maintain electrical service and main distribution panel as is, ready for subsequent Work.
- .2 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items where noted on drawings.
- .3 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
- .4 Perform demolition work in a neat and workmanlike manner:
  - .1 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.

.2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

.5 Disconnect panel feeders back to main distribution panel and re label respective circuit breaker as “SPARE”.

.6 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.

.7 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.

.8 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.

.9 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.4 CLOSEOUT ACTIVITIES

.1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: dispose in accordance with Section 01 74 19- Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000V insulation of cross-linked thermosetting polyethylene material rated RWU90 XLPE, RW90 XLPE, Non Jacketted.

.3 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon, TWU, TWH rated at 600 V.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Ethylene propylene rubber EP.

.2 Cross-linked polyethylene XLPE.

.3 Rating:, 1000V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at

.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Explosion-proof approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.

.3 Outer covering: annealed seamless stainless steel sheath, Type M1 rated 600 V, 250 degrees C.

.4 Overall jacket: PVC applied over the sheath and compliant to applicable Building Code classification for this project, wet locations.

.5 Two hour fire rating.

.6 Connectors: explosion-proof, field installed approved for MI cable.

.7 Termination kits: field installed approved for MI cable

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Type: PVC jacket over thermoplastic armour and compliant to applicable Building Code classification for this project, wet locations.

.5 Connectors: anti short connectors.

2.5 ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: cross linked polyethylene rated 1000V.

.3 Sheath: aluminum applied to form continuous corrugated sheath.

.4 Outer jacket: thermoplastic applied over sheath and to be compliant to applicable Building Code classification for this project, wet locations.

.5 Fastenings for aluminum sheathed cable:

.1 One hole steel straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at

.3 Threaded rods: 6 mm diameter to support suspended channels.

2.6 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket, and armour of closely wound aluminum wire.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: TW.

.2 Shielding: metallized tapes over each conductor.

.3 Overall covering: flat galvanized steel.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Cable Colour Coding: to Section 26 05 00- Common Work Results for Electrical.

.2 Conductor length for parallel feeders to be identical.

.3 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.4 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.5 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Install cable exposed, securely supported by straps.

.2 Support 2 hour fire rated cables at 1 m intervals.

.3 Make cable terminations by using factory-made kits.

.4 Cable terminations: use thermoplastic sleeving over bare conductors.

.5 Where cables are buried in cast concrete or masonry, sleeve for [entry] [exit] of cables.

.6 Do not splice cables unless indicated.

3.6 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.7 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

3.8 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

3.9 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1-18, Canadian Electrical Code, Part 1, 22nd Edition.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.2.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi 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.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, 21 and 27 mm conduit. Minimum size: 73 mm deep.

2.4 CONDUIT BOXES

.1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.5 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.7 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with satin aluminum housing finish for 1 duplex receptacle. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA C22.2 No. 18.1-04, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45.1-07, Rigid Metal Conduit.

.3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985(R2017), Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2-06, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3-15, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

.4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, or hot dipped galvanized steel threaded.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

.1 One hole malleable iron steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1500mm.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

2.7 CABLE PROTECTION

.1 Concrete as shown on drawings,

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Surface mount conduits except in new wall construction

.3 Use rigid galvanized steel hot dipped galvanized steel threaded conduit except where specified otherwise.

.4 Use electrical metallic tubing (EMT) in non Hazardous areas, not embedded in concrete.

.5 Use rigid pvc conduit underground.

.6 Use flexible metal conduit for connection to motors in dry areas.

.7 Use explosion proof flexible connection for connection to explosion proof motors.

.8 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.9 Minimum conduit size for lighting and power circuits: 19 mm.

.10 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 25 mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.15 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 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.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 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.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.8 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.9 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using qualified personnel.

.1 Include necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds.

.1 Ensure resistance to ground of circuits is not less than [50] megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests:

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing at Cable Manufacturer recommendations.

.4 Leakage Current Testing:

.1 Raise voltage in steps from zero to maximum values as specified by manufacturer.

.2 Hold maximum voltage for specified time period by manufacturer.

.3 Record leakage current at each step.

.7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 100-14, Motors and Generators.

.2 CSA C22.2 No. 145-11, Motors and Generators for Use in Hazardous Locations.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta.

.2 Indicate dimensions, recommended installation procedure, wiring diagrams, sizes and location of mounting bolt holes and recommended support method.

.4 Quality Assurance Submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for fractional horsepower motors for incorporation into manual specified in Section 01 78 00- Closeout Submittals.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect, package and store expired motors for either recycling or rebuilding and return to recycler or rebuilder.

Part 2 Products

2.1 FRACTIONAL HORSEPOWER MOTOR

.1 Non-hazardous locations: to CSA C22.2 No. 100, EEMAC M1-7.

.2 Hazardous locations: to CSA C22.2 No. 145-11.

.1 Rating: Zone 22

.2 Type: TEFC

.3 Bearings: 100,000 hour maintenance free

.4 Starting method: Across the line

.3 Motor with inherent overheating protectors.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install wiring, flexible connections and grounding.

.2 Check rotation before coupling to driven equipment.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 SYSTEM

.1 Provide emergency power system for supply of power in the event of failure of normal supply as indicated and in accordance with Canadian Electrical Code Section 46, CAN / CSA 282, and local inspection authority.

.2 System to consist of a complete standby power supply unit, liquid air cooled, diesel engine directly coupled to ac alternator complete with fittings, connections, auxiliaries, control panels, safety devices, meters, etc. as indicated for a complete operating system.

.3 Provide full automatic operation such that upon power failure, unit is on line taking full required load within 10 seconds. On resumption of normal power after time delay on transfer switch, load shall re-transfer to normal power and after rundown time delay, generator unit shall automatically shut down and return to starting condition ready for another operating cycle.

.4 This section includes packaged engine generator sets for standby power supply with the following features:

.1 Diesel driven engine
.2 Unit mounted cooling system
.3 Exhaust system
.4 Starting system
.5 System control and alarm panel
.6 Skin tight weather and sound enclosure

.5 Equipment to be supplied and installed in accordance with the following standards:

.1 Alberta Building Code
.2 Canadian Electrical Code
.3 NFPA 110
.4 NFPA 30
.5 NFPA 37
.6 ISO-8528-1
.7 CAN / CSA 282

1.2 SUPPLIER QUALIFICATIONS

.1 Qualifications: service and parts facilities in close proximity with 24 hour service, experienced in installation and operation of set of comparable size.

.2 The manufacturer shall supply factory trained service and parts support through a factory authorized dealer/supplier that is regularly doing business in the area of

installation. Manufacturer to supply proof to Departmental Representative that the aforementioned service is available.

1.3 SHOP DRAWINGS

.1 Comply with requirements of Section 26 05 00 – Common Work for Electrical.

.2 Submit full technical data and service and parts facilities complete with manufacturer's published h.p. data.

.3 Provide at minimum the following information:
- .1 Dimensional and elevation drawings of generator set and other associated equipment specified.
- .2 Wiring diagrams for power, signal and control wiring.
- .3 Generator set and associated equipment weights and point loads
- .4 Installation instructions including required clearances.
- .5 Heater sizing and voltage requirements
- .6 Current Transformer ratio and model number and accuracy class

.4 Alternate generator manufacturer/suppliers as noted in item 2.1, will be responsible for including a detailed load and sizing report specific to the project requirements and stepped loads. Program is to be created by generator manufacturer being submitted, competitor sizing program analysis for submitted design will not be acceptable.

1.4 FACTORY WITNESS TESTING

.1 The generator set supplier shall perform the tests noted below for the actual generator set to be installed in the presence of the Departmental Representative at the supplier’s facility or yard **PRIOR** to shipping the generator to site. The generator supplier shall pay for reasonable round-trip travel, accommodation, and meal disbursements for one Departmental Representative during Factory Witness testing. Where major deficiencies are discovered during testing, generator supplier shall cover cost for return visit. Once testing is complete, generator supplier shall provide a full written report of the test results to Departmental Representative. Departmental Representative will provide acknowledgement of the report and provide written consent to ship the generator set to site. The following testing is to be performed during factor witness testing and results shall be included in the factory test report:

- .1 Perform torsional analysis test of engine and generator compatibility.
- .2 Perform a four hour load test using a portable test bank. Perform test for four hours with load applied in 20% steps every 30 minutes until full load is applied. Record following at 30 minute intervals during the entire test:
  - .1 Kilowatts
  - .2 Amperes
  - .3 Voltage
  - .4 Frequency

.5 Oil Pressure
.6 Coolant Temperature

.3 Upon completion of 4 hour test, run generator past 110% and record data as noted above indicating the point where the generator "unload protection" is enabled (anticipated 103-110%).

.4 Test response of governor (droop or isochronous) applying 20% load and 100% load in one step. Use a Computer (plugged into ECU), storage oscilloscope or strip chart recorder to determine response time, voltage and frequency fluctuations during test.

.5 Test voltage regulator and compare for conformance to manufacturer's product data.

.6 Submit certified tests results for approval by Departmental Representative.

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: For packaged engine-generator sets to include emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 00 – Closeout Submittals, include the following:

1. List of tools and replacement items recommended to be stored at the project location for ready access. Including part and drawing numbers, current prices, and source of supply.

1.6 MAINTENANCE MANUAL MATERIAL SUBMITTALS

.1 Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every ten of each type and rating, but no less than one of each.
2. Indicator Lamps: Two for every six of teach type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Belts:
   .1 One serpentine belt
   .2 One set of all other belts.

1.7 WARRANTY

.1 The supplier of the generator and associated materials is to provide a two (2) year - 400 hour full parts and labor warranty for all equipment and materials supplied under this specification. The warranty time is to start upon date of substantial completion.

1.8 PROJECT CONDITONS

.1 Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Departmental Representative or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Departmental Representative no fewer than **seven (7) business days** in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Departmental Representative written permission.

.2 Environmental Conditions: Engine driven system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability.

.1 Minimum outdoor ambient temperature: - 36°C
.2 Maximum ambient operating temperature: 33°C
.3 Relative humidity: 0 - 95%
.4 Elevation: 914 meters

.3 The following is a listing of special conditions and requirements for the specified generator set and equipment:

.1 **Clearance from sides and back:** 1500mm minimum from widest/longest point on the generator/frame to adjacent wall or nearest piece of equipment. Maintain minimum 1500mm egress path.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Basis of design product: Subject to compliance with requirements, provide CUMMINS C60D6C that conforms to these specifications or a comparable product by one of the following:

.1 MTU
.2 Caterpillar Power Systems
.3 Kohler
.4 Or Equal

.2 If the Contractor chooses to use an alternate generator model than the basis of design product, the Contractor will be responsible for all architectural, structural, mechanical and electrical changes and alterations necessary to meet the Departmental Representative's requirements. The Contractor will be responsible for paying the Departmental Representative for all additional engineering costs

associated with the review and re-calculation of altered design variables. The additional review work shall include but not be limited to the following:

.1 Additional ceiling and truss support for muffler(s)
.2 Concrete floor/pad thickness and/or additional support (columns, pillars, screw piles etc.)
.3 Wall penetrations
.4 Damper sizes
.5 exhaust fan cooling/heating requirements
.6 Natural gas supply (where applicable) including: pipe size, meter size, additional utility costs etc.
.7 Generator sizing. Manufacturer to provide detailed load report, Departmental Representative can provide step loads details during shop drawing submission only.
.8 Supplementary load voltage, current, cable requirements (heaters, battery charger etc.)

2.2 GENERATOR SET

.1 Packaged generator set shall be coordinated assembly of compatible components capable of providing:

.1 Generator: 50kW, 63kVA, 347/600VAC, 3 phase, 4W, 60 Hz

UNLESS a larger generator set is required to meet the site rating. Generator to be manufactured to CEMA standards.

.2 Site Rating: The generator set shall have a minimum site rating of:

.1 Generator: 50kW based on project conditions. It is the generator set supplier's responsibility to account for site conditions indicated and provide an adequately sized generator set meeting all requirements indicated in this specification. Should the generator set not meet the minimum site rating during on site commissioning the Departmental Representative reserves the right to:

.2 Request manufacturer to modify generator onsite until the site generator meets or exceeds the site rating.
.3 Withhold money from the Contractor at a value deemed acceptable by the Departmental Representative and allow the under rated generator to remain in operation.
.4 Request manufacturer to replace the undersized generator with a suitable generator that will meet the minimum site rating.

.3 Factory assembled and tested engine generator set, provide report as indicated in Item 1.6 of this specification.

.4 Provide semi-flexible couplings between generator and engine and protective guards over moving parts. Unless otherwise indicated all electrical and control enclosures shall be constructed from code gauge metal. Plastic enclosures will not be accepted.

.5 Provide properly sized generator main circuit breaker, **100%** full load rated with metal enclosure. Breaker to be sized for unit protection and motor starting capacity. See Section 26 28 16 – Moulded Case Circuit Breakers for related requirements. The generator main breaker cannot have a larger rating than the transfer switch and main distribution system it is connected to. Coordinate sizing with the single line diagram in the contract drawing set. Include breaker position contacts that are wired back to the generator controller. Breaker shall be furnished with a lockout hasp.

.6 Load bank breaker: Provide properly sized generator load bank circuit breaker. Circuit breaker to be 100% full load rated comes with metal enclosure. Breaker to be sized for unit protection and load bank testing of generator to 110% capacity. See specification 26 18 16 or related requirements. Include breaker position contacts and a shunt trip wired back to the generator controller. Shunt trip for load bank breaker shall operate upon command from the ATS to start generator in case of Utility power failure during load testing.

.7 Provide fuel shut-off valve to the engine.

.8 The generator set and all associated equipment specified is to be mounted on a sub base frame complete with lifting attachments and enclosed in an exterior mounted weather proof sound attenuated enclosure. The enclosure is to include the features as noted in item 2.12 of this specification.

2.3 ENGINE

.1 Capacity: 5% per cent overload for one hour and 25 per cent overload for transient or intermittent loads operating on diesel fuel at the listed elevation in 1.8.2.4 and an ambient temperature of 32°C.

.2 Governor: speed regulation 3 cycles maximum from "No Load" to "Full Load" with two second maximum recovery to steady state.

.3 Accessories: provide all replaceable type oil filters, dry type air cleaners, automatic choke, lubricating oils and greases, etc. as indicated in Item 1.8 of this specification.

2.4 COOLING SYSTEM

.1 Engine - self-contained liquid cooling complete with pusher type fan maintaining safe operating temperature for unit under full load conditions.

.2 Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the alternator air inlet. Radiator fan shall be suitable for use in a system with 13mm water column restriction. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.

.3 Provide sight glass to indicate coolant system level and visible from beside generator.

2.5 ENGINE HEATING SYSTEM

.1 Immersion coolant heater: located in cooling jacket complete with immersion thermostat for 120 or 208V operation as required. It is the Contractors responsibility to provide proper conduit, wiring and breakers in local electrical panel to power the heater. Heater isolation valves are to be installed so as to replace the heater element without draining the entire cooling system.

.2 Oil pan heater: located on the outside or inside of the oil pan with integral thermostat for 120V, operation as required. It is the Contractors responsibility to provide proper wiring and breakers in local electrical panel to power the heater. Heater is to be installed so as to replace the heater element without draining the oil system.

.3 The coolant heater(s) and engine oil pan heaters as required shall be sized by the engine manufacturer to warm the engine to a minimum of 104F (40C) in compliance with NFPA110 requirements, and the temperature required for starting and load pickup requirements of this specification in:

1. Outdoor mounted generator: -40F (40C) ambient.

2.6 STARTING SYSTEM

.1 Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 “Project Conditions” Article.

.2 Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding. The engine starting system shall provide a cranking cycle consisting of

.1 30 s of continuous cranking; or

.2 three 10 s crank attempts separated by 10 s rest periods.

.3 Battery: Absorbent Glass Mat (AG M) as per manufacturer voltage and amp hour requirements in order to meet 8 hour run time capacity requirements, and to have sufficient capacity for two of the complete cranking cycles specified in Clause 2.6.2 (i.e., a total of 60 s cranking time) at 10 °C, with a battery end voltage of at least 80% rated voltage.

.4 Battery Cable: Sized as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

.5 Battery Compartment: Plastic acid proof battery box which includes cover mounted on unit. Include accessories required to support and fasten batteries in place.

.6 Battery Charger: constant potential type with manual and automatic control mounted on wall adjacent to unit, complete with dc ammeter, volt meter, overload protection, ac input switch, pilot switch for ac "On", equalizing charge and high rate charge. Adjustable rate of charge, "floating" on batteries at all times with full charging period of 24 hours maximum. Suitable for AGM battery. Charger to provide charging system trouble/fault indication directly to generator controller or provide fault/fail alarm dry contact output relay and wiring connected to PLC.

2.7 ALTERNATOR

.1 Alternator to be PMG excitation and appropriately sized for variable frequency drive (VFD) motor loads. Shunt or EBS regulators will not be accepted. Temperature rise to be no greater than:

.1 20kW – 199kW Generator = 120 °C
.2 200kW – 799kW Generator = 105 °C
.3 800kW+, Hospital or prime rated Generator = 80°C

2.8 FUEL SYSTEM – DIESEL FUEL SYSTEM

.1 Provide a complete fuel system including duplex filters. Filter elements to be directly replaceable with elements of Canadian manufacturers.

.2 Bring fuel supply lines and return lines to extreme forward part of base plate with drop ear elbows to be affixed thereto. Connect the other end of each elbow with 1m of flexible neoprene hose.

.3 All non-metallic fuel hoses shall be of the steel reinforced rubber type with crimped or swaged end fittings.

.4 Install sub-base duel wall diesel fuel tank, sized for **8 hour** generator operation. Calculated run-time shall be based on manufacturer’s published data for selected generator. Fuel tank size shall deviate not more than 5% from capacity required to achieve desired run-time. Fuel tank to bolt to concrete pad. Fuel tank to c/w

emergency vent outside as per NFPA30, 50mm NPT fill and fuel cap and riser located nearest to the door way, 50mm mechanical level gauge, low level alarm sensor, secondary containment break alarm sensor, supply and return ports, 38mm NPT for draining tank c/w isolation ball valve. Tank to conform to the maximum dimensions, as per 1.10.3.

.5 Install ball valve on supply line between sub-base fuel tank and engine for emergency fuel shut-off.

2.9 EXHAUST SYSTEM

.1 Muffler and piping: Provide a complete exhaust system including heavy duty commercial type muffler and flanged couplings. Exhaust system to be steel and completely sealed with corrugated stainless steel expansion joints of suitable length to absorb both vertical and horizontal expansion.

Muffler type: Hospital Grade

2.10 ALARMS AND INSTRUMENTATION

.1 Engine Control Panel: Solid state controller mounted in Code gauge metal enclosure on frame of unit complete with oil pressure gauge, water temperature gauge, low oil pressure alarm contacts high water temperature alarm contacts low oil pressure shutdown contacts high water temperature shutdown contacts over speed shutdown contacts cranking limiter relay.

.2 Generator Control Panel: Totally enclosed ventilated Code gauge metal panel mounted on unit constructed of channel or angle iron frame finished in enamel over corrosion-resistant primer, complete with hinged door incorporating output circuit breaker volt meter and volt meter selector switch ammeter and ammeter selector switch complete with current transformers as required frequency meter, voltage adjustment rheostat running time meter.

.3 Generator Controller: Cummins Power Command 2.3 or equivalent. Incorporate large size 320x240 pixel LED-backlit Liquid Cristal Display. Controller to be capable of displaying scrolling alarms, engine and alternator performance characteristics and alarm history. Complete with generator Stop/Start/Auto/Manual/Reset selection, cranking limiter, trouble horn, and double pole, double throw silencing switch. HMI to include LED indicating lamps: running, remote start, not in auto, shutdown, warning, auto, manual and stop. HMI to be mounted on generator control panel to provide clear and easy access for operating. HMI to be mounted no higher than 1800mm above finished floor to centre of display.

.1 Current Transformers: Where Generator Controller utilizes Current Transformers (CT) for measuring alternator current, CT ratio shall not to exceed generator overcurrent device rating.

.4 Engine Alarm Panel: Alarm panel to be remote mounted on wall inside mechanical room. Mount alarm panel using suitable enclosure to provide clear and easy access for viewing indicators. Alarm panel to be mounted no higher than 1800mm above finished floor to centre of panel. Alarm panel to be complete with illuminated annunciators with engraved nameplates reading:

.1 Low oil pressure alarm.
.2 High water temperature alarm.
.3 Low oil pressure shutdown.
.4 High water temperature shutdown.
.5 Over speed shutdown.
.6 Over cranking shutdown.
.7 Low fuel alarm
.8 Fuel cell leak alarm
.9 Low coolant temp alarm
.10 Low coolant level shutdown
.11 Generator not in Auto
.12 Generator main breaker open
.13 Low battery voltage

2.11 REMOTE MONITORING

.1 Remote Monitoring: In addition to contacts for remote start through Automatic Transfer Switch, the generator control system shall provide the following 120VAC rated, form C dry contact output, 2 pole relays as to indicate the following generator alarms:

.1 Diesel Generator
  .1 Generator Running
  .2 Generator Fault
  .3 Low Fuel Level
  .4 Tank Leak
  .5 Auto Status

.2 Battery Charger
  .1 Charger trouble/fault

2.12 WIRING AND CONNECTIONS

.1 Provide all conduit, wiring and connections required and recommended by unit supplier.

.2 Install all control and alarm wiring in RPVC conduit unless otherwise noted in the drawings.

.3 Connect mid-point (neutral) of generator to insulated “Grounded Conductor” back to electrical service common neutral point. **Do not** install system bonding jumper

between generator neutral point and generator frame/ground. Refer to Canadian Electrical Code for code requirements.

.4 Provide female Cam-Loks and wiring to load bank breaker suitable for connecting a portable load bank. Cam-Lok connectors to be Levition 16 series, 400A or equivalent. Cam-Lok connectors and wiring to be sized for load bank testing of generator to 110% capacity. Mount Cam-Lok connectors on the bottom or side of the load bank breaker enclosure or a dedicated enclosure adjacent to load bank breaker. Ensure connectors are mounted not more than 1200 above grade. Provided a minimum of 500mm clearance to ensure easy connection of load bank cables.

2.13 OUTDOOR GENERATOR-SET ENCLOSURE

.1 Description: Sound Attenuated Steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.

2. Hinged Doors: Lockable. For each door provide either integral lock or padlocking provision and high security padlock. All locks to be keyed alike. Provide 6 keys. Restraint/Hold back hardware to keep doors door open at 110 (minimum) degrees during maintenance. Restraint/Hold back hardware is to allow all doors to be held open or closed without interfering with opening or restraining another door. Rain lips over all doors.

.3 Exhaust System: Muffler Location: Self-contained within enclosure.

.4 Hardware: All hardware and hinges shall be stainless steel.

.5 Wind Rating: Minimum wind rating shall be 195 km/h.

.6 Mounting Base: Suitable for mounting on sub-base fuel tank.

.7 A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.

.8 Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40° C.

.9 Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer’s standard color or as directed on the drawings.

.10 Service: The enclosure shall allow unobstructed access to perform general maintenance for fluid changes, filter replacements, and monthly inspections as per manufacturer’s recommendations. Arranged for complete gravity drainage to

an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

.11 The enclosure shall include the following maintenance provisions:

.1 Flexible coolant, and lubricating oil drain lines, that extend to the exterior of the enclosure with 12mm bulk heads mounted to the frame of the generator, with internal drain valves for each.

.2 Easily accessible radiator fill provision.

.3 Site Glass for inspecting coolant fill level.

.12 Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 76 dBA measured at any location 7 m from the engine generator in a free field environment.

.13 Site Provisions: Lifting: Complete assembly of engine generator, enclosure, and sub base fuel tank (when used) shall be designed to be lifted into place as a single unit, using spreader bars.

.14 Control Heater: Outdoor generators and enclosures shall be provided with control heaters for anti-condensation protection, and to maintain an ambient temperature inside the enclosure of 10 C when the generator system is not running.

.15 Coordinate electrical generator loads including coolant heater, oil pan heater, enclosure heater, battery charger etc. with supply from electrical panel mounted inside the generator enclosure. Generator Panel to be fed from the control building to provide a complete and fully operational system.

.16 Rodent Proof: All penetrations and openings along bottom of enclosure to be sealed with filler plugs.

.17 Enclosure to come complete with D.C. task lighting on each side of the generator enclosure.

.18 Provide motorized intake and exhaust louvres to minimize air flow through the enclosure when generator set is not operating. Louvres shall include provisions to prevent air leakage and accumulation of ice or snow that might prevent operation. Intake and exhaust louvers shall be powered closed and spring open on loss of power to ensure fail safe operation.

3. EXECUTION

3.1 COORDINATION WITH OTHER SECTIONS OF WORK

.1 Coordinate to ensure proper execution of work covering ventilation, field supply and products-of-combustion exhaust, to form an efficient and well-coordinated layout.

3.2 INSTALLATION OF GENERATOR SET

.1 Provide terminal box for generator and exciter leads.

.2 Install unit complete and make operational.

.3 Coordinate installation of all in-slab conduits with manufacturer drawings prior to pouring concrete.

3.3 INSTALLATION OF EXHAUST SYSTEM

.1 Generator mounted in an exterior enclosure:

.1 To be installed as per manufacturer's recommendations at the factory.

3.4 OPERATION OF STARTING SYSTEM

.1 Stop/start sequence: in automatic position, auxiliary contacts in transfer switch initiates starting cycle of unit. The control system provided shall include a cranking system, which shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between periods. After which if engine fails to start, trouble circuit contacts close illuminating appropriate trouble annunciator window and locking out starting cycle until manually reset. On starting of engine, starting circuits automatically reset. On resumption of normal power after time delay in transfer switch, load to retransfer to normal supply and following rundown period engine shall shutdown and return to starting condition.

3.5 CONTROL PANEL TROUBLE INDICATION

.1 Incorporate contacts so that when shutdown occurs from one set of shutdown contacts, subsequent operation of all shutdown contacts are locked off from operating annunciators.

.2 Operation of silencing switch shall silence trouble alarm but pilot light shall remain illuminated.

.3 On return to normal and resetting off annunciators, trouble horn shall sound again until switch is returned to normal position.

3.6 STANDBY POWER GENERATION SYSTEM TESTING

.1 Prior to energizing power generation units on site:

.1 Ensure generating system is disconnected from normal power supply.

.2 Ensure all auxiliary support devices are operational, including ventilation and exhaust systems.

.3 Ensure that engine has proper lubricant levels, coolant levels and fuel supply.

.4 Ensure all testing on emergency distribution equipment and transfer switch as specified has been completed.

.2 Site Testing:

.1 Site testing shall be conducted in front of the Departmental Representative. Provide written notice to Departmental Representative minimum 7 days prior to testing. Coordinate testing with factory representative and Departmental Representative. Do not proceed with testing until all parties are present.

.2 Site Testing shall follow CSA-C282-09 requirements. The Generator manufacturer is required to complete all testing requirements of CSA-C282-09 along with the tasks noted in 26 06 31.

.3 Perform a four hour load test using a portable test bank. Perform test for four hours with load applied in 20% steps every 30 minutes until full load is applied and one hour at 110% full load. Record following at 5 minute intervals for the first 15 minutes and 15 minute intervals for the remainder of the test. All recordings to be done with computer or digital chart recorder, handheld meter and handwriting on paper are not acceptable:

.1 Kilowatts
.2 Amperes
.3 Voltage
.4 Frequency
.5 Oil Pressure
.6 Coolant Temperature

.4 Test response of governor (droop or isochronous) applying the following load steps.

.1 no load to full load to no load;
.2 no load to 70% load to no load;
.3 40% load to 60% load to no load; and
.4 60% load to 80% load to no load.

Use a Computer or storage oscilloscope or strip chart recorder to determine response time, voltage and frequency fluctuations during test. Record readings at minimum 0.1 second intervals for the duration of the testing.

.5 Test voltage regulator and compare for conformance to manufacturer's product data.

.6 Record noise level measurements in dBA at various locations around unit and area surrounding exhaust port.

.7 Submit certified tests results for approval by Departmental Representative.

.9 Test maximum power up to 100% of rated generator set. This does not mean oversize the generator, the intent is to measure and record absolute maximum output before the generator shuts off.

.10 Simulate power failure including operation of:
- .1 Transfer switch.
- .2 Automatic starting cycle.
- .3 Automatic shutdown and return to normal.
- .4 Loss of single phase by utility and return to normal

.11 Test all alarm and shutdown circuits by simulating conditions. Closing or opening of appropriate sensor contacts mechanically is not acceptable. The following should be tested at a minimum:
- .1 Low oil pressure alarm.
- .2 High water temperature alarm.
- .3 Low oil pressure shutdown.
- .4 High water temperature shutdown.
- .5 Over speed shutdown.
- .6 Over cranking shutdown.
- .7 Low Fuel alarm
- .8 Fuel cell leak alarm
- .9 Low coolant temp alarm
- .10 Low coolant level shutdown
- .11 Not in Auto
- .12 Breaker Open

.12 Test building load and automatic transfer switch settings.

.13 Contractor is responsible for filling the diesel tank prior to testing. After Site testing has been completed to the satisfaction of the Departmental Representative the Contractor is responsible to refill the diesel fuel tank with “winter diesel” to the full level.

.15 The following data shall be observed and recorded:
- (a) the time delay on start;
- (b) the cranking time until the engine starts and runs;
- (c) the time required to come up to operating speed;
- (d) the time required for each life safety equipment transfer switch to be transferred to the emergency position;
- (e) the time required to achieve a steady-state condition, with all switches transferred to the emergency position;
- (f) the time delay(s) for the connection of any loads arranged to be connected to the emergency supply later than the life safety equipment;
- (g) the voltage, frequency, and amperes at start-up, at any observed change in load, and at maximum site design load;
- (h) the battery charge rate 1 min after start, at 5 min intervals for the first 15 min, and at 15 min intervals thereafter;
- (i) the time delay on retransfer for each transfer switch; and
- (j) the time delay on engine cool-down and shutdown.

.14 After Site testing has been completed to the satisfaction of the Departmental Representative the Contractor shall provide a separate onsite Manufacturer demonstration seminar for the Departmental Representative for the generator system:

.1 Allow for up to a 4-hour demonstration and instruction seminar. The seminars will be geared towards general operation of the system, operation and maintenance of the equipment, and all specific system programming and shutdowns.

.2 Provide onsite information specified for each piece of equipment.

.3 Manufactures representative to be present during the demonstration seminar.

.4 The Manufacture shall demonstrate the following yearly service and maintenance on the Generator System; which shall not be less than:

.1 Oil change with oil and filter(s) replacement.

.2 Fuel system maintenance including fuel filter(s) replacement.

.3 Demonstrate fan belt and Air Filter replacements.

.5 Provide sufficient notice (minimum 7 days) to the Departmental Representative for scheduling demonstration seminars. Do not proceed with demonstration seminars without the Departmental Representative.

.15 Generator Manufacturer to provide test results to Contractor and Departmental Representative within 10 business days of completion of test. Result to be submitted as an electronic document. Excel (.xls or .xlsx) and Portable Document Format (.pdf) are acceptable.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 5-02, Molded-Case Circuit Breakers

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for all breakers.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Department Representative for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Department Representative. Unless complying with this requirement, Department Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title: Feed Mill (116) Building Upgrades

.2 End user's reference number: 097511.001

.3 List of circuit breakers

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00-Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store circuit breakers in dry location, off ground and indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Circuit breakers, Moulded-case circuit breakers: to CSA C22.2 No. 5-02

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.6 Circuit breakers with interchangeable trips as indicated.

2.2 THERMAL MAGNETIC BREAKERS (DESIGN A)

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS (DESIGN B)

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS (DESIGN C)

.1 Thermal magnetic breakers with current limiters.

.1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.

.2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

.2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.

.1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 SOLID STATE TRIP BREAKERS (DESIGN D)

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and instantaneous tripping for ground fault short circuit protection.

2.6 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism.

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CAN/CSA-C22.2 No.4-16, Enclosed and Dead-Front Switches

.2 CSA C22.2 No.39-13, Fuseholder Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for disconnect switches - fused and non-fused, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and Non-fusible disconnect switch in CSA approved enclosure size.

.2 Provision for padlocking in off switch position by 1 lock.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with manufacturers recommendations.

.5 Fuseholders: relocatable and to CSA C22.2 No.39 suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

2.3 UNFUSED DISCONNECTS

.1 Unfused Disconnects: to CAN/CSA-C22.2 No. 4 - M89 and as follows:

.1 Poles, Voltage, Amperage, kW Rating and Enclosure: as indicated on drawings or schedules; if not indicated, select disconnect to suit application.

.2 Type: general duty.

.3 Operation: lever handle, capable of being locked in "On" or "Off" position.

2.4 FUSED DISCONNECTS

.1 Fused Disconnects: to CSA C22.2 No. 39-M1987 and as follows:

.1 Same as unfused disconnects except complete with fuse holders.

.2 Fuse holders shall be compatible with fuses as recommended by manufacturer of connected equipment.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of hazardous and non-hazardous areas for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

.1 Remove bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA C22.2 No. 94.2-15, Enclosures for Electrical Equipment, Environmental Considerations.

.2 National Fire Protection Association (NFPA)

.1 NFPA 20-2019, Standard for the Installation of Stationary Fire Pumps for Fire Protection.

.3 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for fire pump controller and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate:

.1 Overall dimensions.

.2 Fixing support dimensions, details.

.3 Schematic, wiring, interconnection diagrams.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for fire pump controller and accessories for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect fire pump controller from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 ELECTRIC MOTOR DRIVEN FIRE PUMP-CONTROLLER

.1 Limited service combined manual and automatic controller for squirrel cage induction motor-driven fire pump, full voltage starting, accommodated in drip-proof CSA Enclosure, completely wired and tested by manufacturer before shipment from factory.

.2 To NFPA 20, and ULC listed for fire pump control.

.3 Rating: 15 kW, 600V 3Ph

.4 Controller capable of being energized automatically through pressure switch or manually by externally operable handle.

.1 Pressure switch set to cut in at 15 psi

.2 Running period time set to keep motor in operation when started automatically, for minimum period of 1 minute for each 7.5 kW of motor rating, but not to exceed 7 minutes.

.5 Pilot lamp to indicate circuit breaker closed and power available.

.6 Alarm relay to energize audible and visible alarm through independent source of power to indicate circuit breaker open or power failure.

.7 Alarm and signal devices in controller to indicate trouble on controller and pumping unit, and loss of power.

.8 Ammeter test link and voltmeter test studs.

.9 Manual selector station, two position, marked "Automatic" and "Non-Automatic".

.10 Means on controller to operate alarm signal continuously while pump is running.

2.2 FIRE PUMP REMOTE ALARM PANEL

.1 Factory installed, coloured indicating Fire pump remote alarm panel: to NFPA 20, sheet steel, wall mounting, finished red, hinged front access door. Audible and visual alarm equipment indicating pump power failure, pump operating, supervisory power failure, controller trouble.

.1 Lamps, pushbuttons, gong, control relays, terminals.

.2 Each abnormal pump condition to light appropriate lamp and to sound audible gong alarm.

.1 Ensure gong can be push button silenced, light to remain on until abnormal condition removed, except that in event of supervisory power supply failure, gong cannot be silenced until supply restored.

2.3 MAKE UP PRESSURE PUMP CONTROLLER

.1 Make up pressure pump controller, "across the-line", combination magnetic starter, thermal overload relay, CSA Enclosure 1, hand off auto switch, control transformer with fused secondary main circuit breaker, running period timer adjustable to 1 10 minutes.

.2 Rating: 1/3 hp, 120V

.3 Ensure pump can be manually started and stopped by operation of switch located near sprinkler valve.

.4 Ensure pump can be controlled by combined manual automatic start interconnected with high low pressure switch installed on fire pump discharge line.

2.4 PUMP CONTROLLER ENCLOSURE

.1 Supply Hoffman enclosure with dimensions that can comfortably fit Pump Controller/ATS, A heater, 2 lights, and conduit/cable marshalling along the sides. See drawings for more details.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for fire pump controller installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

3.2 INSTALLATION

.1 Install fire pump controller and system to requirements of authority having jurisdiction.

.2 Connect make up pressure pump to emergency supply, using properly supported rigid conduit.

3.3 FIELD QUALITY CONTROL

.1 Conduct acceptance tests on complete system.

.2 Submit written statement that work covered in this installation has been completed and tested to approved plans and specifications, by authority having jurisdiction together with request for approval and acceptance testing.

.3 System is subject to final inspection, test and approval by authority having jurisdiction.

.4 System is subject to an operational test witnessed by authority having jurisdiction.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by fire pump control installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 International Electrotechnical Commission (IEC)

.1 IEC 947-4-1-2002, Part 4: Electromechanical contactors and motor-starters.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide shop drawings: in accordance with Section 01 33 00- Submittal Procedures.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta.

.2 Provide shop drawings for each type of starter to indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout and components.

.4 Enclosure types.

.5 Wiring diagram.

.6 Interconnection diagrams.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00- Closeout Submittals.

.2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

.3 Extra Materials:

.1 Provide listed spare parts for each different size and type of starter.

.1 3 contacts, stationary.

.2 3 contacts, movable.

.3 1 contacts, auxiliary.

.4 1 control transformer.

.5 1 operating coil.

.6 2 fuses.

.7 10% indicating lamp bulbs used.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00- Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIALS

.1 Starters: to IEC 947-4 with AC4 utilization category.

2.2 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.3 SINGLE PHASE MOTOR STARTERS

.1 For motors ¼ hp and above, quick-make, quick-break with 120VAC operating coil, motor rated contacts sized for the hp rating of the motor controlled.

2.4 THREE PHASE MOTOR PROTECTION SWITCHES

.1 Across-the-line magnetic motor protection switches with three overload relays, complete with 120 V operating coil, 600/120 V control transformer of sufficient VA to handle the starter coil, controls, and integral pilot light.

2.5 COMBINATION STARTERS

.1 Molded case air circuit breaker style complete with rotary type switch with operating handle and lock-off facility. Opening starter enclosure restricted by the use of a defeater screw, unless switch is in the "Off" position.

.2 Each combination magnetic motor protection switch installed in unit motor control centre to house the following facilities:

1. Moulded case automatic air circuit breaker.
2. Contactor with three overload relays.
3. 120 V holding coil.
4. Pilot light in cover (LED type).
5. Reset button, HOA switch in cover, field convertible to Off/Auto or Start/Stop push button as indicated.

6. Two sets of normally open auxiliary contacts in addition to the standard auxiliary holding contacts supplied with each contactor. One set of auxiliary contacts convertible to normally closed.

7. Control transformer primary and secondary fusing - primary fusing to be HRC type.

8. Control transformer 600/120 V of sufficient VA to operating coil and associated controls.

2.6 ACCESSORIES

.1 Pushbutton: heavy duty, oil tight as required.

.2 Selector switches: heavy duty, oil tight as required.

.3 Indicating lights: heavy duty, oil tight, type and colour as indicated.

2.7 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00- Common Work Results for Electrical.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 In finished area, provide flush mounted motor protection switches complete with stainless steel cover plates.

.2 The current rating of all starter contacts shall be at least 130% of the full load rating of the motor controlled for all motors 10 h.p. (7.5 kW) and less. The full load current used for the calculation shall be that given by Table 44 of the current Edition of the Canadian Electrical Code.

.3 Coordinate motor starter relay sizes of all motors. This co-ordination to be performed at time motors are connected. Starter relay heaters as furnished with starters to be checked in field and if not correctly installed by the manufacturer, they shall be changed and sized according to manufacturer's recommendations for the motor nameplate full load current.

.4 Furnish disconnect for motors as required by the Canadian Electrical Code.

.5 Motors furnished by others to have the following voltage and phase characteristic, unless specifically shown otherwise on the drawings in the Motor

or Equipment Schedules: 0.37 kW (½ h.p.) and less, 120 volt, single phase; all motors 0.56 kW (3/4 h.p.) and over, 208 volt, three phase.

.6 The location and method for connecting to each item of equipment shall be verified prior to roughing-in. The voltage and phase of each item of equipment shall be checked before connecting and if not proper for the energy available, the Departmental Representative shall be promptly notified. Motor rotations shall be made in the proper direction. Minimum size flex for mechanical equipment shall be 13 mm except at small control devices only where 9.5 mm flex may be used. Motors exposed in mechanical equipment rooms to be connected with "Sealtite" flex with a minimum 150 mm slack loop. Pump motors are not to be test run until liquid is in the system. Length of flex used for mechanical equipment connections shall not exceed one metre in length. Conduit shall not be installed on vibrating mechanical equipment.

.7 Mechanical equipment to be installed by others shall be connected complete under this work including all incidental materials, devices, fittings and labour required for a properly finished electrical installation. The connection requirements shall be determined before roughing-in to ensure the proper type of outlet and connection required and the proper location of conduit or outlet.

.8 Where manual motor starters are shown mounted on splitters or in motor control centers, provide suitably sized moulded case breaker or fused switch ahead of starter in accordance with Canadian Electrical Code requirements.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 10 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4-02(R2007), Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE PC62.41.1 Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.

.3 ASTM International Inc.

.1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 CSA Group (CSA)

.5 ICES-005-07, Radio Frequency Lighting Devices.

.6 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00- Quality Control.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 01 45 00- Quality Control.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Divert unused metal materials from landfill to metal recycling facility.

.4 Disposal and recycling of fluorescent lamps as per local regulations.

.5 Disposal of old PCB filled ballasts.

Part 2 Products

2.1 LUMINAIRES

.1 Product Manufacturers: Provide luminaires by one of the approved manufacturers as noted on the drawings.

.2 Diffusers: acrylic, tempered glass or polycarbonate. Do not use styrene diffusers.

2.2 LAMPS

.1 Provide all luminaires complete with lamps or tubes.

.2 LED Lamps:
- .1 80lm/W minimum efficiency.
- .2 Life Span: 100,000 hour, to LM70
- .3 Manufacturer: Cree or equivalent
- .4 Colour Temperature: 4000K

2.3 BALLASTS

.1 LED Driver: to Canadian Ballast Manufacturers (CBM), instant start and as follows:

- .1 Type: Electronic 20 – 42 kHz
- .2 Power Factor: 0.98 for primary lamp.
- .2 Total Harmonic Distortion (THD): < 10%
- .3 Sound Rating: Class A
- .4 Exterior Ballast Rating: Low temperature (-30ºC)

2.4 LIGHTING CONTROLS

.1 Controls: Provide switches, photoelectric controls, timers and relays for lighting circuits and luminaires as indicated on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Provide adequate supports for luminaires. Comply with hazardous location installation requirements. Use rigid conduit for suspended luminaires. Do not support luminaires over 5 kg in weight from outlet boxes.

.2 Coordinate luminaire installation with architectural details, reflected ceiling plans and mechanical equipment. Install accurately in line and level, to present a neat appearance and avoid conflicts.

.3 Follow hazardous installation guidelines from manufacturer and CEC codes for devices and equipment installed in Zone 22 areas.

.4 Do the following prior to Interim Acceptance of the Work:

.1 Clean all luminaires to remove construction dust and debris.

.2 Re-lamp with new lamps, all luminaires which have been used for more than two months as temporary lighting during construction.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 10 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.141-15 , Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for [emergency lighting] for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location, indoors, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect emergency lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No. 141-15 and as follows:

.1 Self-contained Units: complete with sealed lead acid battery of minimum 30 min capacity for connected load, solid state charger, wall bracket or shelf, and two integral LED heads.

.2 Remote Heads: two LED heads mounted on common wall bracket.

.3 Hazardous Rating: Match hazardous ratings for equipment noted in Zone 22 areas or other specific areas on drawings. Equipment must be suitably marked for a Zone 22 area or applicable hazardous areas.

.2 Supply voltage: 120 V, AC.

.3 Operating time: 30 minutes.

.4 Battery: sealed, maintenance free.

.5 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.6 Solid state transfer circuit.

.7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.8 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.9 Auxiliary equipment:

.1 Ammeter.

.2 Voltmeter.

.3 Test switch.

.4 Time delay relay.

.5 Battery disconnect device.

.6 AC input and DC output terminal blocks inside cabinet.

.7 Cord and plug connection for AC.

.8 RFI suppressors.

.10 Product Manufacturers: Provide emergency lighting luminaires by one of the approved manufacturers as noted on the drawings.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type: rigid steel except in non-classified areas. See 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings

.2 Conductors: See 26 05 21- Wires and Cables. In accordance with manufacturer's recommendations or as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Provide adequate supports for luminaires. Comply with hazardous location installation requirements. Use rigid conduit for suspended luminaires. Do not support luminaires over 5 kg in weight from outlet boxes.

.2 Coordinate luminaire installation with architectural details, reflected ceiling plans and mechanical equipment. Install accurately in line and level, to present a neat appearance and avoid conflicts.

.3 Follow hazardous installation guidelines from manufacturer and CEC codes for devices and equipment installed in Zone 22 areas.

.4 Do the following prior to Interim Acceptance of the Work:

.1 Clean all luminaires to remove construction dust and debris.

.2 Re-lamp with new lamps, all luminaires which have been used for more than two months as temporary lighting during construction.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00- 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 00 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

1. General

1.1 INTENT

.1 The work in this section to include, but not necessarily be limited to the following:

.1 Supply, installation, connection and calibration of all instruments as listed in Section 27 20 12.

.2 Programming of the Programmable Logic Controller (PLC) to connect and operate the new devices and associated control requirements noted

.3 Shipment of instrumentation components to the control and instrument panel manufacturer where applicable.

.4 Supply, installation and connections of all cable, conduit and wiring for the control and instrumentation systems.

.5 Supply, installation and connection of control panels.

.6 Commissioning of all instruments as described in Division 01.

1.2 SHOP DRAWINGS

.1 Submit the following items:

.1 Field Instruments listed in section 27 20 12

.2 Control Panels

.3 Control relays

.4 Rail-mount terminals

.5 Rail-mount fuse holders

.6 Power Supplies

.7 Selector Switches and Push Buttons

.8 Uninterruptable Power Supplies

.2 Shop drawings to indicate (where applicable):

.1 Instrument tag numbers(s)

.2 Available range

.3 Materials of construction

.4 Wetted materials

.5 Accuracy

.6 Rating of enclosure

.7 Other details listed on the Instrument Specification Sheet

.8 Detailed wiring/interconnection diagrams with terminal labels

.9 Complete product part numbers for each piece of equipment

.10 Any additional information requested by Departmental Representative

2. Products

2.1 SPARE PARTS

.1 Provide the following spare parts in each control panel:

.1 Five bulbs of each type used.

.2 Ten fuses of each type and rating used.

.3 Two control relays of each type used.

.4 Two rail-mount circuit breakers of each type used.

.5 Two push-button and selector switch contact blocks to each type used .

2.2 TERMINALS

.1 Unfused terminals to be CSA approved for 600 V, 10A, accepting #12-#18 wire. Terminals to be:

.1 Compatible with Weidmuller SAK4

.2 Fused terminals to be CSA approved for 300 V, 10A, with blown-fuse indicator operating on 120 VAC, accepting #10 - #14 wires, and either 5x20 mm fuses or 1/4" x 1.4" fuses, or both. Terminals to be:

.1 Compatible with Weidmuller ASK-1 or equivalent

.3 Provide and install 10% spare terminals of each type used.

.4 Grounding terminals to be CSA approved for 300V, 15A, accepting #14 wires, grounding to the rail, colored green & yellow. Terminals to be:

.1 Compatible with Weidmuller SAK2.5

.5 Shorting bars to be used for jumpering. Wire jumpers are not acceptable.

.6 Terminals to be colored as shown:
Ground – Green and yellow
120V Line – black
120V Neutral – White
24V DC – Blue, Red

.7 All terminals to be DIN rail mounted. DIN rail is – G Section EN 50035.

3. Execution

3.1 INSTRUMENT TAGGING

.1 Provide each instrument with a tag stamped or engraved with the Instrument number.

.2 Tags to be done in accordance with specifications described in Section 27 20 12.

.3 The code lettering and number system shall be as shown on the Contract Drawings or as directed by the Departmental Representative.

.4 Affix tags to instruments with nylon tie-wraps or adhesive. Do not use adhesive on curved surfaces.

3.2 COMMISSIONING

.1 Commission all instruments as described in Division 01. Commission PLC programming mentioned in 3.4 – confirm that all new additions fulfill their purpose and confirm that the existing process continues to function the same as before without any issues resulting from modifying the PLC program.

.2 Retain the services of the equipment Manufacturers Technical Representative as required as described in Section 27 20 12

.3 Upon completion of construction, all circuits are to be operational and all instruments operating within manufacturer's specifications.

.4 Prior to notifying Departmental Representatives Commissioning Team to begin commissioning activities, verify all PLC inputs, and outputs, and complete Record Drawings.

.5 Electrical controls, circuits and systems shall be tested by trial operation of control equipment after all wiring is completed to see that each interlock and control function operates in accordance with the contract drawings and the description of operation for the equipment. Where field conditions prevent actual equipment functioning during testing, The contractor shall simulate the intended operating condition in the associated control circuits.

.6 The contractor shall locate the cause of any malfunction and make the necessary wiring and / or equipment changes or corrections to obtain the particular systems intended operation as defined by the contract drawings. Such changes shall be included in the test report.

.7 Control Panels shall be operated through all design functions. This shall include remote operation of all equipment and actuation of alarms and indicating devices according to design requirements.

.8 Complete operation tests shall be given to all relays, and control devices to show that the equipment performs all design functions and meets design and procurement specifications.

.9 During start-up, assist Commissioning Team in debugging system operation and correct any deficiencies and omissions which appear.

3.3 RECORD REPORTS

.1 During each of the aforementioned tests, the electrical contractor shall maintain a comprehensive set of test reports defining the specific condition in which the apparatus is left, after it has been given approval for use in its indented service. The completed report shall become the property of the Departmental Representative.

.2 A Departmental Representative supplied check list type report for each individual item of all electrical equipment listed in Division 27, should be headed with but not limited to the following identification data, defining:

1 Equipment Name
2 Item Tag Number
3 Manufacturer
4 Type of Class
5 Application
6 Plant Location
7 Voltage Rating
8 Date of Test
9 Ambient Conditions
10 Testers Signature

.3 Among the specific requirements of testing to determine the equipments operation condition relative to that particular apparatus, all items shall be visually inspected and evaluated on the report as to its general condition both exterior and interior.

3.4 PLC PROGRAMMING

.1 The existing PLC system is a Modicon Quantum PLC with a Wonderware HMI. Existing WonderWare software and PC operating system is not current, and therefore not supported. The contractor will need to have experience with a similar system to program the devices to the available software version as follows:

.1 Audible Alarm – OP 10062: Discrete Output, Audible output to audible horns alarm to be created on initiation of emergency stop or other possible fire risk related fault shutdowns. Emergency stop devices if present should be programmed to initiate audible alarm output. Fire risk related shutdowns with direct inputs are belt rub sensors, and the belt slow down sensors. Programming on the initiation of the alarm from analog devices is noted below.

.2 MUA Enable – OP 10063: Discrete Output, MUA to be operated with warm side air dust collector systems P93, this system replaces transfer fan MF-1 (Steam Chest Fan on old record drawings and PLC program. Assigned to PLC output OP 00242 for reference). Remove related MF-1 programming. The control should enable the make-up air on the operation of warm side dust collector P93, and shut down when the dust collector is shut down. The output for “Dust Collector (Warm Air)” is assigned to PLC output OP 00225.

.3 Drop Chute 1 / 2, Raise / Lower – OP 00077, OP 00078, OP 00079, OP 00080: There are 2 drop Chutes for the most commonly used feed systems. The basic operation of these chutes would be ahead of the chutes being used for feed truck or bin filling. The Lower command output to lower the chute to the desired height ahead of the feed being dispensed. The lower command should be programmed with the fill truck modifier to allow for different drop times ahead of the feed being delivered, the drop time to be calibrated for timed length of travel and the travel length being provided to enable manual resetting of the chute drop or calibration for different chute attachments that may be desired by the operator. Raise command shall enable when feed process is completed, fixed run time to 5 seconds past drop time. Chute ## connected to OP 00077, OP 00078, for lower ad raise respectively, and chute ## connected to OP 00079, OP 00080, for lower ad raise respectively.

.4 Belt Rub Sensors – IP 30009, IP 30010, IP 30011, IP 30012, IP 30013, IP 30014, IP 30015, IP 30016, IP 30017, IP 30018: Analog inputs that will generate a differential temperature flag from right to left to sense when a belt rub condition exist and a differential temperature to the nonoperational legs for the interior legs and to the ambient temperature sensor for the main leg. Temperature differentials 5°C (User adjustable 2-40°C) may occur over an averaged 1 minute period (user adjustable from 20s to 200s) the leg will shut down and trigger the audible alarm. Reset of the audible and manual reset of the process will only be enabled on the screen after a 5 second ring time.

.5 Speed Sensor – IP 30003, IP 30004, IP 30005, IP 30006, IP 30007,: Leg Speed Sensors to have base line speeds based on regular operating conditions and where a speed slow down occurs over a 10s period (user adjustable from 5 to 30s) the leg will shut down and trigger the audible alarm. Reset of the audible and manual reset of the process will only be enabled on the screen after a 5 second ring time. Speed threshold is to be 80% of the normal operating speed.

.6 Ambient Temperature Sensor – IP 30008: Ambient Temperature Sensors to display current ambient temperature on screen. Sensor temperature shall be used to compare against temperature signals from the leg belt rub indicators.

.7 Safety alarm logic – Alarm and acknowledge logic shall be added for alarms listed in the Alarm List table. Logic additions to follow similar logic found within the existing program and assign unused addresses. Once an alarm occurs, the alarm will become latched. The alarm will stay latched (even through a power failure) until the condition causing the alarm has been removed AND the alarm has been acknowledged by the operator via the operator workstation.

.8 Operator screen modifications (InTouch) – InTouch screen modifications shall use identical graphics objects, colours and tag configurations similar to existing components of the InTouch operator interface configuration.

.9 Operator screen submittals – Contractor shall submit shop drawings with annotated screen shots of each InTouch screen that will be modified. Annotations shall show where new graphics, discrete status and numerical displays will be located on existing screens. If new screens are to be created, annotations shall show the general layout of new graphics, discrete status and numerical displays will be located. The Contractor must submit annotated screen shots for review by the Owner and the Owner's representative before any work commences on InTouch screens.

.2 The PLC program is to be properly annotated to match existing programming methodology and back-ups of new and old program are to be supplied for continued operation of the feed mill system.

END OF SECTION

1. General

.1 Not Applicable.

2. Products

2.1 WIRE AND CABLE

.1 Wire for 120 VAC control signals to be as specified in Division 16, except that control wiring within cabinets shall be #18 AWG.

.2 All control wires shall be color coded as follows:

120VAC Hot- Black.
120VAC Neutral- White.
24VDC Positive- Red.
24VDC Negative- Blue.
GROUND- Green.

.3 Wire for 24 VDC analog instrument signals to be stranded copper, AWG 18 or AWG 20, foil or braided shield, 300V rating.

.4 All control and instrumentation cables not in control cabinets shall be protected via interlocked galvanized steel or RPVC Conduit or aluminum armour with PVC Coating.

.5 All wiring in Hazardous Areas are to be installed in explosion proof conduit or wired to ensure that devices are intrinsically safe.

3. Execution

3.1 TERMINATION OF CONDUCTORS

.1 Where spare conductors are pulled into an instrument or junction box where spare terminals are not provided, tie back spare conductors.

.2 Where spare conductors are pulled into a control panel, provide spare terminals and terminate all conductors.

.3 The conductor and conduit schedules are intended to show the majority of the power and instrument runs. Supply, Install and connect all cables and conduit for the control instrumentation and power system to provide a complete and functional system.

3.2 CABLE LABELING

.1 Label each cable where it enters a panel or instrument with double zip tied engraved lamacoid labels. See section 16075 for electrical identification.

.2 Write on labels are not acceptable.

.3 All teck control cable is to have an outer jacket colour as follows:

.1 Instrumentation and control cable – Grey
.2 Power cable - Black
.3 Ethernet Network cable (Cat5e or Cat6) - Blue

3.3 CONDUCTOR LABELING

.1 Conductors to be labeled at each end by slip-on plastic tags Wieland type Z5 or Weidmuller type Z or equivalent, or by machine-printed heat-shrink labels.

.2 Hand-written labels are not acceptable.

3.3 CONDUIT AND WIRE

.1 Conduits for devices are to be installed in accordance with Section 26 05 34.

.2 Wiring to comply with manufacturers recommendations and the CEC.

END OF SECTION

1. General

1.1 INTENT

.1 All field instruments required including:

.1 Speed Sensors

.2 Belt Rub Sensors

.3 Temperature Sensors

1.2 UNIFORMITY OF INSTRUMENTS

.1 Instruments of one manufacturer to be used throughout to the extent practical. Variations will be permitted only where the major supplier cannot supply a particular instrument as specified.

.2 Note that where the specifications specify a variety of instrument manufacturers, these are to establish standards of quality.

.3 All instruments must be CSA approved and meet all applicable industry standards and codes.

1.3 DRAWINGS AND DESIGN

.1 The drawings are intended to show the major details of the controls and instrumentation work but it is the Contractor's responsibility to examine the electrical, mechanical, structural and architectural drawings before beginning the work and report to the Departmental Representative any discrepancies or interferences which may occur.

.2 Control and instrumentation system layouts shown on the drawings are generally diagrammatic and the locations of equipment are approximate. Exact routing of conduits, cables, wiring, tubing and air headers to be governed by the mechanical, structural and architectural conditions which prevail.

.3 The Departmental Representative reserves the right to change the location of any piece of equipment without extra payment therefore, providing only that the change is requested before installation and that the new location is within 1.5 meters of the original location.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings.

.2 Indicate:

.1 Instrument manufacturer's name, type, model, year, and serial number.

.2 The manufacturer's specifications for each instrument.

.3 Outline and arrangement drawings.

.4 Cross-sectional drawings.

.5 Materials of construction.

.6 Available range and accuracy.

.7 All other pertinent product information and data.

1.5 OPERATION & MAINTENANCE DATA

.1 Provide operating & maintenance data for incorporation into the - Operation and Maintenance Manual.

.2 Data to Include:

.1 Manufacturer's name, type, model year, capacity and serial number.

.2 Details on operation, servicing and maintenance.

.3 As-built wiring diagrams.

.4 Available range, accuracy and rating information of instrument.

2. Products

2.1 GENERAL

.1 Manufacturer and Supplier

.1 All instruments shall be of a manufacturer/supplier with service facilities in Southern Alberta.

.2 Serial Numbers and Nameplates

.1 Each piece of equipment shall be stamped with a serial number, prior to shop performance testing.

.2 Each piece of equipment shall be provided with a substantial steel or brass nameplate attached to the unit, clearly inscribed with the manufacturer's name, year of manufacture and the principal rating data.

.3 Painting

.1 Paint all equipment where applicable to match existing.

.4 Instrument Description

.1 All instruments are given a description "Tag #". The Tag # refers to the description relative to the electrical drawings for reference.

2.2 SPEED SENSORS

.1 Feed Leg Velocity Sensors: FLVS-101, FLVS-102, FLVS-103, FLVS-104, FLVS-105

.1 General
- .1 All Feed Leg Velocity Sensors within this subsection shall be provided by the same manufacturer.

.2 Size: 25 mm

.3 Location:
- .1 Feed Legs: Zone 22 Hazardous Rated

.4 Operating Conditions:
- .1 Temperature: -40 to 35°C.
- .2 Humidity: 95% Non-Condensing

.5 Specified Equipment:
- .1 Supplier: 4B Components Limited, or equivalent
- .2 Model: Whirligig WG1-4B-4 and MIL8001V4C or equivalent

2.3 BELT RUB SENSORS

.1 Applicable Equipment: BAL-101, BAL-102, BAL-103, BAL-104, BAL-105

.1 Specified Equipment:
- .1 Manufacturer: 4B Components Ltd.
- .2 Type: Brass Rub Blocks – Belt Misalignment Sensors
- .3 Model:
  - .1 Brass Block: RB2W4LR2
  - .2 Temperature Sensor: 4-20 mA, KIT-RUB-8 for 2 in x 4 in block

.2 Accessories: All connections as required.

2.4 AMBIENT TEMPERATURE SENSOR

.1 Applicable Equipment: TT-101

.1 Specified Equipment:
- .1 Manufacturer: Comet or equivalent
- .2 Type: Intrinsically safe humidity and temperature transmitter with 4-20 mA output.

.3 Model:
.1 T3110ex

.2 Accessories: All connections as required.

3. Execution

3.1 INSTALLATION

.1 The Contractor is to be responsible for the correct installation and assembly of all items of equipment. Manufacturer's instructions to be carefully read and rigidly adhered to in the installation.

.2 Any damage resulting from failure to observe the installation instruction or as a result of proceeding without sufficient knowledge of proper installations techniques will be the Contractor's responsibility.

.3 Mounting of Instruments & Accessories

.1 Instruments to be installed in accordance with the drawings. Instruments shall be rigidly supported, level and plumb, and in such a manner as to provide accessibility, protection from damage, isolation from heat, shock and vibration, and freedom from interference with other equipment, piping and electrical work.

.2 Instruments not to be installed until heavy construction work adjacent to the instruments has been completed.

.3 Instruments devices including accessories to be located where they will be accessible from structural platforms, permanent ladders, or grade. Locally mounted indicating instruments to face toward, and within reading distance of a normal operating area.

.4 Sufficient clearance to be allowed for removal of equipment for maintenance and repair.

.5 Field located instruments to be mounted on building columns and walls or pipe stands and/or other means of support as required in accordance with manufacturer's instructions and the Drawings.

3.2 INSPECTION

.1 The Contractor will include in his Bid for inspection and startup services by a qualified factory trained manufacturer’s representative to inspect and certify the completed installation of the field instrument.

.2 The Contractor will, after obtaining confirmation for the Engineer, arrange for the equipment supplier’s inspection and will provide sufficient personnel and materials to assist the manufacturer in the inspection and testing of each system completely.

.3 The Contractor will obtain from the manufacturer written certification of the complete installation and testing and will forward to the Engineer.

.4 The Contractor will, at their own expense, repair any irregularities or discrepancies determined during the examination. Any additional trips required by the manufacturer's representative for re-testing due to faulty installation of incomplete systems shall be borne by the Contractor.

3.3 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

.1 The equipment manufacturer's technical representative shall be familiar with the equipment supplied and shall come prepared with both knowledge and equipment to perform and interpret the test, inspections and procedures recommended by the manufacturer for the starting of equipment that has not previously been run.

.2 The equipment manufacturer's technical representative shall, immediately after completion of the inspection, convey to the Engineer in writing, confirmation of the tests and inspections carried out and the result of this examination of the work.

.3 If the inspection reveals defects in the work, correct as soon as possible and repeat the entire inspection procedure. Repeat until the work passes the inspection.

.4 Document the results of the inspection by the equipment manufacturer's representative.

.5 Ensure the installation meets all manufacturer's requirements for durable and trouble-free operation.

3.4 FIELD INSPECTION

.1 The Departmental Representative will request that the equipment be operated to demonstrate that it will perform as specified. The Engineer will note deficiencies, and if possible, the deficiency will be corrected immediately by the Contractor. All deficiencies that cannot be corrected at the time of inspection will be noted by the Engineer who will advise the Contractor of these deficiencies in writing. Correct the deficiencies as soon as possible and advise the Engineer of their correction. Should the deficiencies be of a sufficiently serious nature to require the work to be re-inspected, the cost of the inspection will be borne by the Contractor.

3.5 TRAINING

.1 The Contractor will include in their price costs a minimum of one hour of training for the operating personnel for field instruments listed in this section by qualified manufacturer personnel. The training shall cover all aspects of operation, maintenance and calibration of the equipment.

3.6 TESTING, ADJUSTING AND COMMISSIONING

.1 Testing, adjusting and commissioning of all instruments shall be in accordance with Division 01

END OF SECTION

Part 1 General

1.1 WORK INSTALLED BUT SUPPLIED UNDER OTHER SECTIONS

.1 Install and connect following components supplied under other Sections:

.1 Magnetic door holders: Section 08 70 00.

1.2 CONNECTION OF WORK SUPPLIED AND INSTALLED UNDER OTHER SECTIONS

.1 Connect via relays or otherwise, the following auxiliary equipment supplied and installed under other Sections:

.1 Door hardware: Division 08

1.3 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 01 for requirements pertaining to product options and substitutions.

1.4 REFERENCED DOCUMENTS

.1 CAN/ULC-S524:2019, Standard for the Installation of Fire Alarm Systems

.2 CAN/ULC-S526:2016, Visual Signal Appliances for Fire Alarm Systems

.3 CAN/ULC-S528-14, Manual Pull Stations for Fire Alarm Systems

.4 CAN/ULC-S529:2016, Smoke Detectors for Fire Alarm Systems

.5 CAN/ULC-S530-M91-R2018, Heat Actuated Fire Detectors for Fire Alarm Systems

.6 CAN/ULC-S533-15, Egress Door Securing and Releasing Devices

.7 CAN/ULC-S537-13 (R2018), Verification of Fire Alarm Systems

.8 ULC-S525:2016, Audible Signal Devices for Fire Alarm Systems

.9 ULC-S527-99, Control Units for Fire Alarm Systems

.10 ULC-S553-14-R2019, Installation of Smoke Alarms

.11 To comply to the Canadian Electrical Code (CEC) Class II Division I Group G hazardous locations.

1.5 DESCRIPTION OF SYSTEM

.1 Single stage, hard wired, conventional component, class B, supervised, annunciated, fire alarm system consisting of the following major components:

.1 Control panel with integral annunciator
.2 Remote annunciator panels
.3 Manual fire alarm stations
.4 Thermal detectors
.5 Products-of-combustion detectors
.6 End-of-line resistors
.7 Audible and visual signal appliances
.8 External relay driven devices

.2 The facility is to be divided into fire zones as indicated on the drawings. Each zone is to be isolated from other fire zones with zone isolation modules. The fire zones will respond to the alarms as indicated.

.3 Function description (First Stage Alarm)

.1 Upon a first stage alarm only the zone in alarm is to be annunciated with a slow temporal alarm. The remaining zones throughout the facility are to remain in a normal state (no annunciation in these zones).
.2 The magnetic holders and locks will deactivate upon a first stage alarm in the affected zones.
.3 Signal to be sent to the fire alarm monitoring agency.

1.6 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

.1 Comply with requirements of Section 26 05 00 – Common Work For Electrical.

.2 Provide factory data sheets for the following:

.1 Annunciator panels: indicating materials, finishes, layouts, and proposed labeling.
.2 System devices: indicating typical wiring connection, installation instructions, control settings, and component limitations

.3 If requested by 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 Audible and visual signaling devices

1.7 OPERATION AND MAINTENANCE DATA

.1 Comply with requirements of Section 26 05 00.

1.8 SUPPLIER QUALIFICATIONS

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

1.9 SOURCE OF SUPPLY

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

1.10 COORDINATION

.1 Coordinate installation of fire alarm system with:

.1 Mechanical equipment controls specified in Division 23.
.2 Other related work.

.2 Coordinate with the above noted work as required to provide a complete, integrated, and functional system.

Part 2 Products

2.1 CONTROL PANEL

.1 Control Panel: to CAN/ULC-S527, sheet steel construction, semi-flush mounted, hinged doors, integral remote battery compartment, and integral annunciator panel.

.2 Features:

.1 10 initiating device circuits (IDC)
.2 4 signal circuits (NAC)
.3 To be compatible with existing Fire Alarm system
.4 Additional relay contacts required with new panel

.3 Operation of System Supervision:

.1 Fault on system or power failure condition shall cause:
.1 Trouble signal to operate.
.2 Trouble lamp to illuminate.
.3 Silence switch to de-activate trouble signal only.

.2 Trouble signal to reset automatically on system restoration.

2.3 REMOTE ANNUNCIATOR PANELS, GENERALLY

.1 Construction: Sheet steel, painted, flush mounted.

2.4 MANUAL FIRE ALARM STATIONS

.1 Manual Fire Alarm Stations: to CAN/ULC-S528 and as follows.

.1 Type: intelligent analog device.
.2 Contacts: normally open.
.3 Construction: metal.
.4 Features: glass rod.
.5 Operation:
.1 First stage: manual lever.
.2 Second stage: key operated.
.6 To comply to CEC Class II Division I Group G hazardous locations.
.7 Explosion proof manual station

2.5 THERMAL DETECTORS

.1 Thermal Detectors: to CAN/ULC-S530 and as follows.

.1 Type: intelligent analog device.
.2 Mounting: 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 Auxiliary contracts for remote annunciation.
.5 Screw terminals: designed to accept No. 14 AWG conductors, separate terminal for each conductor.
.6 Operation:
.1 Projecting centre disk shall indicate when alarmed.
.2 Fixed Temperature Type: non reset shall operate at 88°C.
.3 Fixed Temperature and Rate of Rise Type:
.1 Rate of rise element: reset type.
.2 Fixed temperature element: 88°C non reset type.
.3 Rate of rise: 8°C per minute.
.4 Selection of heat detector type:
.1 Heat detectors shall be installed in areas based on manufacturer's recommendations.
.7 Explosion proof heat detector Model

2.9 SIGNAL APPLIANCES

.1 Audible signal appliances: to ULC-S525 and as follows.
.1 Voltage: 24 V DC.
.2 Mounting: wall mount.
.5 Horn: Explosion Proof dB rating 100dBA at 3 meters. ULC rated for use in Canada. To come with appropriate back box and mounting hardware for

flush mounting.

.6 Explosion proof horn

.2 Visual signal appliance: to CAN/UCL-S526 and as follows:

.1 Voltage: 24VDC

.2 Mounting: device to mount in conjunction with audible signal appliances.

2.10 VIBRATING BELLS (PLC AUDIBLE ALARM)

.1 Manufacture: Edwards Signaling or approved alternate

.2 Model: to comply to CSA Class II Division I Group G hazardous locations.

.1 Universal Adaptaplate for mounting directly on surface or electrical box

.2 Shockproof die cast housing and Dustproof

.3 Corrosion resistant heat flowed epoxy finish

.4 Size: 102mm

.5 120VAC 60HZ, 0.062 A

2.11 END-OF-LINE RESISTOR ASSEMBLY

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

2.12 RELAY MODULE

.1 Addressable relay module complete with form “C” dry relay contact rated at 0.5 amps at 120 VAC. Module to include a green polling LED and a red alarm LED.

2.13 ISOLATION MODULE

.1 Addressable line isolation module. Module is to isolate short circuits within floor areas exceeding 2,000 sqare meters and between floors, so that a fault witing one floor area shall not affect another floor area. At least one isolator module shall be provided for each protected zone of the building.

2.14 INPUT MODULE

.1 Addressable input module complete with supervised Class “B” input circuit(s) to monitor non addressable contact devices. Module to include a green polling LED and a red alarm LED.

2.15 WIRE AND CABLE

.1 Remote Control and Signal Cable: as specified in Section 26 05 13.

2.16 HAZARDOUS DEVICES

.1 Hazardous areas are to have devices that are suitably labeled for service in specific area.

Part 3 Execution

3.1 INSTALLATION

.1 Install system in accordance with CAN/ULC-S524.

.2 Mount end-of-line resistors where indicated in accordance with Rule 32-008 of the Canadian Electrical Code.

.3 External AC Power Supply:
- .1 Provide 120 V AC emergency supply, two circuits.
- .2 Provide separate breaker(s) clearly marked "Fire Alarm System".
- .3 Provide locking device on breaker(s).
- .4 Provide power supply disconnect breaker location in control panel.

.4 Central Station Tie-In:
- .1 Provide 19 mm conduit and 2 No. 14 conductors to telephone panel for central station tie-in.

.5 Wiring:
- .1 Make conductor terminations in panel on terminal strips with separate terminal for each conductor.
- .2 Neatly install wiring clamped with nylon cable straps or laced with jute cord.
- .3 Attach wiring diagram to inside of panel door.
- .4 All wiring to comply to CEC Class II Division I Group G hazardous locations.

.6 Connect the following fire alarm system components as indicated on drawings:
- .1 Manual fire alarm stations.
- .2 Thermal detectors.
- .3 Ionization products-of-combustion detectors.
- .4 Duct detectors.
- .5 Audible signal appliances.
- .6 Visual signal appliances.

3.2 TESTING AND VERIFICATION

.1 Verify completed system in accordance with requirements of CAN/ULC-S537.

3.3 DEMONSTRATION AND INSTRUCTION

.1 Provide any additional reprogramming to improve operation, from issues arising from demonstration.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for fire alarm systems.

.2 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating [two-stage] [general] alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.

.3 Trouble signal devices.

.4 Power supply facilities.

.5 Manual alarm stations.

.6 Automatic alarm initiating devices.

.7 Audible signal devices.

.8 End-of-line devices.

.9 Annunciators.

.10 Visual alarm signal devices.

.11 Ancillary devices.

1.2 REFERENCE STANDARDS

.1 Government of Canada

.1 TB OSH Chapter 3-03, 1997-01-28, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.

.2 TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 National Fire Protection Agency

.1 NFPA 72-2002, National Fire Alarm Code.

.2 NFPA 90A-2002, Installation of Air Conditioning and Ventilating Systems.

.4 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

.5 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524-2019, Standard for the Installation of Fire Alarm Systems.

.2 CAN/ULC-S525-2016, Audible Signal Device for Fire Alarm Systems.

.3 CAN/ULC-S526-2016, Visual Signal Devices for Fire Alarm Systems.

.4 CAN/ULC-S527-M87, Control Units for Fire Alarm Systems.

.5 CAN/ULC-S528-14, Manual Pull Stations for Fire Alarm Systems.

.6 CAN/ULC-S529-2016, Smoke Detectors for Fire Alarm Systems.

.7 CAN/ULC-S530-M91-R2018, Heat Actuated Fire Detectors for Fire Alarm Systems.

.8 CAN/ULC-S531-2019, Standard for Smoke Alarms.

.9 CAN/ULC-S536-2019, Standard for Inspection and Testing of Fire Alarm Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00- Submittal Procedures.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00- Submittal Procedures.

.2 Shop Drawings:

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

.1 Shop drawings: stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Include:

.1 Layout of equipment.

.2 Zoning.

.3 Complete wiring diagram, including schematics of modules.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00- Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: manufacturer's field reports specified.

.4 Closeout Submittals:

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00- Closeout Submittals in accordance with ANSI/NFPA 20.

.2 Authority of Jurisdiction will delegate authority for review and approval of submittals required by this Section.

.3 Submit to Authority of Jurisdiction 2 sets of approved submittals and drawings immediately after approval but no later than 15 working days to prior to final inspection.

.4 Submit following:

.1 Manufacturer's Data for:

.1 Control panel and modules.
.2 Storage batteries.
.3 Battery charger.
.4 Manual pull stations.
.5 Heat detectors.
.6 Open-area smoke detectors.
.7 Duct smoke detectors.
.8 Alarm bells.
.9 Alarm horns.
.10 Visible appliances.
.11 Main annunciator.
.12 Remote annunciator panel.
.13 Graphic annunciator panel.
.14 Master fire alarm boxes.
.15 Auxiliary transmitter.
.16 Master box pedestal.
.17 Radio master box pedestal.
.18 Master box.
.19 Radio master box location light.
.20 Radio fire alarm master box.
.21 Radio fire alarm auxiliary transmitter.
.22 Radio fire alarm interface panel.
.23 Combination auxiliary transmitter and interface panel.
.24 Freeze protection thermostatic switch.
.25 Electro-magnetic door holder-releases.
.26 Valve tamper switches.
.27 Wiring.
.28 Ground rods.
.29 Conduit.
.30 Outlet boxes.
.31 Fittings for conduit and outlet boxes.
.32 Trouble buzzer.
.33 Projected beam smoke detector.
.34 Surge suppression devices.

.35 Mark data which describe more than one type of item to indicate which type will be provided.

.36 Submit 1 original for each item and clear, legible, first-generation photocopies for remainder of specified copies.

.2 System wiring diagrams:

.1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.

.2 Show modules, relays, switches and lamps in control panel.

.3 Design data: Power Calculations:

.1 Submit design calculations for new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.

.2 Show comparison of detector power requirements per zone versus control panel smoke detector power output per zone in both standby and alarm modes.

.3 Show comparison of notification appliance circuit alarm power requirements with rated circuit power output.

.4 Instructions for operation:

.1 Projected beam smoke detector.

.5 Schedules:

.1 Conductor wire marker schedule.

.6 Test Reports:

.1 Open-area 2-wire smoke detectors.

.2 Preliminary testing:

.1 Final acceptance testing.

.2 Submit for inspections and tests specified under Field Quality Control.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in fire alarm system installations approved by manufacturer with documented 5 experience].

.2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

.3 System:

.1 To TB OSH Chapter 3-04.

.2 Subject to Fire Commissioner of Canada (FC) approval.

.3 Subject to FC inspection for final acceptance.

.4 To Canadian Forces Fire Marshal approval.

.4 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00- Closeout Submittals.

.5 Maintenance Service:

.1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00- Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to CAN/ULC-S525.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Manual pull stations: to CAN/ULC-S528.

.7 Thermal detectors: to CAN/ULC-S530.

.8 Smoke detectors: to CAN/ULC-S529.

.9 Smoke alarms: to CAN/ULC-S531.

2.2 SYSTEM OPERATION

.1 Provide complete, electrically supervised, code 3 temporal common coded, manual and automatic, zoned, annunciated, fire alarm system.

.2 Provide separate circuits from control panel to each zone of initiating devices. Transmission of signals from more than one zone over common circuit to control panel is prohibited.

.3 Single stage operation. Operation to actuation following:

.1 Manual station.

.2 Heat detector.

.3 Smoke detector.

.4 Automatic fire sprinkler system.

.5 Fire extinguishing system.

.6 Fire standpipe system.

.4 Actuation of single operation device to initiate following:

.1 Building evacuation alarm devices to operate continuously.

.2 Transmit signal to fire department via monitoring station fire alarm transmitter.

.3 Zone of alarm device to be indicated on control panel and remote annunciators.

.4 Air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.

.5 Fire doors and smoke control doors if normally held open, to close automatically.

.6 Electro-magnetic door holders to de-energize.

.7 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.

.5 Two stage operation: operation to actuation following:

.1 Manual station.

.2 Heat detector.

.3 Smoke detector.

.4 Automatic fire sprinkler system.

.5 Fire extinguishing system.

.6 Fire standpipe system.

.6 Actuation of two stage operation device to initiate following:

.1 Audible signal devices throughout building to sound at 20 strokes per minute.

.2 Audible signal devices in zone of alarm and zones on floor level immediately above and floor level immediately below adjacent zones on same floor level to sound continuously while other audible signal devices throughout building sound at 20 strokes per minute.

.3 Zone of alarm to be indicated on control panel and remote annunciator.

.4 Transmit signal to fire department via monitoring station fire alarm transmitter.

.5 Air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.

.6 Fire doors and smoke control doors if normally held open, to close automatically.

.7 Electro-magnetic door holders to de-energize.

.8 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.

.7 Operation of alarm initiating device on second stage to:

.1 Cause audible signal devices throughout building to sound continuously.

.8 Capability to program smoke detector status change confirmation on any or zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

.1 Class A.

.2 Single stage operation.

.3 Zoned.

.4 Coded

.5 Enclosure:

.1 CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.

.2 Provide modular type panel installed in surface mounted steel cabinet with hinged door and cylinder lock.

.3 Mount with panel centerline 1.5m above finished floor elevation.

.4 Switches and other controls: not accessible without use of key.

.5 Design of control panel: neat, compact assembly containing parts and equipment required to provide specified operating and supervisory functions of system.

.6 Control panel components: CSA approved and approved by control panel manufacturer for use in control panel.

.7 Panel cabinet: finished on inside and outside with factory-applied enamel finish.

.8 Provide main annunciator located on exterior of cabinet door or visible through cabinet door.

.9 Provide audible trouble signal.

.10 Provide rigid plastic identification plates, silk-screened labels attached to rear face of panel viewing window, for lamps and switches.

.11 Provide 1 set of Form C dry alarm contacts per zone, common system Form C dry alarm contact, and common system Form C dry trouble contact.

.12 Permanently label switches.

.13 Provide panel with following switches:

.1 Trouble silencing switch which silences audible trouble signals including remote trouble devices without extinguishing trouble indicating lamp(s).

.1 For non-self-resetting type switch: Upon correction of trouble condition, audible signals will again sound until switch is returned to its normal position.

.2 For silencing switch of momentary action self-resetting type: trouble signal circuit automatically restored to normal upon correction of trouble condition.

.2 Evacuation alarm silencing switch which when activated will silence alarm notification appliances without resetting panel, and cause operation of system trouble signals. Subsequent alarm(s) from additional zone(s) not originally in alarm to cause activation of notification appliances even with alarm silencing switch in "silenced" position.

.3 Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of system and zone trouble signals.

.4 Reset switch which when activated will restore the system to normal standby status after cause of alarm has been corrected, and activated initiating devices reset.

.1 Operation of reset switch to restore activated smoke detectors to normal standby status.

.5 Lamp test switch.

.6 Drill switch which will enable test of notification appliances and restoration to normal without tripping master box.

.7 Master box disconnect switch which when activated will disconnect coded device and cause operation of system trouble signal.

.8 HVAC shutdown bypass switch. Operation of the switch to allow HVAC system to operate with detectors in alarm and cause operation of system trouble signals.

.6 Supervised, modular design with plug-in modules:

.1 Alarm receiver with provision for remote supervised annunciation, trouble and alarm indications, for class A initiating circuit.

.2 Spare zones: compatible with smoke detectors and open circuit devices.

.3 Space for future modules.

.4 Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.

.7 Components:

.1 Coded alarm receiver panel with trouble and alarm indications for class A initiating circuit.

.2 Single stage alarm pulse rate panels:

.1 Single stroke control type for output to signal control panel continuously.

.3 Two stage alarm pulse rate panel for single stroke output to signal control panel. First stage-20 strokes per minute, second stage continuous.

.4 Audible signal control panel with connections.

.5 Common control and power units:

.1 Control panel containing following indications and controls:

.1 "Power on" LED (green) to monitor primary source of power to system.

.2 "Power trouble" indication.

.3 "Ground trouble" indication.

.4 "Remote annunciator trouble" indication.

.5 "System trouble" indication.

.6 "System trouble" buzzer and silence switch c/w trouble resound feature.

.7 System reset switch.

.8 "LED test" switch if applicable.

.9 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.

.10 "Signals silenced" indication.

.2 Master power supply panel to provide 24 V dc to system from 120 V ac, 60 Hz input.

.6 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit.

.1 Contacts: 2.0 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down.

.2 Contact terminal size: capable of accepting 22-12 AWG wire.

2.4 POWER SUPPLY

.1 120 V, ac, 60 Hz input, 24 V dc output from rectifier to operate alarm and signal circuits, with standby power of gell cell batteries minimum expected life of 4 years, sized in accordance with NBC.

2.5 MANUAL ALARM STATIONS

.1 Provide non-coded single action type with mechanical reset features.

.1 Non-coded single pole normally open contact for single stage.

.2 General alarm key switch for two stage system.

.2 Stations: surface mounted and explosion proof type as indicated.

.1 For surface mounting provide station manufacturer's approved back box.

.2 Back box finish to match station finish.

.3 Equip each station with terminal strip with contacts of proper number and type to perform functions required.

.4 Stations: type not subject to operation by jarring or vibration.

.1 Break-glass-front stations are not permitted

.5 Station colour: red.

.6 Provide station with visible indication of operation.

.7 Restoration to require use of key.

.1 Keys: identical throughout system for stations and control panel(s).

.8 Mount stations with operating lever not more than 1.2 m above finished floor.

.9 Where weatherproof stations are required, provide stations with cast metal, weatherproof housings with hinged access doors.

.1 Finish housings with red enamel paint and provide bilingual raised-letter plastic signage indicating "FIRE ALARM" with white letters of 19 mm high.

2.6 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors: provide heat detectors designed for detection of fire by rate compensating principle.

.2 Combination Fixed Temperature Rate-Of-Rise Detectors (Spot Type): designed for surface outlet box mounting and supported independently of conduit, tubing or wiring connections.

.1 Contacts: self-resetting after response to rate-of-rise actuation

.2 Operation under fixed temperature actuation to result in external indication.

.3 Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes to operate on fixed temperature principle only.

.3 Open-Area Smoke Detectors: provide detectors designed for detection of abnormal smoke densities by photoelectric principle.

.1 Detectors: 2-wire type.

.2 Provide necessary control and power modules required for operation integral with control panel.

.3 Detectors and associated modules: compatible with control panel and suitable for use in supervised circuit.

.4 Malfunction of electrical circuits to detector or its control or power units to result in operation of system trouble signals.

.5 Equip each detector with visible indicator lamp that will flash when detector is in normal standby mode and glow continuously when detector is activated.

.6 Provide remote indicator lamps for each detector that is concealed from view.

.7 Each detector: plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which detector base contains screw terminals for making wiring connections.

.8 Detector head: removable from its base without disconnecting wires. Removal of detector head from its base to cause activation of system trouble signals.

.9 Screen each detector to prevent entrance of insects into detection chamber(s).

.4 4-Wire Smoke Detectors: detector circuits 4-wire type capable of transmitting detector operating power over conductors separate from initiating circuit.

.1 Provide separate, power circuit for each smoke detection initiating circuit (zone).

.2 Failure of power circuit to be indicated as trouble condition on corresponding initiating circuit.

.5 2-Wire Smoke Detectors: detector circuits of 2-wire type capable of transmitting detector operating power over initiating circuit are permitted, provided detectors used are approved by control panel manufacturer for use with control panel provided and are ULC listed as being compatible with control panel.

.1 Total number of detectors on any detection circuit: not exceed 80% of maximum number of detectors allowed by control panel manufacturer for that circuit. Provide additional zones if required to meet this requirement.

.6 Ionization Detectors: multiple chamber type responsive to both invisible and visible particles of combustion.

.1 Detectors: not susceptible to operation by changes in relative humidity.

.7 Photoelectric Detectors: operate on light scattering principle using LED light source.

.1 Detector: respond to both flaming and smoldering fires.

.8 Locate detectors in accordance with their listing by ULC and the requirements of NFPA 72, except provide at least 2 detectors in rooms of 54 square meters or larger in area.

.9 Mount detectors at underside of ceiling or deck above unless otherwise indicated.

.1 For mounting heights greater than 3 m above floor level, reduce actual detector linear spacing from listed spacing as required by NFPA 72.

.2 For heights greater than 9 m space detectors no farther apart than 34% of their listed spacing.

.10 Temperature rating of detectors: in accordance with NFPA 72.

.11 Locate detectors minimum 300 mm to lighting fixtures and not closer than 600 mm to air supply or return diffuser.

.12 Ensure detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, are approved for such locations.

.13 Provide detectors with terminal screw type connections.

.14 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.

2.7 ALARM INITIATING DEVICE SPACING AND LOCATION

.1 Detector spacing and location: in accordance with manufacturer's recommendations and requirements of NFPA 72.

.2 Provide at least 2 detectors in rooms of 54 square meters or larger.

.3 Spacing: not to exceed 9 m by 9 m per detector, and 9 linear m per detector along corridors.

.4 Locate detectors minimum 0.9 m from air discharge or return grille, and not closer than 300 mm to lighting fixtures.

.5 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.

.6 Mount detectors installed beneath raised floors with base within 50 mm of underside of raised floor, with detector facing downward.

.1 Where space under raised floor is less than 300 mm in height, mount detectors with their bases either horizontal or vertical, with detection chamber(s) located in upper half of underfloor space.

.2 Do not mount detectors facing upward.

.3 Space detectors beneath raised floors maximum 4.5 m per detector.

2.8 AUDIBLE SIGNAL DEVICES

.1 Provide remote system trouble 100 mm buzzer arranged to operate in conjunction with panel's integral trouble signal – “Audible Alarm” on PLC drawings.

.2 Locate remote trouble buzzer.

.1 Provide external trouble buzzer at control panel arranged to operate in conjunction with panel's integral trouble signal.

.2 Provide trouble buzzer with rigid plastic white on red engraved identification sign which reads "FIRE ALARM SYSTEM TROUBLE".

.3 Lettering on identification sign: minimum 25 mm high.

.3 Audible device(s):

.1 Horns: Wall mounting, 24 V dc. Explosion Proof

.4 Do not exceed 80 percent of listed rating in amperes of notification appliance circuit. Provide additional circuits above those shown if required to meet this requirement.

.5 Provide appliances specifically listed for outdoor use in locations exposed to weather.

.6 Finish appliances in red enamel.

.7 For surface mounting provide appliance manufacturer's approved back box. Back box finish to match appliance finish.

2.9 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.10 REMOTE ANNUNCIATOR PANELS

.1 Provide panels where indicated mounted 1.5 m above finished floor elevation.

.2 Panels: duplicate requirements for control panel annunciator, with exception of individual trouble lamps are not required.

.3 LED type with designation cards to indicate zone.

.4 LEDs to annunciate alarm and trouble.

.5 Wired in multiple and with other remote annunciator panels with main control panel.

.6 Supervised, including trouble signal for open circuit.

.7 LED test button.

2.11 GRAPHIC ANNUNCIATOR PANEL

.1 Provide panel located as shown.

.2 Mount with panel centerline 1.5 m above finished floor elevation.

.3 Panel: Explosion proof type, surface-mounted.

.4 Panel: provided with room building floor plan, drawn to scale, with alarm lamps mounted to represent location of each concealed detector and each initiating device.

.5 Panel graphic: show locations of annunciator panel and control panel, and have "you are here" arrow showing its location. Orient building floor plan on graphic to location of person viewing graphic, i.e. direction viewer is facing is toward top of graphic display. Provide North arrow.

.6 Label principal rooms and areas shown with titles.

.7 Provide detectors and different types of initiating devices with lamps of different colours for identification. Lamps to illuminate upon activation of corresponding device and remain illuminated until system is reset.

.1 Provide panel with lamp test switch.

2.12 VISUAL ALARM SIGNAL DEVICES

.1 Surface-mounted assembly of stroboscopic type suitable for use in electrically supervised circuit and powered from notification appliance circuits .

.2 Appliances: minimum of 15 candela measured as approved by ULC, but not less than effective intensity required by National Building Code of Canada for appliance spacing and location. Provide candela rating as indicated on drawings.

.3 Protect lamps with thermoplastic lens and labelled "FIRE" in letters at least 12 mm high.

.4 Provide visible appliances within 300 mm of each audible appliance [as indicated.

.5 Visible appliances may be part of audio-visual assembly, where more than two appliances are located in same room or corridor.

2.13 VALVE TAMPER SWITCHES

.1 Provide switches to monitor open position of valves controlling water supply to sprinkler systems.

.2 Switch contacts to transfer from normal position to off-normal position during first two revolutions of hand wheel or when stem of valve has moved not more than one-fifth of distance from its normal position.

.3 Provide switch with tamper resistant cover.

.4 Removal of the cover to cause switch to operate into off-normal position.

2.14 OFF-PREMISES FIRE ALARM

.1 Provide auxiliary connection to base fire alarm system in accordance with NFPA 72, except as specified.

2.15 ALARM TRANSMITTER

.1 To be compatible with existing base system.

.2 Transmitter code number(s): as specified by Departmental Representative.

.3 Transmitter and interface : operate on 120 VAC and be provided with manufacturer's approved battery charger and standby battery adequate to supply standby power for at least 60 hours.

.4 Transmitters to send separate alarm signal for each alarm and supervisory zone on fire alarm control panel.

.5 Provide exterior antenna as recommended by transmitter manufacturer.

.6 Provide engraved rigid plastic code number plate mounted on face of housing.

2.16 GROUNDING

.1 Ground each transmitter by connection from grounding terminal connection of box to either driven ground rod or buried, metallic water pipe.

.1 Resistance to ground: not exceed 10 ohms.

.2 Ground rods: sectional type, copper-encased steel, with minimum diameter of 19 mm and total length of 3 m.

.3 Rods: hard, clean, smooth, continuous copper surface throughout rods length.

.4 Copper: minimum wall thickness of 0.325 mm at any point on rod.

.5 Ground rods: not to protrude more than 75 mm above grade.

2.17 LOCATION LIGHT

.1 Provide vapour tight type fixture constructed of cast aluminum housing and unbreakable, heat resistant, threaded ruby globe.

.2 Support light with 12 mm minimum galvanized steel conduit screwed into hub on top of master box.

.3 Locate light approximately 300 mm above master box.

.4 Mount light in pendant position.

.1 Provide light with screw-in, 9-watt minimum compact fluorescent lamp with integral ballast.

2.18 CONDUIT

.1 Rigid Steel Conduit:

.1 Zinc-Coated.

.2 Intermediate Metal Conduit (IMC):

.1 Zinc-coated steel only.

.3 Electrical Metallic Tubing (EMT)

.4 Surface Metal Raceway and Fittings:

.1 Two-piece painted steel.

.2 Totally enclosed snap-cover type.

2.19 WIRING

.1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.

.2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor

.3 Wire to remote annunciators: No. 18 AWG minimum solid copper conductor.

.4 Wire for connection to base telegraphic alarm loop: No. 12 AWG minimum solid copper conductor.

.5 Insulation 75 degrees C minimum with nylon jacket.

.6 For underground or wet allocations cable from control panel to master box auxiliary transmitter and to telegraphic loop: type UF.

.7 Colour code wiring.

2.20 SURGE SUPPRESSION

.1 Provide low voltage line voltage surge suppression devices to suppress voltage transients which might damage control panel and transmitter components.

.2 Mount suppressors in separate enclosure(s) adjacent to control panel and transmitter unless suppressors are specifically UL approved for mounting inside control panel and transmitter provided and approved for such use by control panel and transmitter manufacturer[s] .

2.21 LOW VOLTAGE SURGE SUPPRESSOR

.1 Provide surge suppression for circuits which leave building shell.

.2 When circuits interconnect 2 or more buildings, provide arrestor at circuit entrance to each building.

.3 Suppressor: UL 497B listed with maximum 30 volt clamping level and maximum response time of 5 nanoseconds.

.4 Suppressor: multi-stage construction and both differential and common mode protection.

2.22 AS-BUILT RISER DIAGRAM

.1 Fire alarm system riser diagram: in glazed frame on black lamicoid sheet with bevelled edges, white lettering and designations, minimum size 600 x 600 mm.

2.23 HALON SYSTEM

.1 Room detection and protection system, zoned non coded, electrically supervised with equipment as follows:

.1 Room fire detection panel.

.2 Manual alarm stations.

.3 Thermal detectors continued temperature type, directly under computer floor and as indicated.

.4 Smoke detectors: mounted on ceiling of room and directly under raised floor.

.5 Manual discharge station.

.6 Chime in room.

.7 Horn in room.

.8 Smoke and heat detectors to have common mounting base (interchangeable).

2.24 ANCILLARY DEVICES

.1 Remote relay unit to initiate fan shutdown.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.

.2 Install main control panel and connect to ac power supply, ac standby power.

.3 Locate and install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits to main control panel.

.6 Locate and install visual signal devices and horns and connect to signalling circuits.

.7 Connect signalling circuits to main control panel.

.8 Install end-of-line devices at end of alarm and signalling circuits.

.9 Install remote annunciator panels and connect to annunciator circuit wiring.

.10 Locate and install door releasing devices.

.11 Locate and install remote relay units to control fan shut down.

.12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.13 Room detection system including Halon 1301.

.1 Locate and install detectors. Make necessary connections between room detection panel and main fire alarm panel.

.2 Locate and install visual alarms audible signals.

.3 Locate and install detectors under raised floor. Fasten to steel brackets approximately 300 mm above sub-floor level to clear cables and conduits.

.4 Locate and install gas discharge stations. Connect valves on Halon system to room detection panel.

.14 Connect fire suppression systems to control panel.

3.3 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical and CAN/ULC-S537.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, smoke thermal detectors sprinkler system Halon system transmit alarm to control panel and actuate ancillary devices general alarm first stage alarm .

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Class A circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset

control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.5 Class B circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 00- Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. General

1.1 INTENT

.1 This Section is intended to be used as a reference section for excavating, backfilling of trenching required for installation of underground services which may include pipes, fittings, valves, manholes, vaults, catch basins, ducts, duct banks, conduits, cable, wire, etc.

2. Products

2.1 FILL MATERIALS

.1 General

.1 Do not use frozen fill materials.

.2 Remove cobble, stones and rock fragments have maximum dimension greater than 75 mm from fill material or other object other objects which could be detrimental to the pipe or the embedment materials.

.2 Native Backfill Material

.1 Native backfill containing no debris; tree roots, sod or other organic materials.

.3 Non-shrink Backfill

.1 Non-shrink Backfill is a very weak mixture of Portland Cement or Lime/Fly Ash, concrete aggregates and water that resists settlement when placed in a utility trenches and is capable of being readily excavated.

.1 Compressive Strength – 0.2 to 0.5 Mpa with a maximum 56 day strength of 0.5 Mpa.

.2 Aggregate consisting of washed sand conforming to the requirement of C.S.A. Standard CAN#-A23.1-M77. Aggregate gradation to be within the following limits:

Sieve Size, mm	Percent Passing by Weight
10	100
5	95–100
2.5	80–100
1.25	50–100
0.630	25–65
0.315	10–35
0.160	2–15
0.080	0–10

.3 Minimum slump - 75 mm. Maximum slump - 125mm.

.4 Calcium chloride admixture may be used. Air entrainment admixture may be used to improve workability.

.5 Cold Weather Requirements: Non shrink backfill delivered in cold weather will conform to the requirement specified in Section 18 of C.S.A Standard CAN3-A23.1-M77.

.4 Concrete

.1 Concrete mix will satisfy the requirements of Exposure Classification C-2 of Table 1 in the latest revision of CAN/CSA A23, and will be in accordance with the following minimum requirements unless shown in the Contract Documents:

.1 28 day compressive strength – 20 MPa

.2 Maximum nominal size of coarse aggregate – 25 mm

.3 Slump – maximum 75 mm

.4 Air Content – 4% to 7%

.5 Maximum water cementing materials ratio – 0.45

.6 Portland Cement – Type 50 or HS, Sulfate Resistant

.7 Minimum cement content – 300 kg/m3

.8 Fly Ash Content – 20% max.

2.2 RIGID FROST SHIELD

.1 Rigid frost shield material to be extruded polystyrene insulation 50 mm thick with a minimum resistance to heat transfer of 1.76 RSI (R-value of 10) as determined by ASTM C518 and a minimum comprehensive strength of 275 kPa (40 psi) as determined by ASTM D1621.

.2 Approved products:

.1 Dow STYROFOAM HIGHLOAD 40

.2 Owens Corning Foamular 400

.3 or approved equal

2.3 GRANULAR FROST INSULATION

.1 Processed lightweight aggregates (LWA) used as granular frost insulation material in pipe bedding and insulating cover due to high thermal insulation value and low thermal conductivity compared to natural soils.

.2 Approved products:

.1 Granulite

.2 Aggrelite by Atrium Lightweight Materials Inc.

.3 Liteweight 730

.4 or approved equal

2.4 CELLULAR CONCRETE INSULATION

.1 Insulating material will be precast cellular concrete blocks with wet density equal to 475 kg/m^3.

.2 Approved products:

.1 Cematrix CMI-475

.2 Or approved equal

3. Execution

3.1 EXCAVATION

.1 Excavate trenches to the lines, grades and elevations shown on the Contract Documents. For pipe trenches, comply with Pipe Trench Width Schedule.

.2 Where a trench box and/or cage will be employed for a trench excavation refer to Uni-Bell's latest edition of "Handbook of PVC Pipe – Design and Construction" for the trench design and method of installation.

.3 Where shoring will be employed for trenching and/or protection of utilities and structures the Contractor must engage the services of qualified professional engineer who is registered or licensed in province of the project to design and inspect shoring and anchoring required for work.

.4 Grade and shape pipe trench to give uniform and even bearing for each length of pipe. Dig bell holes at each joint as required.

3.2 MOISTURE CONTENT CONTROL OF BACKFILL MATERIAL

.1 Uniform moisture content of each layer of fill to be within the Optimum Moisture Content limits specified in Backfilling Schedule, as determined by ASTM D698 test procedures.

.2 When the moisture content in the fill material is lower than that specified for placement, add water and mix with the material to achieve uniform moisture content in the material to conform to the requirements.

.3 When the moisture content in the fill material is higher than that specified for placement, dry the material by scarifying, disking, mixing and harrowing to achieve uniform moisture content in the material that conforms to the requirements.

3.3 PLACEMENT AND COMPACTION OF BACKFILL MATERIAL

.1 Backfill trenches using fill materials as specified in Backfilling Schedule.

.2 Place fill materials in layers not exceeding loose thickness specified in Backfilling Schedule.

.3 Uniformly compact each layer of fill to minimum percentages of Standard Proctor Density specified in Backfilling Schedule, as determined by ASTM D698 test procedures.

.4 Uniform moisture content of each layer of fill to be within the Optimum Moisture Content limits specified in Backfilling Schedule.

.5 Where a trench box and/or cage is employed, ensure that the pipe installation and pipe zone compaction requirements are met. Refer to Uni-Bell's, latest edition of "Handbook of PVC Pipe - Design and Construction" for trench box/ cage design and methods of installation. The installed pipe and its embedment will not be disturbed when using movable trench boxes and/or cages. Movable supports will not be used below the top of the pipe zone unless an approved method is used to maintain the integrity of the embedment material. Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. As supports are moved, finish placing and compaction of embedment material.

.6 Where shoring is employed, the shoring professional will provide the Contractor instructions how the backfill schedule requirements will be achieved. Provide instructions to the Owner's Representative for review and comment at least 7 days prior to commencing backfilling

.7 When compacting in the pipe zone, care should be taken to avoid contact between the pipe and the compaction equipment (mechanical tampers, tamping bars, etc.).

.8 Compaction in the haunch area is to be obtained by use of mechanical tampers and tamping bars. Care should be taken to ensure that the pipe does not "float" due to the compacting methods.

.9 When compacting initial backfill, mechanical tampers are to be used adjacent to the pipe. Mechanical tampers shall not be used directly above the pipe until a minimum of 300 mm of backfill material is in place above the pipe.

.10 When compacting backfill in the intermediate zone, roller compacting equipment is not to be used until a minimum of 500 mm of backfill material has been placed above the top of pipe.

.11 The use of hydro-hammer in the pipe zone is not be permitted.

.12 When compacting backfill above the pipe zone, hydro-hammer is not to be used until a minimum of 1,000 mm of backfill material has been placed above the top of pipe.

3.4 UTILITY CROSSINGS

.1 Install crossings to the lines, grades and elevations shown on the Contract Documents.

.2 Comply with requirements of crossing agreement, permit or other crossing requirements issued by utility company.

3.5 PIPE TRENCH WIDTH

.1 Except as otherwise specified, minimum and maximum trench widths, up to a point 300 mm above top of pipe, will be as specified in Pipe Trench Width Schedule.

.2 Maximum trench widths indicated in Pipe Trench Width Schedule exclude an allowance for shoring.

.3 Trench width at any point will not be less than trench width at any depth below such point.

3.6 PIPE TRENCH WIDTH SCHEDULE

Pipe Size (Outside Diameter)	Minimum Trench Width	Maximum Trench Width
850 mm diameter or less	300 mm greater than external pipe diameter	600 mm greater than external pipe diameter or 750 mm total trench width, whichever is greater
Greater than 850 mm diameter	300 mm greater than external pipe diameter	600 mm greater than external pipe diameter

3.7 BACKFILLING SCHEDULE

Location	Fill Material	Max. Lift Thickness	Minimum Compaction	Moisture Content Variance from Optimum

Location	Fill Material	Max. Lift Thickness	Minimum Compaction	Moisture Content Variance from Optimum
Pipe Zone – pipe bedding	Zone ? Granular	150 mm	95%	±2%
	Material	150 mm	90%	±2%
Type 1	Zone ? Granular	150 mm	90%	+2%
Type 2	Material	150 mm	85%	±2%
Type 3	Zone ? Granular			
Type 4	Material			
	Zone ? Granular			
	Material			
Pipe Zone - haunching	Suitable Native	150 mm	95%	±2%
Type 1	Material	150 mm	90%	±2%
Type 2	Zone ? Granular	150 mm	85%	+2%
Type 3	Material	150 mm	90%	±2%
Type 4	Zone ? Granular			
	Material			
	Zone ? Granular			
	Material			
Pipe Zone – initial backfill	Suitable Native	150 mm	95%	±2%
Type 1	Material	150 mm	90%	±2%
Type 2	Zone ? Granular	150 mm	85%	+2%
Type 3	Material	150 mm	90%	±2%
Type 4	Suitable Native			
	Material			
	Suitable Native			
	Material			
Intermediate Zone	Suitable Native	150 mm	95%	±2%
Type 1	Material	150 mm	90%	±2%
Type 2	Suitable Native	150 mm	85%	+2%
Type 3	Material	150 mm	90%	±2%
Type 4	Suitable Native			
	Material			
	Suitable Native			
	Material			

Location	Fill Material		Max. Lift Thickness	Minimum Compaction	Moisture Content Variance from Optimum
Final Zone to 1.0m below subgrade	Suitable Material	Native	150 mm	95%	±2%
Type 1	Suitable Material	Native	150 mm	90%	±2%
Type 2			150 mm	85%	+2%
Type 3	Suitable Material	Native		90%	±2%
Type 4	Suitable Material	Native			

3.8 CONCRETE BEDDING AND ENCASEMENT

.1 Place concrete to details indicated or directed by Owner's Representative

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 36 hours after placing.

END OF SECTION

18.0 BUILDING 116 - FEED MILL

The Feed Mill (Building 116) was inspected on September 27, 2016. The site inspection consisted of a walkthrough of the entire building, including all accessible rooms and corridors. EGE did not assess the top of the feed bins on the outside of the building. A number of photographs were taken during the site inspection and are included throughout this section.

The Feed Mill is a 24.4 x 28.4 m two storey structure constructed in 1984, with a concrete foundation and concrete slab floor. The building exterior consists of exterior aluminum cladding over concrete block and preformed concrete walls with steel framing. The interior walls are concrete block with a combination of open ceilings and suspended metal grate ceiling tiles.

The building contains a large number of individual rooms. The main floor consists of a truck loading/unloading bay on the west side, with an office, electrical and mechanical room on the south side, a central processing and post-mixing area, washrooms, lunch room, and elevator on the east side, and a warehouse/stores area on the north side. Flooring is generally concrete, with the staff areas containing vinyl floor tile. The mezzanine and bin-top levels above have metal grate floors.

An aerial view of the Feed Mill and immediate area is provided on Plate 18.1 below. The Feed Mill is located within the South Campus area, as shown on Figure 03.

Plate 18.1: Feed Mill (Building 116).

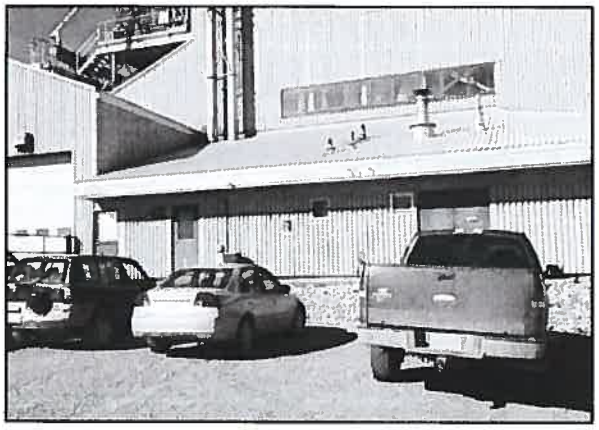

Photo 18.1: South elevation.

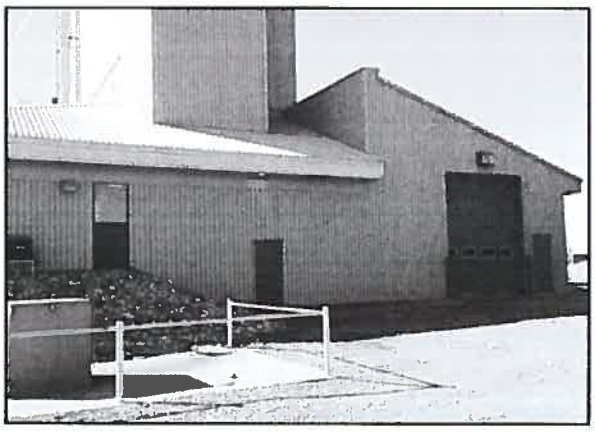

Photo 18.2: East elevation.

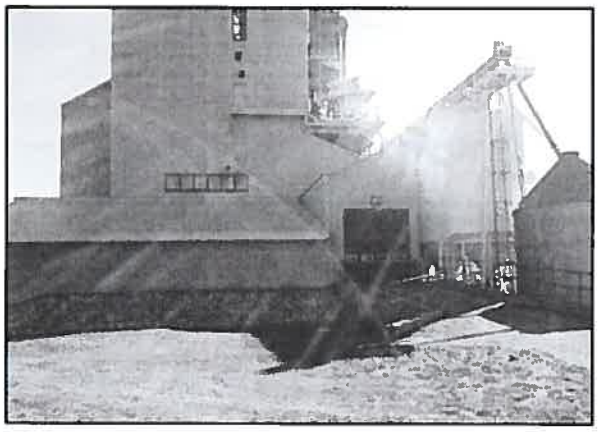

Photo 18.3: North elevation.

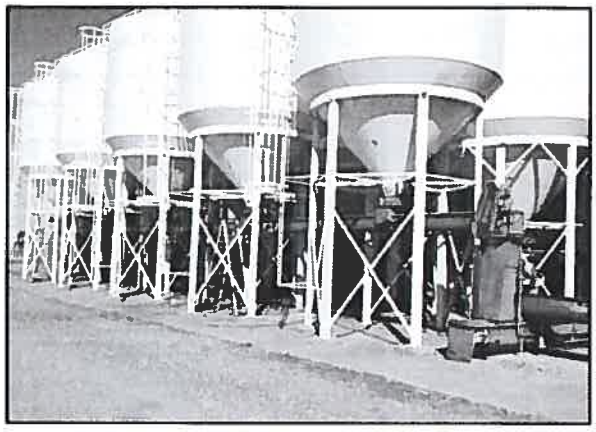

Photo 18.4: West elevation.

18.1 ASBESTOS

18.1.1 Asbestos Survey Results

EGE identified that potential ACMs within the building included the following materials:

- Interior parging cement on pipe runs in the mechanical room; and
- Interior vinyl floor tiles.

Bulk samples of each potential ACM were collected and submitted for analysis of asbestos. The results of the asbestos analyses are summarized in Table 18.1 below (and in Table 1 at the conclusion of this report).

The sample locations are shown on Figure 18. The analytical report is provided in Appendix B. Photographs of the sample locations are provided below.

Table 18.1: Summary of Asbestos Analyses

Sample ID	Sample Media/Description	Analytical Result (% vol/vol)
116-A-01	Interior vinyl floor tile (12 x 12") in office/scale room.	**2% chrysotile asbestos**
116-A-02	Cement parging on condensate trap in boiler room.	No asbestos fibres detected.
116-A-03	Cement parging on pipe chase (MC-1 Instantaneous Hot Water Heat).	No asbestos fibres detected.
116-A-04	Interior vinyl floor tile (12 x 12") in Men's Washroom.	**2% chrysotile asbestos**

Photo 18.5: Vinyl floor tile (beige) - ACM.

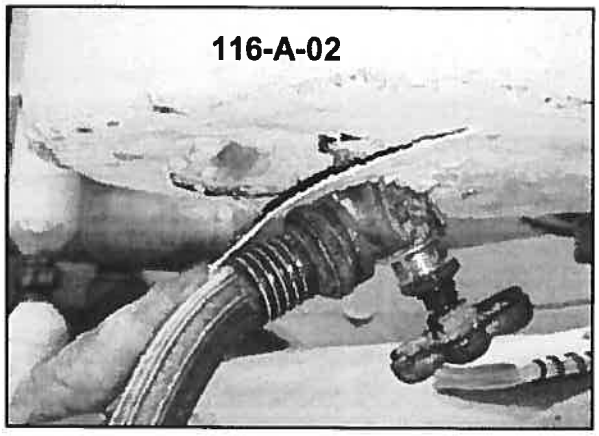

Photo 18.6: Parging cement - no asbestos.

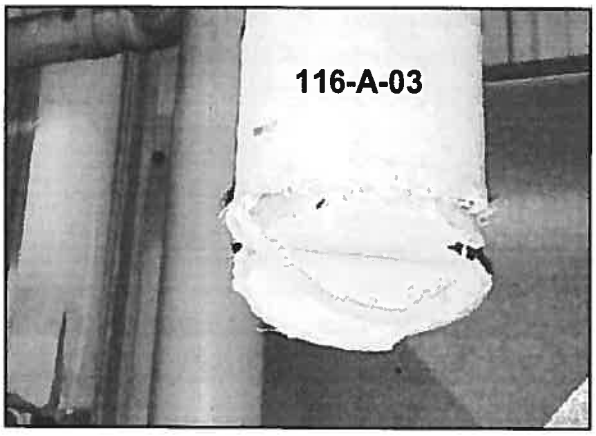

Photo 18.7: Parging cement - no asbestos.

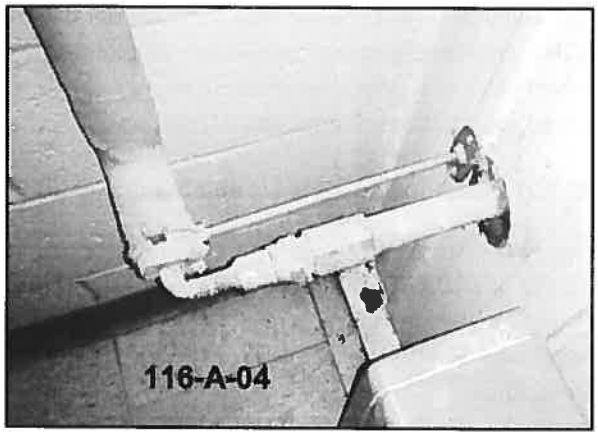

Photo 18.8: Vinyl floor tile (beige) - ACM.

Photo 18.9: Boiler gasket - potential ACM.

The analytical results confirm the presence of asbestos in the vinyl floor tile (12 x 12") located in the office/scale room and washrooms in the building. The parging cement used on the pipe chases in the boiler room did not contain asbestos. The remainder of the pipe chases and elbows inspected in the boiler room and remaining areas of the building were fibreglass insulation with no parging cement on the elbows. Two exterior concrete block walls were drilled (main floor storage room and mezzanine level) and no vermiculite insulation was found (fibreglass was found on the main floor while the mezzanine level was not insulated).

The vinyl floor tile is in good condition and is non-friable, but is accessible to all staff and visitors to the facility. There is approximately 30 m^2 of 12 x 12" vinyl floor tile in the south area of the building, located in the office/scale room and washrooms.

EGE observed gasket seals on the steam boiler in the mechanical room, but did not collect a sample of this material. It is possible that the material is an ACM. All gaskets should be considered as potential ACMs unless tested and confirmed to be free of asbestos. A large number of mechanical flanges are present in the building. Mechanical flanges may contain ACMs and should be considered as such unless tested and confirmed to be free of asbestos.

18.1.2 Asbestos Abatement and Management Plan

The AAAM notes that vinyl floor tile contains asbestos fibres that are bound up within the vinyl matrix of the tile and there is generally a small quantity (less than 10%) of asbestos and little risk of fibre release. Therefore, vinyl floor tiles can be managed in place, as long as an Asbestos Management Plan is developed for the building. Alternatively, the vinyl floor tiles can be abated using Low Risk (Type 1) procedures.

If it is left in place, the employer must develop a suitable management plan. A building can be demolished with vinyl floor tiles in place, unless they have an asbestos backing, asbestos levelling compound or asbestos adhesives present under the floor (these conditions were not observed). The Asbestos

Management Plan should incorporate the requirements of the OHS Code (Part 4) pertaining to asbestos. The general requirements for the plan are noted in Section 4.1.

Abatement of the vinyl floor tiles can be achieved using low risk (Type 1) removal techniques, as long as proper procedures are followed. This includes:

- Use only hand tools (such as ice scrapers). Powered tools or abrasive techniques are not permitted for low risk procedures;
- Pre-wet the floor surface to assist in releasing the tiles from the floor;
- Scrape up the tile and any mastic and double bag for disposal as asbestos waste; and
- HEPA vacuum the exposed surface to remove dust.

Alternatively, new flooring can be installed over asbestos flooring materials to seal the materials in place. This option will still require an asbestos management plan and future renovations/demolition must take into account that ACMs are present under the newer flooring.

The recommended activities and costs are summarized in Table 18.2 below.

Table 18.2: Summary of Asbestos Management and Abatement Recommendations/Costs

Recommendation	Cost
Develop an Asbestos Management Plan.	$5,000
Conduct asbestos abatement of 30 m^2 of vinyl floor tile.	$2,500
Replace 30 m^2 of vinyl floor tile.	$1,500

18.2 LEAD PAINT AND OTHER LEAD PRODUCTS

18.2.1 Lead Survey Results

Three representative samples of the painted surfaces from the building were collected and submitted for lead analysis. The results of the analyses are summarized in Table 18.3 below (and in Table 2 at the conclusion of this report). The sample locations are shown on Figure 18. A copy of the analytical report is provided in Appendix B.

Table 18.3: Summary of Lead Paint Analyses

Sample ID	Sample Media/Description	Lead Concentration
116-P-01	Interior light green paint used in boiler room (walls).	**1,400 mg/kg** **4.28 mg/L - TCLP**
116-P-02 (P-BD2)	Interior light green paint used in lunch room (walls).	**160 mg/kg** **470 mg/kg (duplicate)**
116-P-03	Exterior green paint used on hand railing and trim.	**2,100 mg/kg**

All three lead paint concentrations exceeded the 90 mg/kg limit for surface coatings and should be considered LCPs. This includes the interior light green paint used on the walls, and the exterior green paint used as trim. There were no concentrations that exceeded the 0.5% by weight (5,000 mg/kg) criteria for consideration as a potentially hazardous material.

One paint sample was submitted for TCLP analysis from Building 116. The interior light green paint with a lead concentration of 1,400 mg/L returned a leachable lead concentration of 4.28 mg/L, which is below the hazardous waste criteria of 5.0 mg/L. This result is consistent with the use of 5,000 mg/L as the limit for when lead paint may become a hazardous waste.

Photographs of the painted surfaces that were sampled are provided below.

Photo 18.10: Interior light green LCP.

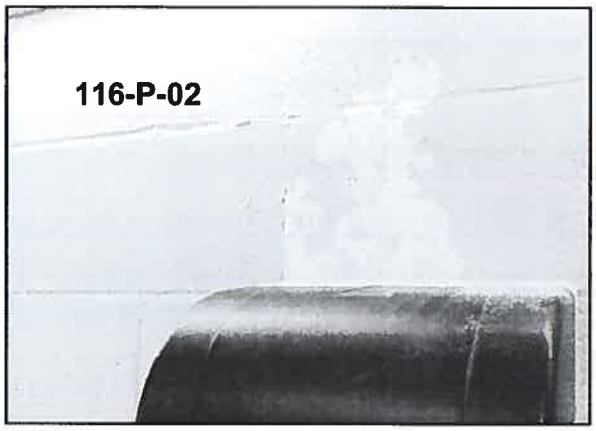

Photo 18.11: Interior green LCP.

Photo 18.12: Exterior green LCP.

The majority of the interior LCPs were in good condition, with the exception of the boiler room and lunch room, where peeling was noted. The exterior LCP was also in good condition.

Two batteries are located in the electrical room and may contain lead acid. There was no other lead containing material observed during the inspection.

18.2.2 Lead Abatement and Management Plan

A Lead Exposure Control Plan is required under the Alberta OHS Code, if a restricted area is present where the OEL of 0.05 mg/m^3 may be exceeded. Given that the LCPs are generally in good condition, a restricted area, as defined under OHS legislation, is not expected to occur for normal continued operation of the building.

Airborne lead may be generated during renovation activities such as cutting, grinding or sanding. A lead abatement and management plan would be required prior to renovation or demolition activities at Building 116 in order to reduce the potential exposure to lead from the painted surfaces, and to ensure proper handling and disposal of any waste materials.

For on-going operation of the facility, AAFC should prohibit operations that generate dust (sanding and grinding) on the LCPs identified above unless specific mitigation measures are undertaken. PPE should be worn when working on painted surfaces in the building. Best practices would include avoiding skin contact with paint waste and wearing respiratory protection when cutting, grinding or sanding painted surfaces, if required. Airborne lead dust should not exceed the eight-hour OEL of 0.05 mg/m^3.

There are no lead concentrations that exceed 5,000 mg/kg; therefore, it is not expected that construction waste from the building would be considered a hazardous material. Encapsulation of LCPs with lead concentrations above 5,000 mg/kg is not required at Building 116.

The recommended activities and costs are noted in Table 18.4 below.

Table 18.4: Summary of Lead Management and Abatement Recommendations/Costs

Recommendation	Cost
Develop lead abatement and management plan for renovation/demolition (if required).	$2,500

18.3 MERCURY

18.3.1 Mercury Survey Results

Multiple thermostats were observed in the building and an inspection of one unit noted the presence of a mercury switch.

Fluorescent lighting is located throughout the building and mercury vapour is present in the fluorescent light tubes. HID (metal halide) fixtures that use mercury vapour lamps are also present in the building.

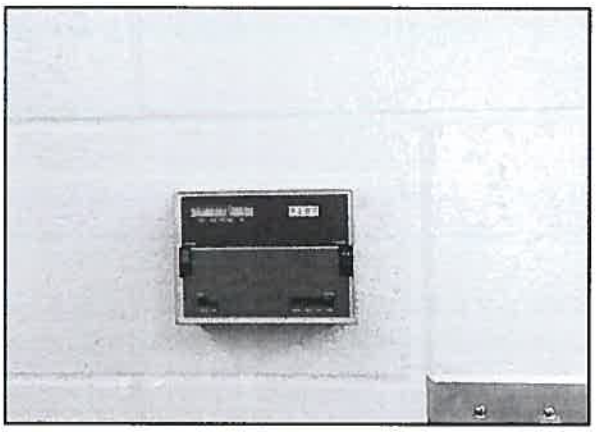

Photo 18.13: Mercury thermostat.

Photo 18.14: Metal halide lamp.

18.3.2 Mercury Abatement and Management Plan

The mercury present in fluorescent and HID lamps can be managed in place since this material is not considered a hazardous waste. The mercury present in thermostat switches can also be managed in place; however, this material is considered to be a hazardous waste when disposed.

Direct skin contact with mercury materials should be avoided, as well as, inhalation of mercury vapour. In this regard, breaking of light tubes and lamps should not be permitted, and care should be taken to avoid a release of mercury from thermostat switches. Best environmental practice includes diverting light tubes, lamps and thermostats from the waste stream to recover the mercury, rather than disposal of mercury as a waste material.

If disposal is to be considered, best practices include packaging spent mercury lamps with sorbent material such as elemental sulphur or calcium polysulphide. Small quantities may be bagged or containerized and disposed at Class I or II landfills; however, as noted, diverting these materials to a mercury recycler should be the first option. All mercury-containing equipment such as thermostats, should be handled, transported and disposed of as a hazardous waste. Shipping mercury-containing materials also requires proper waste manifesting.

If a lamp or thermostat is broken, follow the safe work procedures for spills of this size (Health Canada and Alberta guidance). Mercury spill kits are available for a nominal cost that can be deployed at a central location or in each building where mercury is present. The recommended activities and costs are noted in Table 18.5 below.

Table 18.5: Summary of Mercury Management and Abatement Recommendations/Costs

Recommendation	Cost
Collect and recycle fluorescent tubes and HID lamps, and mercury thermostats (if required).	N/A - internal cost
Provide a mercury spill kit for deployment as required (if required).	$200

18.4 POLYCHLORINATED BIPHENYLS

18.4.1 PCB Survey Results

The building was constructed in 1984 after the use of PCBs in light ballasts was prohibited (about 1980). Fluorescent and HID fixtures are present throughout the building. Several dry-type transformers are located in the electrical room on the main floor.

Four fluorescent fixtures were checked and the labels indicated the units were non-PCB ballasts. Given the construction date of the building and the findings of the inspection, it is unlikely that ballasts will contain PCBs in this building. The results of the inspection are summarized in Table 18.6 below.

Table 18.6: Summary of Inspected Fluorescent Light Ballasts

Sample ID and Location	Ballast Identification	PCBs
Interior fluorescent fixture (electrical room).	GE Gold Label Wattmiser 17A1137E	Non-PCB
Interior fluorescent fixture (boiler room).	GE Gold Label Wattmiser 17A1137E	Non-PCB
Interior fluorescent fixture (lunch room).	Phillips GQM-2540-TPC	Non-PCB
Interior fluorescent fixture (lunch room).	GE Gold Label Wattmiser 17A1137E	Non-PCB

18.4.2 PCB Abatement and Management Plan

Best practice is to check all fixtures when they are replaced and/or removed from service and if they contain PCBs, to segregate them for proper off-site disposal as a hazardous waste. All PCB ballasts containing more than 50 mg/kg are required to be removed from service by 2025. The recommended activities and costs are noted in Table 18.7 below.

Table 18.7: Summary of PCB Management and Abatement Recommendations/Costs

Recommendation	Cost
Collect and dispose PCB-containing light ballasts (if required).	N/A - internal cost

18.5 MOULD

There were no areas of mould observed during the survey and no samples were collected.

18.6 OZONE DEPLETING SUBSTANCES

There were no freezers located inside the building, and no roof-top cooling systems were observed. An exterior air conditioning unit is located on the south side of the building and services the office/staff area. A refrigerator is present in the lunch room and may contain ODS. Dry portable fire extinguishers are present in the building and did not contain ODS. Refrigerant (R-134a) is present in a chiller system in the basement/crawlspace and ODS inventory data sheets are posted beside the unit.

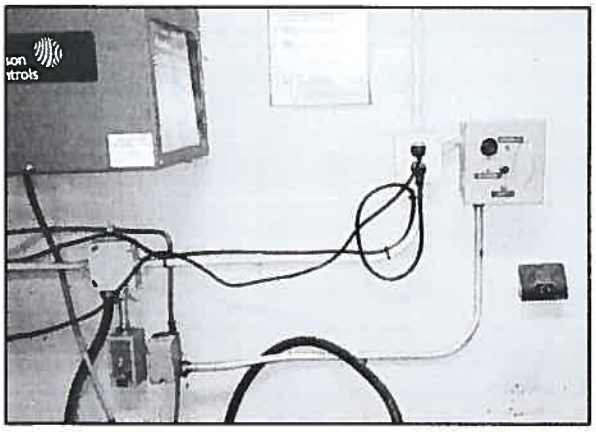

Photo 18.15: Refrigerant (R-134a) in basement.

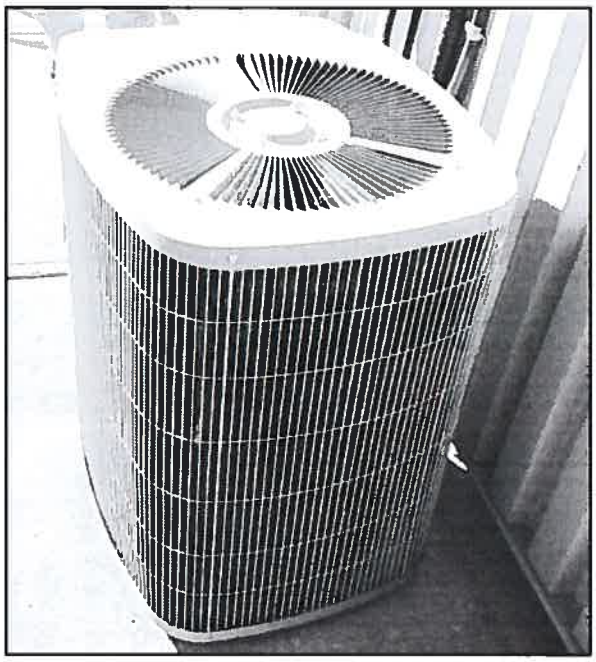

Photo 18.16: Exterior air conditioner.

Equipment containing ODS should be maintained and serviced in such a way as to avoid the release of any ODS. The equipment cannot be disposed of until the ODS is recovered by a licensed technician.

18.7 RADIOACTIVE MATERIALS

There was no equipment containing radioactive materials observed in the building at the time of the assessment. The building did not appear to be sprinklered and no heat or smoke detection devices were observed. Fire alarm systems are present in the building, along with a fire pump.

18.8 UREA FORMALDEHYDE FOAM INSULATION

There was no evidence of the application of UFFI observed in the building at the time of the assessment.

18.9 SILICA

18.9.1 Silica Survey Results

Silica may be present in the following building materials and locations:

- Concrete foundation;
- Concrete slab floor; and
- Concrete block walls.

18.9.2 Silica Abatement and Management Plan

If silica-containing materials within the building are to be disturbed and/or removed (e.g. coring through the concrete slab, demolition of the concrete foundation or cutting through the concrete block walls), dust control measures should be employed so that airborne silica concentrations do not exceed the OEL of 0.025 mg/m^3.

Abatement actions should include, but are not limited to, the following:

- Providing workers with respiratory protection;
- Wetting the surface of the materials and the use of water or dust suppressing agents to prevent dust emissions; and
- Providing workers with facilities to properly decontaminate prior to exiting the work area.

The recommended activities and costs are noted in Table 18.8 below.

Table 18.8: Summary of Silica Management and Abatement Recommendations/Costs

Recommendation	Cost
Develop a Silica Management/Abatement Plan for renovation/demolition (if required).	$1,000